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Final

Remedial Investigation/Feasibility Study Report Operable Unit 2C - Anomaly Area 3

FORMER MARINE CORPS AIR STATION EL TORO, CALIFORNIA

July 2009

Prepared for:
Base Realignment and Closure
Program Management Office West
San Diego, California

Prepared under:
Naval Facilities Engineering Command
Contract Number N62742-94-D-0048 and N68711-03-D-5106
Contract Task Order 0068 and 006
DCN: ET-0048-0068-0005.R1

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EXECUTIVE SUMMARY

This Remedial Investigation/Feasibility Study (RI/FS) Report provides a comprehensive assessment of the nature, extent, and potential impact of contamination to human health and the environment at Anomaly Area 3 (AA 3), former Marine Corps Air Station (MCAS), El Toro, California. This Report also presents the development and evaluation of remedial alternatives to provide the decision makers with sufficient information to propose the most appropriate remedial alternative for AA 3. This Report was prepared for the United States (U.S.) Department of the Navy (DON), Southwest Division, Naval Facilities Engineering Command (NAVFAC SW), under Contract Task Order (CTO) numbers 0078 contract number N62742-94-D-0048 and CTO-006 of contract number N68711-03-D-5106.

ES.1 BACKGROUND

This Report summarizes data collection procedures and analytical results from all previous investigations, including results from the removal site evaluation (RSE) field investigation conducted primarily between October and December 2002 and additional drilling conducted during February 2005. Results from human health screening risk assessment (SRA) and a revised ecological SRA for AA 3 are also included in this report.

Responses to regulatory agency comments on the Draft SRA were incorporated into the Draft Expanded Site Investigation (ESI) Report (Earth Tech 2003c). The DON received and responded to regulator comments on the Draft ESI Report on 28 June 2004. Based on comments received from regulators and on subsequent discussions during Base Realignment and Closure (BRAC) Cleanup Team (BCT) meetings, the DON agreed that "no further action" was not appropriate, and that additional site characterization at AA 3 pursuant to an RI/FS was required. All regulatory comments that were received by the DON in response to the submittal of the Draft ESI Report (Earth Tech 2003c) are incorporated into this RI/FS Report.

ES.2 REGULATORY STATUS

The Navy is addressing AA 3 pursuant to its authority under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Defense Environmental Restoration Program (DERP) as provided by the Federal Facility Agreement (FFA). CERCLA contaminants have been detected at the site; therefore the investigation and response action selection process is continuing within CERCLA. As such, the FFA is the framework for the investigation and response action selection process. This approach has been discussed extensively during BCT meetings. AA 3 continues to be addressed as a part of Operable Unit 2C which includes landfills at IRP Sites 3 and 5.

ES.3 SITE DESCRIPTION

Former MCAS El Toro is located in Orange County, California, approximately 8 miles southeast of Santa Ana and 12 miles northeast of Laguna Beach (Figure 1-1). Former MCAS El Toro covers approximately 4,738 acres. Land use around MCAS El Toro includes commercial, light industrial, and residential. MCAS El Toro closed on 2 July 1999, as part of the BRAC Act.

AA 3 encompasses an area of approximately 5.14 acres (2.08 ha) and is located in the northwestern section of the former MCAS El Toro facility near Pusan Way, adjacent to the Agua Chinon Wash (Figure 1-1). AA 3 has also been designated as miscellaneous refuse (MSCR) 1, a "former refuse disposal area" in the BRAC Business Plan update (DON 2000). Miscellaneous refuse AA 3 refers to seven aerial photograph (APHO) anomaly areas (APHO 59, APHO 60, APHO 61, APHO 62, APHO 63, APHO 64, and APHO 65) identified by Science Applications International Corporation (SAIC) during a review of aerial photographs taken between 1946 and 1992 (Figure 2-1 [SAIC 1993]). Historically, AA 3 was used as a source of borrow material. Records indicate that some of the borrow pits and trenches were backfilled with construction debris and later covered with 5 feet or

more of fill soil (IT/OHM 2000). During the RSE investigation, it was confirmed that there is an average of approximately 4.5 feet of soil cover with isolated areas having as little as 2 feet of soil cover over the construction debris. Based on a review of historical aerial photographs and topographic maps, placement of construction debris occurred between 1972 and 1988.

ES.4 PHYSICAL SETTING

The former MCAS El Toro lies on the southeastern edge of the Tustin Plain, a gently sloping surface of alluvial fan deposits derived mainly from the Santa Ana Mountains. Former MCAS El Toro is located within the Irvine Management Zone (formally known as Irvine Groundwater Forebay), which has been designated by the California Regional Water Quality Control Board (CRWQCB) as a public water supply source (CRWQCB 1995). The aquifer located directly beneath former MCAS El Toro is not currently used for municipal water supply; however, the groundwater near the Station is used for agricultural purposes.

ES.5 PREVIOUS INVESTIGATIONS

Previous investigations at AA 3 include the following:

- Literature and records search
- Site visit and visual inspection
- Installation of 4 groundwater monitoring wells and sampling
- Installation of 3 vadose zone vapor wells and sampling
- Geophysical investigation
- Exploratory trenching, including collection of subsurface soil samples for chemical laboratory analysis

A literature and records search was conducted during early 1999, and the BCT conducted a site visit and visual inspection of the area during August 1999. IT/OHM installed monitoring wells and vadose zone wells, conducted a geophysical investigation of the area, advanced exploratory trenches at the site, and conducted a radiological screening survey as part of the exploratory trenching. A Technical Information Package compiling the results from these investigations was submitted to the BCT (IT/OHM 2000).

ES.6 REMOVAL SITE EVALUATION

The RSE field investigation program for AA 3 was developed using EPA's Data Quality Objectives (DQO) process (EPA 2000a). The RSE field investigation program was designed to supplement data gathered from previous investigations and to provide information sufficient to evaluate potential response actions for the site. The scope of work included the following:

- Collecting soil vapor, soil, groundwater, surface water, and sediment samples to evaluate the impact, if any, due to waste remaining at the site;
- Confirming the lateral limits of the waste at the site;
- Evaluating human health and ecological risks; and,
- Collecting soil samples to conduct a geotechnical assessment of the existing soil cover.

The bulk of the RSE fieldwork was completed during Fall 2002 – Winter 2003; however, groundwater well installation and groundwater sampling activities occurred periodically through April 2005.

As part of RSE investigation, a biological site reconnaissance (BSR) was also conducted at AA 3 to provide biological input to the screening-level problem formulation for a ecological screening risk assessment (SRA), as required by the CERCLA process and in accordance with the legal requirements set forth under Section 7 of the Endangered Species Act of 1973, (19 U.S.C. 1536(c), 50 CFR 402). No listed or sensitive species were observed on the study site. One listed and one sensitive bird species (coastal California gnatcatcher and coastal wren, respectively) and a sensitive mammal (San Diego desert woodrat) were documented adjacent to the site.

ES.7 NATURE AND EXTENT

The delineation of the wastes remaining at the site is complete, and is consistent with previous estimates developed using historic and current topographic maps. Site characterization indicates that predominantly construction-related debris was placed within the limits of AA 3. Based on results from two trenching activities (pre-RSE and RSE investigations) and subsurface exploration during the soil gas survey, the existing soil cover approximately averages 4.5 feet with isolated areas having as little as 2 feet of soil cover. Based on trenching activities, borehole data, and historical topographic maps, the lateral and vertical limits of construction debris placement, and the existing soil cover depth, are consistent with the initial demarcation of debris placement. One area near the southeast corner of the site was revised inward. The revised area of waste placement at AA 3 is approximately 5.15 acres (225,000 square feet). The volume of waste within AA 3 is approximately 230,000 cubic yards.

Air sampling results show that integrated surface air sample results are not impacted by wastes remaining at the site and the results are consistent with ambient air samples. Volatile organic compounds (VOCs) were not detected in any of the soil gas samples collected from within the debris placement boundary, although low concentrations of VOCs (including common laboratory contaminants) were detected in ambient air samples (upwind and downwind of the site) and in integrated surface air samples, VOCs were not detected in any of the soil gas samples collected from within the debris placement boundary. Methane was detected in integrated surface air samples at concentrations ranging from 2 to 3 parts per million by volume (ppm_v), similar to ambient air concentrations. No significant differences were noted between upwind and downwind ambient air sample results.

Methane was reported in soil gas samples at eight of 33 locations; these eight locations were confined to the central portion of the site, with only three central sampling locations exceeding the Title 27 CCR stipulated lower explosive limit (LEL) of 50,000 ppm_v for methane at the site perimeter. Methane was not detected in any of the perimeter soil gas wells during three rounds of sampling. These results indicate that methane is confined to the central portion of the site and is not migrating to the perimeter of the site.

Surface soil (0 – 1 foot below ground surface [bgs]) has been adequately characterized and the results show few exceedances of residential EPA Region 9 preliminary remediation goals (PRGs). Only five semi volatile organic compounds (SVOCs) at only one of 33 surface soil sampling locations exceeded their respective residential PRGs. 2,3,7,8-TCDD exceeded its residential PRG at only one of nine surface soil sampling locations analyzed for dioxins and furans. All metals that were analyzed were either less than PRGs or within background concentrations at all 33 surface soil sampling locations. Petroleum hydrocarbons were detected at very low concentrations. These results, coupled with site-specific risk assessments, indicate that the surface soil does not pose unacceptable risk to ecological and human health.

The subsurface soil has been adequately characterized with 42 samples collected and analyzed. The results show few exceedances of residential EPA Region 9 PRGs. Only one SVOC in only one sample out of 42 samples exceeded its residential PRG. Asbestos and perchlorate were not detected

in any of the subsurface soil samples. Diesel range petroleum hydrocarbons were reported at concentrations (ranging to a maximum of 5,600 milligrams per kilograms [mg/kg]) and are generally not of concern. Exceedances of background and PRGs for metals were isolated and analytical results indicate high variability in concentrations of metals at the site, which is not uncommon and can be attributed to natural conditions. These results, coupled with site-specific risk assessments, indicate that the surface soil does not pose unacceptable risk to human health.

Groundwater analytical results indicate that very low concentrations of CERCLA contaminants within and in the vicinity of AA 3. The results of the supplemental groundwater monitoring and statistical evaluation indicated that the groundwater data collected during the Round 9 was consistent with previous monitoring rounds. In addition, the statistical evaluation concluded that debris place at AA 3 was not impacting groundwater at the point-of-compliance wells. This finding was consistent with previous conclusions that there was no statistically significant of groundwater at the point of compliance wells.

Although there is a complete groundwater pathway for contaminant migration due to the close proximity of groundwater no groundwater specific response action is recommended due to the low frequency of detection and no statistically significant evidence of a release at the downgradient point of compliance.

Results from sediment samples collected from upstream and downstream locations on Agua Chinon Wash show that all detected metal concentrations were within the Station-wide soil background concentrations. The sediment sampling results indicate that surface water runoff and/or surface soil transport from AA 3 are not mechanisms of off-site transport of contamination.

Results from surface water samples collected from upstream and downstream locations within the Agua Chinon Wash indicate that only two metals, aluminum and chromium were detected at concentrations exceeding their respective maximum contaminant levels (MCLs). However, the upstream and downstream concentrations of these constituents were consistent, indicating that AA 3 is not impacting the surface water within Agua Chinon Wash.

ES.8 RISK ASSESSMENTS

A Tier 1 human health screening risk assessment (SRA) was conducted to identify chemicals of potential concern (COPCs) that may pose unacceptable risks to human health. Elements typically included in a Tier 2 assessment were included to satisfy screening requirements of EPA Region 9. Analytical results from surface soil (0 to 1 foot bgs), subsurface soil (0 to 10 feet bgs), and groundwater analyses were used to identify the human health COPCs for each exposure medium evaluated in the SRA. All analytes detected in surface soils, subsurface soils and groundwater were retained as COPCs for the human health SRA. The human health risk estimates are all within or below the EPA-established risk management range of 10^{-6} to 10^{-4} (for carcinogens) and hazard indices for (non-carcinogens) are all equal to or below 1. Results for soil and groundwater are summarized as follows:

- The surface soils (0 to 1 foot bgs) and subsurface soils (0 to 10 feet bgs) indicate a generally acceptable risk for residential reuse scenarios, with estimated incremental lifetime cancer risks of $4x10^{-5}$ for both soil intervals under a reasonable maximum exposure (RME) assumption. Under an average or central tendency exposure (CTE) assumption, risk estimates decreased by approximately an order of magnitude. Under the RME assumption, the risk estimates for other receptor scenarios range from less than $2x10^{-6}$ (escorted visitor - surface soil scenario) to a maximum of $3x10^{-5}$ (agricultural worker–subsurface soil scenario). A significant portion of the risk (between 66 percent and 78 percent) is attributable to B[a]P equivalents. Arsenic concentrations are within the Station-wide background concentrations.

Although arsenic contributes approximately 20 percent of the risk, its exclusion from risk estimates does not substantially reduce cancer risks or noncancer hazards.

- The evaluation of human health risks associated with potential soil vapor migration from subsurface soil to indoor air resulted a residential excess cancer risk of $4x10^{-6}$ and a cumulative noncancer hazard of less than 1 (unity). The residential excess cancer risk and noncancer HI associated with volatile chemicals in groundwater were below $1x10^{-6}$ and 1 (unity), respectively. Additionally, health risks for potential industrial exposures are lower.
- For human health groundwater pathway evaluation, the RME and CTE cancer risk estimates were $3x10^{-4}$ and $5x10^{-5}$, respectively for a residential receptor at the site. Arsenic accounted for approximately three-fourths of the risk estimates. The hazard indices ranged from 7 to 6 for the RME and CTE scenarios, respectively. The primary contributors to the noncancer hazard estimate are metals – antimony, arsenic, chromium, thallium, and vanadium. The maximum detected concentration (60.3 micrograms per liter [ug/L]) and the exposure point concentration of arsenic (11.0 ug/L) exceed the current MCL of 10 ug/L; however, arsenic concentrations in groundwater are within the ambient concentrations reported at other groundwater wells at the former MCAS El Toro.

An ecological screening risk assessment (SRA) was performed to assess the risks to ecological receptors from exposure to chemicals present at AA 3. The SRA fulfilled both the requirements of an EPA SRA and a U.S. Navy Tier 1 ecological risk assessment (ERA). The SRA used existing data and conservative assumptions regarding contaminant exposure in a two-step process to determine if additional ERA work was warranted for the site. Step 1 included a site description, habitat assessment, pathway identification/problem formulation, and toxicity evaluation. Step 2 involved first estimating exposure based on conservative assumptions and then estimating risk by comparing the media-specific exposure point concentrations (EPCs) to conservative, screening-level, media-specific benchmark values. At this point, a scientific management decision point (SMDP) was made to determine if the exit criteria for Tier 1, Step 2 have been met. Surface soil samples (0 to 1 foot bgs) that were collected as part of the RSE investigation and trench samples collected between 1 and 6 feet bgs were used to represent the exposure zone for SRA purposes. Concentrations of 11 metals, two polynuclear aromatic hydrocarbons (PAHs) groups, diethylphthalate, and dioxins/furans (mammal and bird) in surface soil, six metals in sediment, and 11 metals in surface water had hazard quotient (HQ) values equal to or greater than 1. Therefore, the site failed the SRA for soil and sediment, and water and the ERA process for the site continued to Tier 2, Step 3a Baseline Risk Assessment (BERA).

The ecological BERA Tier 2, Step 3a used the same representative species, exposure pathways, and toxicity reference values (TRVs), with refined exposure assumptions to more accurately estimate the potential risk to ecological receptors from chemicals of potential concern (COPECs) that failed the conservative Tier 1 screening process. Five metals in soil, antimony, cadmium, nickel, selenium, and zinc, had HQ values greater than 1 after the Tier 2, Step 3a risk calculations. However, four metals maximum soil concentrations (0 to 6 feet bgs) were within the Station-wide background concentrations. The fifth metal (selenium) exceeded the Station-wide background concentration. However, selenium concentrations in western soils are variable and can be locally high. Because there is no evidence of an anthropogenic source for the other soil metals, it is assumed that site activities did not result in a release of these metals (including selenium) that would cause adverse effects to terrestrial wildlife at AA 3. Evaluation of the ecological risk from other media suggests that anthropogenic activities have not had a negative effect on ecological receptors.

ES.9 CONCLUSIONS OF THE RI

Based on the conclusions cited above, investigation of all media (air, soil, soil gas, groundwater, sediment, and surface water) and site characterization for contiguous areas associated with AA 3 are complete. The human health and ecological risks have been quantified and are within acceptable risk management ranges. However, due to the presence of construction related debris, its proximity to groundwater, and the presence of elevated methane concentrations in soil gas samples from the central portion of the site, an evaluation of response actions necessary for continued protection of human health and environment is recommended.

The statistical evaluation of data from nine rounds of monitoring concluded that historical activities at AA3 have not resulted in statistically significant release of constituents to groundwater at the point of compliance. Additionally, a significant portion of the risk associated with groundwater at Anomaly Area 3 is attributable to ambient levels of arsenic. Therefore, no groundwater specific response action is planned for Anomaly Area 3. However, groundwater monitoring would be conducted consistent with potential action-specific ARARs for soil for capping alternatives where landfill closure and postclosure requirements may be potentially relevant and appropriate.

ES.10 FEASIBILITY STUDY

The purpose of the FS is to present the development and evaluation of remedial alternatives and to provide adequate information for decision makers to propose the most appropriate alternatives for AA 3. The selection of a preferred alternative will occur following a review of this document by regulatory agencies and the public. The preferred alternative will be stated in the Proposed Plan and the Record of Decision documents for AA 3.

The remedial action objectives (RAOs) developed for AA 3 as part of this FS are:

- Minimize direct contact with the landfill wastes.
- Control runon, runoff and erosion; minimize infiltration and potential contaminant leaching to groundwater.
- Mitigate landfill gas migration consistent with DON's agreement with FFA Signatories and the California Integrated Waste Management Board (CIWMB) (see below).
- Minimize contact between surface water in the wash (Aqua Chinon Wash) and the landfill waste.

The DON reached an agreement with FFA signatories, including the CIWMB, regarding institutional controls (ICs) and access restrictions pertaining to the landfill gas control measures at AA 3 in a letter dated 24 June 2004. This agreement was based on the results of the following: landfill gas investigations; anticipated post closure land use; the DON's consultation with representatives of CIWMB and the Department of Toxic Substances Control (DTSC) at a meeting on 4 December 2003; and subsequent discussions with CIWMB and other FFA signatories via email, letter, telephone conferences on 5 February and 18 February 2004.

The CIWMB along with other FFA signatories concurred on the following measures proposed by the DON to address the underlying concern of potential landfill gas migration at AA 3:

1. Implementation of an appropriate response action at AA 3;
2. Installation of an active landfill gas collection system or gas vent system during remedy implementation at AA 3. The system will remain inactive or will passively vent landfill gas unless a contingency for active gas extraction is triggered based on monitoring results.

Although inactive, wells/pipes installed within the waste will be used to monitor landfill gas inside the waste itself, providing an early warning feature;

3. As an additional safety feature, construction of passive gas control gravel trenches within the compliance monitoring zone during remedy implementation;
4. Implementation of the CIWMB monitoring protocol with installation of compliance landfill gas monitoring probes within 50 feet of the waste boundary. The perimeter will be monitored to demonstrate that landfill gas is not migrating off-site. Once adequate data are collected, and with CIWMB concurrence, monitoring would be discontinued and ICs and access restrictions would be removed; and,
5. Implementation of ICs and access restrictions within approximately 100 feet of the waste boundary (including the 50-foot compliance monitoring zone plus another 50 feet as an additional safety buffer zone). Within this 100-foot buffer zone, any future construction of structures would require obtaining approval from the DON and the CIWMB.

ES.10.1 Feasibility Study Evaluation

The following four remedial alternatives were developed for AA 3, one of which has four options:

- Alternative 1: No Action
- Alternative 2: Limited Grading, Monitoring, and Institutional Controls (ICs)
- Alternative 3: Containment, Monitoring, and Institutional Controls
  - Alternative 3a: Containment with Evapotranspiration (ET) Cover
  - Alternative 3b: Containment with Title 27 Prescriptive Cap
  - Alternative 3c: Containment with Modified Title 27 prescriptive cap with Geosynthetic Clay Liner (GCL)
  - Alternative 3d: Containment with Modified Title 27 prescriptive cap with Flexible Membrane Liner (FML)
- Alternative 4: Clean Closure and Groundwater Monitoring

ES.10.2 Comparative Evaluation of Alternatives

Table ES-1 compare costs for each alternative evaluated under the FS for AA 3.

The following summarize the results of the comparative evaluations of the alternatives developed for AA 3.

- The installation of the landfill covers as part of Alternative 3 may result in the lateral migration of landfill gas beyond the 100-foot buffer zone. In that event, the landfill gas controls proposed by the DON and agreed to upon by the CIWMB would be triggered. Consequently, compliance with the 27 CCR §20921(a)(1), (2), and (3) and 27 CCR §21160(b) requirements for landfill gas monitoring controls will be maintained. As a result, the threshold requirement of not exceeding 5 percent by volume in air at the facility property boundary will be met.

- Alternative 1, No Action, does not add a landfill cover or provide erosion control. The existing soil layer prevents contact with landfill wastes and reduces infiltration into landfill materials. However, since the site is currently ungraded, portions of the site are subject to

ponding and potential infiltration. Therefore, Alternative 1 is not considered protective of human health and the environment.

Table ES-1: Cost Comparison of Remedial Alternatives

Alternative	Capital Cost (millions)[a]	Operation and Maintenance Costs (millions)[a]	Grand Total Costs (millions)[a]
Alternative 1	Not Applicable	Not Applicable	Not Applicable
Alternative 2	1.46	2.98	4.44
Alternative 3			
Alternative 3a	3.16	3.29	6.46
Alternative 3b	3.38	3.29	6.67
Alternative 3c	2.77	3.29	6.07
Alternative 3d	3.23	3.29	6.53
Alternative 4[b]	Scenario 1: 36.80 Scenario 2: 30.65 Scenario 3: 24.80	Scenario 1: 0.52 Scenario 2: 0.52 Scenario 3: 0.52	Scenario 1: 37.33 Scenario 2: 31.18 Scenario 3: 25.32

Notes:
[a] Costs do not include the Present Value Discount Factor (2.8%).
[b] Three scenarios were developed for Alternative 4 costs: Scenario 1 (50% hazardous waste/50% non-hazardous waste); Scenario 2 (25% hazardous waste/75% non-hazardous waste); and, Scenario 3 (100% non-hazardous waste).

- Alternative 2 includes limited grading and construction of a finger dike and placement of rip rap to prevent erosion and control stormwater flow in the vicinity of AA 3. Access controls, such as fences and signs, should prevent inadvertent contact with wastes. ICs would restrict land-use that may lead to unacceptable risk to human health and the environmental and prevent activities that could threaten the integrity of the existing cover. For these reasons, Alternative 2 is considered protective of human health and the environment.

- Alternative 1, which is no action, does not trigger ARARs. Alternative 2 would comply with CCR Title 22 and Title 27, and 40 CFR 258 requirements for closure and post-closure of landfills identified as potential ARARs. Alternatives 3 would also comply with potential ARARs for the closure and post-closure of landfills. Alternative 4 would comply with clean closure requirements of CCR Title 22 identified as potential ARARs. The potential ARARs identified for AA 3 are presented in Appendix H of this report.

- Alternative 3, Containment, Monitoring, and IC, involves construction of a landfill cover with erosion and landfill gas control measures. Construction activities at AA 3 would result in added short-term risks to workers and the surrounding community during implementation compared to Alternatives 1 and 2 due to consolidation of wastes and fugitive-dust releases.

- Alternative 3a (ET cap) prevents contact with landfill wastes, mitigates erosion, controls landfill gas migration and reduces infiltration and potential migration of contaminants to groundwater. Alternative 3a provides performance equivalent to the prescriptive standard (clay) cap (Alternative 3b) in preventing potential migration of contaminants to groundwater where they could pose a risk to human health and the environment. For this reason,

Alternative 3a is expected to comply with potential ARARs identified for AA 3 for closure of a landfill by constructing engineered alternative to prescriptive cover.

- Alternatives 3b (Title 27 prescriptive cap), 3c (GCL liner), and 3d (FML liner) prevent contact with landfill wastes, mitigate erosion, control landfill gas migration and reduce infiltration and resultant potential migration of leachate to groundwater. These alternatives would comply with potential ARARs identified for AA 3. Both Alternatives 3c and 3d are as effective as the prescriptive (clay) cap (Alternative 3b) in preventing potential migration of contaminants to groundwater where they could pose a risk to human health and the environment.

- Of the four Alternative 3 options, Alternative 3a can be implemented in a shortest period of time. In addition, the native soil cover used in Alternative 3a is resistant to desiccation and cracking, as well it is easy to maintain and repair. The CRWQCB has indicated that this type of cover is preferred in semiarid climates such as the former MCAS El Toro. However, this type of cover is not as effective in areas where reuse requires irrigation (i.e., recreational parks).

- Of the four Alternative 3 options, Alternative 3c is the least costly and is the easiest to implement. This is because the geosynthetic clay liner included in the alternative does not require specialized equipment or labor to install. Alternative 3d is easier to install than the clay layer but still requires skilled labor.

- The clay liner used in Alternative 3b is subject to desiccation in arid climates and to cracking due to differential settlement. The flexible membrane liner can withstand large differential settlement and is not subject to desiccation and cracking. The clay liner is also more difficult to maintain and repair than both, the geosynthetic clay liner and the flexible membrane liner.

- The flexible membrane liner barrier used in Alternative 3d is expected to be slightly more reliable than the geosynthetic clay liner barrier used in Alternative 3c because it is more resistant to root penetration. In addition, this type of liner is preferred in areas where reuse requires irrigation (i.e., recreational parks).

- Alternative 4, Clean Closure, is the most effective in meeting potential ARARs identified for AA 3 and is also the most effective in meeting RAOs; however, this alternative is extremely expensive compared to the other alternatives presented in the FS.

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ACRONYMS AND ABBREVIATIONS

-	Minus
>	greater than
"	Inch
%	Percent
°C	degree Celsius
°F	degree Fahrenheit
^3H	Tritium
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
AA	Anomaly Area
ABS	absorption factor
AF	adherence factor
AI	animal ingestion
Air SWAT	Air Quality Solid Waste Assessment Test
AL	action level
ALARA	as low as reasonably achievable
AM	action memorandum
APHO	aerial photograph
ARAR	applicable or relevant and appropriate requirements
ASTM	American Society of Testing and Materials
AT	averaging time
B[a]P	benzo(a)pyrene
BAI	Barajas & Associates, Inc.
BCF_i	soil to invertebrate bio-concentration factor
BCF_p	soil to plant bio-concentration factor
BCT	Base Realignment and Closure Cleanup Team
BERA	baseline ecological risk assessment
bgs	below ground surface
BHHRA	baseline human health risk assessment
BNI	Bechtel National, Inc.
BRAC	Base Realignment and Closure
BSR	biological site reconnaissance
BTEX	benzene, toluene, ethylbenzene, and total xylenes
BTF_a	prey to predator bio-concentration factor
BW	body weight
ca	Carcinogenic
Cal-OSHA	California Occupational Safety and Health Administration
CARB	California Air Resources Board
cc/min	cubic centimeter per minute
CCR	California Code of Regulations
CDD	chlorinated dibenzo-n-dioxin
CDF	chlorinated dibenzo-n-furan
CDM Federal	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CDD	chlorinated dibenzo-*p*-dioxin
CDF	chlorinated dibenzo-*p*-furan
CDFG	California Department of Fish and Game

CF	conversion factor
CFR	Code of Federal Regulations
C/I	construction/industrial
CIWMB	California Integrated Waste Management Board
CL	sandy clay
CLEAN	Comprehensive Long-Term Environmental Action Navy
cm	centimeter
cm^2	square centimeters
cpm	counts per minute
CNDDB	California Natural Diversity Data Base
CNPS	California Native Plant Society
Co	cobalt
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CPE	chlorinated polyethylene
CPT	cone penetrometer test
CRWQCB	California Regional Water Quality Control Board
c-s	Chemical-specific
CSF_o	oral cancer slope factor
CSF	cancer slope factor
CSM	conceptual site model
CSS	coastal sage scrub
CTE	central tendency exposure
CTO	contract task order
CWS	community water system
d/yr	days per year
DCGL	derived concentration guideline level
$DCGL_w$	DCGL for average concentrations over a wide area, used with statistical tests
DERP	Defense Environmental Restoration Program
DHS	Department of Health Services
DON	Department of the Navy
DPT	direct push technology
DQO	data quality objective
DTSC	Department of Toxic Substances Control
dw	dry weight
Earth Tech	Earth Tech, Inc.
EC	engineering control
EcoSSL	ecological soil screening level
ED	exposure duration
EF	exposure frequency
eq	equivalent
EFAW	Engineering Field Activity West
Eh	redox potential
EM	electromagnetic
EOD	explosive ordnance disposal
EF	exposure frequency
EPA	Environmental Protection Agency
EPC	exposure point concentration
ERA	ecological risk assessment

ESI	Expanded Site Investigation
ET	evapotranspiration; exposure time
FAA	Federal Aviation Administration
FAC	facultative wetlands plant
FACW	facultative wetlands
FBI	Federal Bureau of Investigation
FFA	Federal Facilities Agreement
FI	food intake; fraction ingestion
FID	flame ionization detector
FML	flexible membrane layer
FOD	frequency of duration
FS	feasibility study
FWS	Fish and Wildlife Service, United States
GCL	geosynthetic clay layer
GI	Gastrointestinal
GPS	global positioning system
HA	habitat assessment
ha	Hectare
HDPE	high-density polyethylene
HECRAS	Army Corps of Engineers River Analysis System
HI	hazard index
HHRA	human health risk assessment
HPCDD	Heptachlorodibenzodioxin
HPCDF	Heptachlorodibenzofuran
HQ	hazard quotient
HRA	Historical Radiological Assessment
hr/d	hours per day
HSA	hollow-stem auger
HSP	health and safety plan
HXCDF	Hexachlorodibenzofuran
IC	institutional control
ID	Identification
IDW	investigation-derived waste
ILCR	incremental lifetime cancer risk
IMZ	Irvine Management Zone
in. Hg	inches of mercury
IngR	ingestion rate
InhR	inhalation rate
IR	ingestion rate
IRA	Interim Removal Action
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
IT	The IT Group
JEG	Jacobs Engineering Group
kg	Kilogram
k_{ow}	octanol-water partitioning coefficient
kPa	kilo pascal
Kr	Krypton
L/d	liters per day
LDPE	low-density polyethylene

LDR	land disposal restriction
LEL	lower explosive limit
LFG	landfill gas
LIFOC	lease in furtherance of conveyance
LL	liquid limit
LOAEL	lowest observed adverse effect level
Log k_{ow}	logarithm of octanol-water partitioning coefficient
LRA	local reuse authority
LUC	land-use control
m^3/day	cubic meters per day
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
max	maximum
MCAS	Marine Corps Air Station
MCL	maximum contaminant level
MDC	maximum detected concentration
MEK	methyl ethyl ketone
MF	modifying factor
MIBK	methyl isobutyl ketone
m^3/day	cubic meter per day
m^3/hr	cubic meter per hour
m^3/hr	cubic meter per kilogram
min	minimum
mg	milligrams
mg/cm^2	milligrams per square centimeter
mg/kg	milligrams per kilogram
mg/kg-day	milligram per kilogram per day
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
mL	milliliter
mm Hg	millimeters of mercury
mol L^{-1}	mole per liter
mph	miles per hour
mrem/y	millirem per year
MSCR	miscellaneous refuse
msl	mean sea level
MTBE	methyl tertiary butyl ether
MW	monitoring well
N/A	not applicable
NA	not analyzed, not available
NAVFAC EFD PACIFIC PEARL HARBOR HI	Pacific Division, Naval Facilities Engineering Command
NAVFAC SW	Naval Facilities Engineering Command Southwest
NC	noncarcinogenic
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NE	not encountered, not established
ng/L	nanograms per liter
no.	number
NOAEL	no observed adverse effect level
NPL	National Priorities List

NR	not reported
NRC	Nuclear Regulatory Commission
NRWQC	national recommended water quality criteria
NTNCWS	non-transient, non-community water system
OEHHA	Office of Environmental Health Hazard Assessment
O&M	operation and maintenance
OBL	obligate wetlands plant
OCHCS	Orange County Habitat Classification System
OCDD	Octachlorodibenzodioxin
OCDF	Octachlorodibenzofuran
OHM	OHM Remediation Services
OHWM	ordinary high water mark
ORNL	Oak Ridge National Laboratory
OSWER	Office of Solid Waste and Emergency Response, EPA
Pa	Pascal
$Pa.m^3.mol^{-1}$	pascals cubic meter per mole
PAH	polynuclear aromatic hydrocarbons
pcf	pounds per cubic foot
pCi/g	picocuries per gram
pCi/L	picocuries per liter
PEF	potency equivalency factor; particulate emission factor
pg/g	picograms per gram
pg/kg	picograms per kilogram
pH	hydrogen ion concentration
PI	plant ingestion
PID	photoionization detector
PL	plastic limit
ppbv	parts per billion by volume
PPE	personal protective equipment
PPE	personal protective equipment
ppm	parts per million
ppm_v	parts per million by volume
PPRTV	Provisional Peer Reviewd Toxicity Value, EPA
PRE	preliminary risk evaluation
PRG	preliminary remediation goal
PVC	polyvinyl chloride
PZ	Piezometer
QA/QC	quality assurance/quality control
Ra	Radium
RACER	Remedial Action Cost Engineering Requirements
RAGS	Risk Assessment Guidance for Superfund
RAO	remedial action objective
RBC	risk bask concentration
RBCA	Risk Based Corrective Action
RCRA	Resource Conservation and Recovery Act
RBS	risk-based screening
RfC	reference concentration
RfD	reference dose
RfD_i	inhalation reference dose
RfD_o	oral reference dose
RI	Remedial Investigation

RME	reasonable maximum exposure
ROD	Record of Decision
RPF	relative potency factor
RSE	removal site evaluation
SA	surface area
SAIC	Science Applications International Corporation
SAP	sampling and analysis plan
sat.	saturation
SARA	Superfund Amendments and Reauthorization Act
SC	clayey sand
SCAQMD	South Coast Air Quality Management District
SERA	screening ecological risk assessment
SF_i	inhalation slope factor
SF_o	oral slope factor
SI	soil ingestion
SRA	screening risk assessment
SMDP	scientific management decision point
SOP	CLEAN II Standard Operating Procedure
SQL	sample quantitation limit
Sr	strontium
SRA	screening risk assessment
SPRE	Screening Preliminary Risk Evaluation
SPT	standard penetration test
SSPRE	Site-Specific Preliminary Risk Evaluation
SSRBE	site-specific risk-based evaluation
SSL	soil screening levels
STLC	soluble threshold limit concentration
SUF	site use factor
SVOC	semivolatile organic compound
SWDIV	Southwest Division, Naval Facilities Engineering Command
TBC	to be considered
TCDD	tetrachlorodibenzodioxin
TCLP	toxicity characteristic leaching potential
TCR	target cancer risk
TDS	total dissolved solids
TEDE	total effective dose equivalent
TEF	toxicity equivalency factor
TEQ	toxicity equivalency quotient
Th	thorium
THQ	target hazard quotient
TOC	top of casing
TPH	total petroleum hydrocarbons
TRV	toxicity reference value
tsf	tons per square foot
TTLC	total threshold limit concentration
UCL	upper confidence limit
UF	uncertainty factor
UNSAT-H	unsaturated soil water and heat flow model
UPL	obligate upland species
U.S.	United States
U.S.C.	U.S. Code

USACE	United States Army Corps of Engineers
USC	United States Code
USCS	Unified Soil Classification System
USGS	United States Geological Survey
VF_w	volatization factor-water
VLDPE	very low-density polyethylene
VOC	volatile organic compound
WET	obligate wetlands
wt	Weight
v/v	volume per volume
WHO	World Health Organization
WOE	Weight of Evidence
WRS	Wilcoxon Rank Sum

1. INTRODUCTION

This Remedial Investigation/Feasibility Study (RI/FS) report provides a comprehensive assessment of the nature, extent, and potential impact of contamination to human health and the environment by evaluating the results of all investigations at Anomaly Area 3 (AA 3), former Marine Corps Air Station (MCAS), El Toro, California. This Report also presents the development and evaluation of remedial alternatives and provides adequate information to the decision makers to select the most appropriate remedial alternative for AA 3. The selection of a preferred alternative will occur following a review of this document by regulatory agencies and the public. The preferred alternative will be stated in the Proposed Plan and the Record of Decision documents for AA 3.

This Report was prepared for the United States (U.S.) Department of the Navy (DON), Naval Facilities Engineering Command Southwest (NAVFAC SW), under Contract Task Order (CTO) number 0068 contract number N62742-94-D-0048.

This Report presents the data collection procedures and analytical results of all previous investigations, the results of the removal site evaluation (RSE) field investigation (Earth Tech 2002a) conducted primarily between October and December 2002 and additional drilling conducted in February 2005. The results of the human health screening risk assessment (SRA) and revised ecological SRA for AA 3 are also included in this Report. An ecological SRA was performed to estimate the risks posed by the site to the ecological receptors by using the analytical results of all investigations conducted at the site. A *Draft Screening Ecological Risk Assessment, Removal Site Evaluation, Anomaly Area 3* (Earth Tech 2003a) presented the SRA methodology, selection of the representative species, exposure parameters and the results of the SRA. This Report was submitted to the Base Realignment and Closure (BRAC) Cleanup Team (BCT) on 13 May 2003, for their review, comment, and concurrence on the SRA methodology and selection criteria for the site. Also, a working draft of the baseline ecological risk assessment (BERA) was also presented in the draft report.

The regulatory agency comments on the draft SRA were incorporated and presented in the Draft Expanded Site Investigation (ESI) report (Earth Tech 2003c). The DON received and responded to the regulator comments on the Draft ESI Report on 28 June 2004. Based on the comments received from the regulators and subsequent discussions during BCT meetings, the DON agreed that additional site characterization of AA 3 pursuant to a RI/FS was required and that a "no further action" determination of the Draft ESI Report was not appropriate at this stage of the process. Therefore, the preparation of the RI/FS document was initiated. All the regulatory comments that were received by the DON in response to the submittal of the Draft ESI Report (Earth Tech 2003c) were incorporated into the Draft RI/FS report (Earth Tech 2005d). The DON received and responded to the regulator comments on the Draft RI/FS report on 23 July 2007, and 17 December 2007, respectively. All the regulatory comments that were received by the DON in response to the submittal of the Draft RI/FS report (Earth Tech 2005d) are incorporated into this Report.

1.1 PROJECT DESCRIPTION AND BACKGROUND

The former MCAS El Toro is located in Orange County, California, approximately 8 miles southeast of Santa Ana and 12 miles northeast of Laguna Beach (Figure 1-1). The former MCAS El Toro covers approximately 4,738 acres. Land use around MCAS El Toro includes commercial, light industrial, and residential. The former MCAS El Toro closed on 2 July 1999, as part of the BRAC Act.

The DON conducted an *Initial Assessment Study* at the former MCAS El Toro in 1985 (Brown and Caldwell 1986) and a *Site Inspection Plan of Action* during 1987 and 1988 (James M. Montgomery Engineers, Inc. 1988).

The former MCAS El Toro was added to the National Priorities List (NPL) of the Superfund Program on 15 February 1990 due to volatile organic compound (VOC) contamination at the former MCAS boundary and in the agricultural wells west of the former MCAS El Toro. A Federal Facilities Agreement (FFA) was signed by the Marine Corps and the DON in October 1990 with the Environmental Protection Agency (EPA) Region 9, California Department of Health Services (DHS) (part of which is currently the Department of Toxic Substances Control [DTSC]), and the California Regional Water Quality Control Board, Santa Ana Region (CRWQCB).

In March 1993, the former MCAS El Toro was placed on the list of military facilities scheduled for closure under the BRAC Act. The BCT includes representatives from NAVFAC SW, EPA, DTSC, and CRWQCB, and was formed to oversee implementation of the FFA.

Implementation of the FFA at former MCAS El Toro included the following investigations and studies at various sites: an Air Quality Solid Waste Assessment Test (Air SWAT), a Phase I RI, a Phase II RI, and a FS. The DON routinely conducts Station-wide groundwater sampling.

1.2 REGULATORY STATUS AND GUIDANCE DOCUMENTS

The Navy is addressing AA 3 pursuant to its authority under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Defense Environmental Restoration Program (DERP) as provided by the FFA. CERCLA constituents have been detected at the site; therefore the investigation and response action selection process is continuing within CERCLA. As such, the FFA is the framework for the investigation and response action selection process. This approach has been discussed extensively during BCT meetings. AA 3 continues to be addressed as a part of Operable Unit 2C which includes landfills at Installation Restoration Program (IRP) Sites 3 and 5.

In addition, investigation and subsequent recommendation of the response action will be in accordance with the following guidance:

- Final Work Plan Phase II RI/FS, MCAS El Toro (Bechtel National, Inc. [BNI] 1995)
- Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites (EPA 1991a)
- Guidance for Performing Site Inspections Under CERCLA (EPA 1992a)
- Presumptive Remedy for CERCLA Municipal Landfill Sites (EPA 1993a)
- Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills (EPA 1996)

1.3 REPORT ORGANIZATION

This RI/FS Report consists of the main report and 13 appendices. The sections are organized to present the background information and the results of previous investigations (prior to RSE

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FIGURE 1-1 – PROJECT LOCATION MAP

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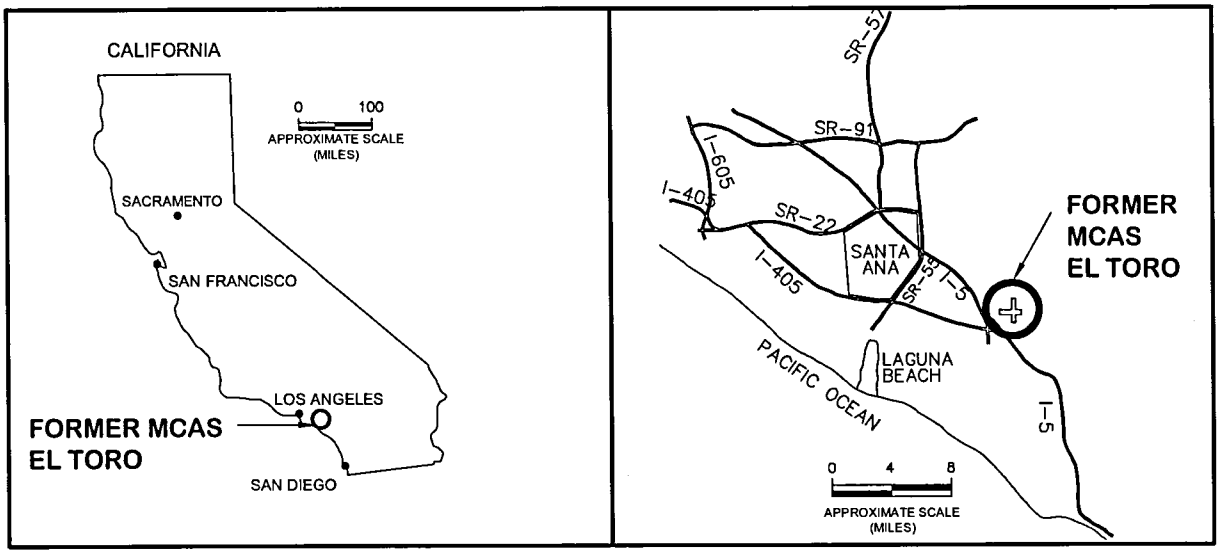

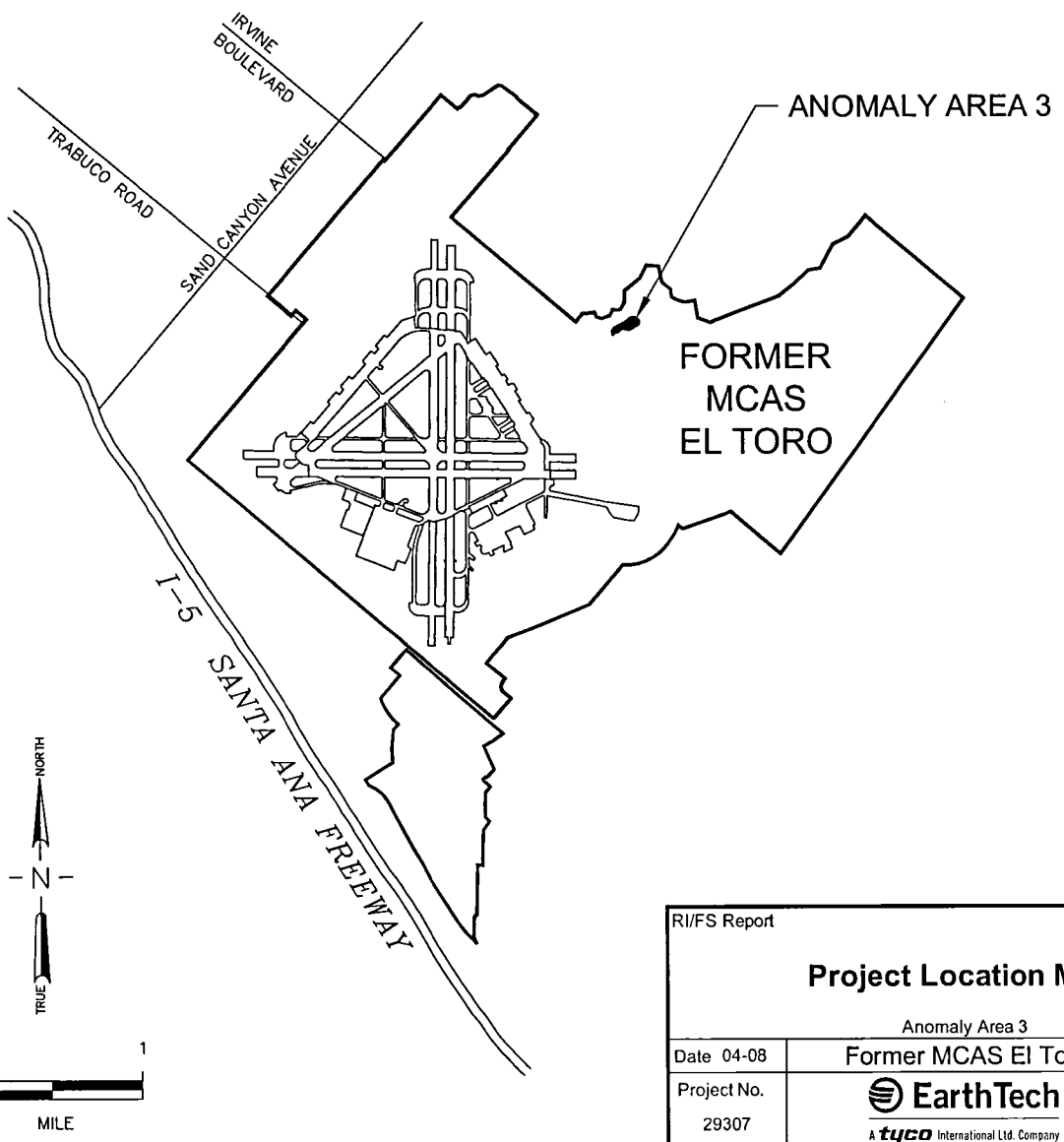

RI/FS Report		Draft Final
Project Location Map		
Anomaly Area 3		
Date 04-08	Former MCAS El Toro	Figure 1-1
Project No. 29307	EarthTech A tyco International Ltd. Company	

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investigation) in Sections 1.0 through 3.0. The field investigation methods, results, and conclusions of the RSE investigation are presented in Sections 4.0 through 6.0. Section 7.0 presents the contaminant fate and transport information. Section 8.0 presents the human health SRA protocol and results. The Ecological Risk Assessment (including the SRA and BERA) for the site is presented in Section 9.0 of the Report. Section 10.0 presents the conclusions of the RI. Section 11.0 presents the identification and screening of remedial alternatives as part of the FS. Section 12.0 presents the development of remedial alternatives for AA 3. Section 13.0 presents the detailed analysis of the remedial alternatives identified for the AA 3. This section also presents the comparative analysis of the remedial alternatives against the nine National Oil and Hazardous Substances Pollution Contingency Plan (NCP) criteria. Section 14.0 presents a summary of the FS activity. Section 15.0 is a compilation of all references cited in the main text and/or appendices. Appendices present specific information from the RSE field investigation, biological habitat assessment, and the human health and ecological risk-based screening (RBS).

Section 1 – Introduction. This section consists of the project introduction, description, and background.

Section 2 – Site Background. The site background and description are presented in this section.

Section 3 – Previous Environmental Investigations. The results of all previous investigations at the site are presented in this section. The section includes environmental investigations conducted during 1999 and 2000: geophysical investigation; exploratory trenching; and subsurface soil, perimeter soil gas, and groundwater sampling information. Relevant information regarding concurrent groundwater radionuclide evaluation and soil radiological assessments (including AA 3) is also presented in this section.

Section 4 – RSE Study Area Investigation. The RSE field investigation boundaries, methodologies protocol, and sampling information are presented in this section. The RSE field investigation sampling design was based on the EPA data quality objectives (DQOs) process. The sampling information provided in this section is organized to support the project DQOs.

Section 5 – Physical Characteristics. This section presents the updated geological, hydrogeological and geotechnical information gathered during the RSE field investigation. This section also presents the results of the biological habitat assessments (HAs) that were conducted in October 2002 (winter survey) and June 2003 (spring/early summer survey).

Section 6 – Nature and Extent of Contamination. This section presents the analytical results of various media samples (air, soil gas, soil, groundwater, sediment, and surface water) that were collected and analyzed to evaluate the nature and extent of contamination. Results from all investigations are evaluated in this section.

Section 7 – Fate and Transport. This section presents the fate and transport evaluation for the AA 3 site. The contaminant fate and transport analysis is used to assess the physical and chemical changes that may occur to the contaminants and to analyze site-specific transport mechanisms that may act upon them.

Section 8 – Screening Risk Assessment - Human Health. This section presents the methodologies and the results of human health SRA performed using the analytical results of surface (0-foot to 1-foot below ground surface [bgs]) and subsurface (0-foot to 10 feet bgs) soil samples for potential receptors and pathways at the site. The human health risk assessment (HHRA) presented in the Draft

ESI Report (Earth Tech 2003c) was revised and is presented in this RI/FS Report. This section incorporates all regulatory comments on the Draft ESI and the Draft RI/FS Report.

Section 9 – Screening Risk Assessment - Ecological. This section presents the methodologies and the results of the ecological SRA performed using the analytical results of soil samples (0 to 6 feet bgs) for ecological representative species and pathways at the site. This ecological SRA was prepared in response to the comments provided by the BCT members on the Draft Report (Earth Tech 2003a) and the Draft ESI Report (Earth Tech 2003c). This section incorporates the results of the winter and spring/early summer biological surveys, includes revisions to the ERA based on the BCT comments, and presents the results of both the SRA and the BERA.

Section 10 – Conclusions of the RI

Section 11 – Identification and Screening of Remedial Technologies

Section 12 – Development of Remedial Alternatives

Section 13 – Detailed Analysis of the Remedial Alternatives. This section presents the comparative analysis of remedial alternatives

Section 14 – Summary of Feasibility Study

Section 15 – References

Appendix A – Logs. Subsections of this appendix are: A1 - Trench Excavation Logs, A2 - Groundwater Monitoring Well Logs, A3 - Perimeter Gas Monitoring Well Logs, A4 - Soil/Soil gas Survey Borehole Logs, A5 - Photographs of Continuous Cores – MW11 through MW14 and BH01. Appendices A through G will be presented in a compact disk.

Appendix B – Sampling Information

Appendix C – Cone Penetrometer Survey Information

Appendix D – Data Validation Reports

Appendix E – Risk Assessments – E1: Human-Health Risk Assessment and E2: Ecological Risk Assessment

Appendix F – Geotechnical Laboratory Report

Appendix G – Response-to-Comments

Appendix H – ARAR Evaluation

Appendix I – HEC-RAS Model

Appendix J – RACER Cost Estimates

Appendix K – UNSAT-H Model

Appendix L – CIWMB Agreement Letter

Appendix M – Final Technical Memorandum, Anomaly Area 3, Supplemental Groundwater Monitoring

Appendix N – MOA Between DTSC and the DON and Two Sample Environmental Covenants

2. SITE BACKGROUND

2.1 LOCATION

AA 3 encompasses an area of approximately 9 acres and is located in the northwestern section of former MCAS El Toro facility near Pusan Way, adjacent to the Agua Chinon Wash (Figure 2-1). AA 3 has also been designated as miscellaneous refuse (MSCR) 1, a "former refuse disposal area" in the *BRAC Business Plan* update (DON 2000). MSCR AA 3 refers to seven aerial photograph (APHO) anomaly areas (APHO 59, APHO 60, APHO 61, APHO 62, APHO 63, APHO 64, and APHO 65) identified by Science Applications International Corporation (SAIC) during a review of historical aerial photographs taken between 1946 and 1992 (SAIC 1993). These APHOs and their corresponding anomalies are listed in Table 2-1.

Table 2-1: APHO List

SAIC Photograph Year	APHO Anomaly ID	Description of the Anomaly
1946	APHO 59 (SAIC 20)	An area encompassing three areas of apparent extraction
1952	APHO 60 (SAIC 64)	Quarried extraction areas
1960	APHO 61 (SAIC 106)	Quarried extraction areas
1967	APHO 62 (SAIC 156)	An area of extraction near Agua Chinon Wash with possible refuse or liquid within the excavated area
1981	APHO 63 (SAIC 443)	An area of extraction near Agua Chinon Wash that has been revegetated
1988	APHO 64 (SAIC 536)	A former extraction area near Agua Chinon Wash that has been filled
1992	APHO 65 (SAIC 564)	A graded area

The APHO anomalies identified by SAIC are associated with AA 3 and include features that are not contiguous with the study boundary. These non-contiguous anomaly features are shown on Figure 2-1 and are discussed below.

These non-contiguous features include the following anomalies: APHO60-1952C, APHO60-1952D, APHO61-1960A, APHO61-1960B, APHO61-1960D, APHO61-1960E, APHO61-1960F, and APHO62-1967B. All other anomalies associated with these APHOs (APHO59-1946A, APHO59-1946B, APHO59-1946C, APHO60-1952A, APHO60-1952B, APHO61-1960C, APHO62-1967A, APHO63-1981A APHO64-1988A, and APHO65-1992A) lie within the AA 3 investigation boundary.

2.1.1 APHO 60

APHO 60 corresponds to anomaly SAIC 64 of the 1952 SAIC APHO (Table 2-1). APHO60 is associated with three anomalies; APHO60-1952A, APHO60-1952B, and APHO60-1952C, and were identified as extraction areas. These are presented in Figure 2-1.

APHO60-1952C, an extraction area, is located east of the currently demarcated AA 3 site. The Wherry Housing area presently occupies part of this area. Based on a review of APHOs taken through 1971, this area of apparent extraction remained unfilled. In addition, the 1972 Wherry Housing grading plans show this anomaly as requiring engineered backfill. Based on this evaluation,

it is unlikely that this area would contain construction debris. As a result no further investigation is recommended.

APHO60-1952D. A review of the 1952 SAIC photograph shows the presence of another anomaly identified as SAIC 66. The anomaly designated as APHO60-1952D is shown in Figure 2-1 and is located southwest of the current study boundary. The SAIC report identifies this anomaly as a 250-foot-long trench.

A review of subsequent APHOs and the 1978 grading plans for Building 722 show that this area had not been filled. This area was subsequently graded (cut) as part of asphalt paving around the building. Based on these observations it is unlikely that construction debris was placed within this trench and no further investigation of this area is recommended.

2.1.2 APHO 61

APHO 61 corresponds to the 1960 SAIC APHO anomaly SAIC 106 (Table 2-1). There are two anomalies associated with APHO 61 and these two areas are identified as APHO61-1960A and APHO61-1960B and are presented in the Figure 2-1.

APHO61-1960A, a quarry (extraction) area, is located outside the Station boundary to the west of AA 3 site. The SAIC report describes APHO61-1960A as an area probably used as a material source for the former MCAS El Toro construction activities. This anomaly is not within the general vicinity of AA 3 (see Figure 2-1). A review of the subsequent APHOs does not yield evidence of this feature persisting or any backfilling activities at this area. This area was not identified as an anomaly in any of the subsequent APHOs, and no further investigation is recommended.

APHO61-1960B is described as a cleared area (grading) for cultivation and is located north of AA 3. This anomaly is not within the general vicinity of AA 3 (see Figure 2-1). Similar to APHO61-1960A, a review of the subsequent APHOs did not yield evidence of this feature persisting or any other activities conducted at this area. This area was not identified as an anomaly in any of the subsequent APHOs. This area was subsequently graded in 1972-1973 as part of the construction of Wherry Housing. Based on these observations, no further investigation of these areas is recommended.

APHO61-1960D, APHO61-1960E, and APHO61-1960F. These anomalies are part of SAIC Anomaly 107 and were identified in the 1960 APHO. These anomalies are located within the Wherry Housing area, and correspond to locations of cleared/disturbed ground. These areas appear to remain unfilled through to 1971. In addition, the 1973 construction drawings for Wherry Housing indicate that these areas were part of grading operations. It is unlikely that these areas would have been backfilled with construction debris or waste; therefore, no further investigation is recommended.

2.1.3 APHO 62

APHO 62 corresponds to the 1967 SAIC APHO anomaly SAIC 155 (APHO62-1967B in Figure 2-1).

APHO62-1967B (SAIC 155). This area corresponds to anomalies APHO60-1952D and APHO61-1960D, and lies within the Wherry Housing area. This area was part of grading operations for the Wherry Housing; therefore, no further investigation is recommended for this area.

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PORTIONS OF THIS RECORD ARE CONSIDERED SENSITIVE AND ARE NOT AVAILABLE FOR PUBLIC VIEWING

FIGURE 2-1 – SITE LOCATION MAP

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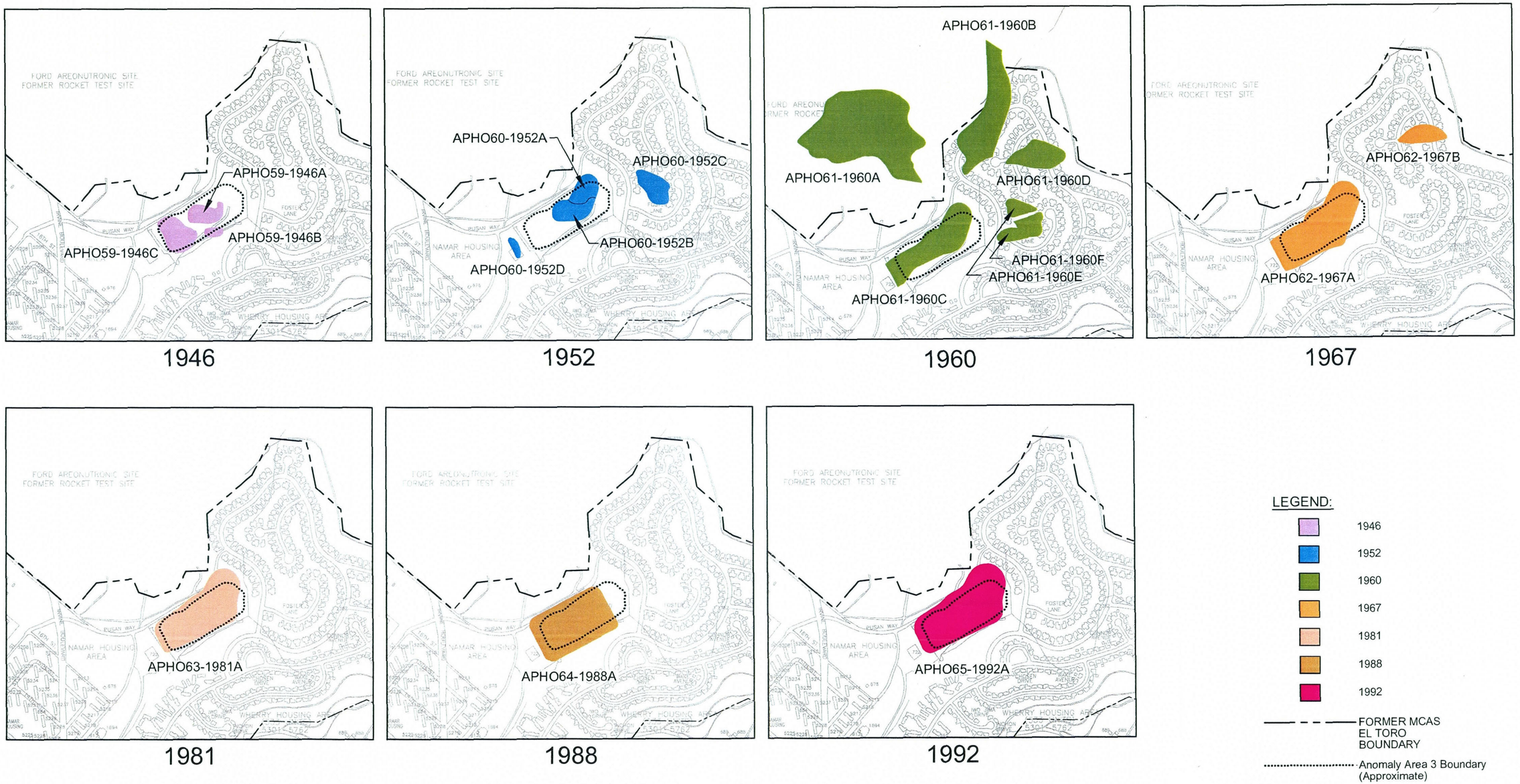

NOTES:

Anomalies depicted are approximate and based on aerial photographic interpretations from 1946 through 1992 (SAIC 1993)

NORTH

0 500' 1,000 FEET

SCALE: 1"= 1,000'

RI/FS Report		Draft Final
Site Location Map		
Anomaly Area 3		
Date 04-08	Former MCAS El Toro	Figure 2-1
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2.2 LAND USE

Historically, AA 3 was used as a source of borrow material. Records indicate that some of the borrow pits and trenches were backfilled with construction debris and later covered with 5 feet or more of fill soil (IT/OHM 2000). During the RSE investigation, it was confirmed that there is an average of 4.5 feet of soil cover with isolated areas having 2 feet of soil cover over the construction debris. Based on a review of historical APHOs and topographic maps, placement of construction debris occurred between 1972 and 1988. Interviews with former Station personnel indicate that construction debris generated during the construction of the investigation-derived waste (IDW) management area at the IRP Site 3 was placed at AA 3.

2.2.1 Future Land Use

Former MCAS El Toro was closed on 2 July 1999. From 1994 to 2002, the County of Orange, the designated Local Reuse Authority (LRA), proposed a commercial aviation reuse for former MCAS El Toro. This proposal was submitted as a BRAC Reuse Plan (P&D Consultants Team 1996). In March 2002, County voters overturned those planning efforts with the passage of Measure W, a referendum that changed the Orange County General Plan for former MCAS El Toro to a non-aviation use and recreational theme, with limited development intensities. After the March 2002 vote, the LRA decided that it would not prepare another BRAC reuse plan for the property. Consequently, the DON decided not to dispose of the property with any particular reuse or redevelopment plan and that reuse would ultimately be determined by local zoning applicable at the time of sale.

In November 2003, the city of Irvine annexed the former Station property. The city of Irvine has not prepared a BRAC Reuse Plan. However, a conceptual Reuse Plan entitled the "Orange County Great Park" has been prepared and approved by the city of Irvine. This plan calls for mixed reuse with residential, commercial and recreational open space uses. In July 2005, the DON completed the process of conveying portions of the former Station through public sale to a private developer. AA 3 is in a parcel zoned as low density residential.

2.3 GEOLOGY

Former MCAS El Toro lies on the southeastern edge of the Tustin Plain, a gently sloping surface of alluvial fan deposits derived mainly from the Santa Ana Mountains. Silts and clays predominate in the central and northwestern portion of former MCAS El Toro, and sands predominate in areas near the foothills. Sandstone and siltstone bedrock outcrops in the foothills. The sands are generally well-graded and commonly contain clay lenses.

2.4 HYDROGEOLOGY

Former MCAS El Toro is located within the Irvine Irvine Management Zone (formerly the Irvine Groundwater Forebay), which has been designated by the CRWQCB as a public water supply source (CRWQCB 1995). The aquifer located directly beneath former MCAS El Toro is not currently used for the municipal water supply; however, the groundwater near the Station is used for agricultural purposes.

3. PREVIOUS INVESTIGATIONS

Previous investigations at AA 3 include the following:

- Literature and records search;
- Site visit and visual inspection;
- Installation of four groundwater monitoring wells and groundwater sampling;
- Installation of three vadose zone vapor wells and soil vapor sampling;
- Geophysical investigation; and,
- Exploratory trenching, including collection of subsurface soil samples for chemical laboratory analysis.

The sampling locations and other relevant information from previous investigations are presented on Figure 3-1. A literature and record search was conducted during early 1999, and the BCT conducted a site visit and visual inspection of the area during August 1999. IT/OHM was contracted to install monitoring wells and vadose zone wells, conduct a geophysical investigation of the area, advance exploratory trenches at the site, and conduct a radiological screening survey as part of the exploratory trenching activity. A technical information package (IT/OHM 2000) compiling the results of the data was submitted to the BCT.

3.1 WELL INSTALLATION

The *Technical Information Package* (IT/OHM 2000) refers to the monitoring and vadose zone wells at AA 3 with "MSCR1" preceding the well numbers; however, this prefix was dropped during the preparation of the RSE Work Plan. During October 1999, four monitoring wells were installed at the site (MW01, MW02, MW03, and MW04) to evaluate the groundwater elevations and flow direction. Wells MW01, MW02, and MW04 were installed as downgradient wells, and Well MW03 was installed as an upgradient well. Figure 3-1 shows the locations of these wells.

In October 1999, three vadose zone wells were also installed (PZ1, PZ2, and PZ3). Wells PZ1, PZ2, and PZ3 have total depths of 22 feet bgs (screened interval 17 feet to 22 feet bgs), 30 feet bgs (screened interval 25 feet to 30 feet bgs), and 26 feet bgs (screened interval 15 feet to 20 feet bgs), respectively.

3.2 GROUNDWATER SAMPLING

Two rounds of groundwater sampling were conducted (4 November 1999 and 20 April 2000) at the four monitoring wells located at AA 3 (MW01, MW02, MW03, and MW04). The groundwater samples were analyzed for total petroleum hydrocarbons (TPH), VOCs, metals, mercury, perchlorate, nitrate, lead, gross alpha and gross beta radiation, and the following radioisotopes: uranium isotopes, radium, thorium isotopes, americium, and lead^{210}.

None of the groundwater samples had concentrations exceeding the maximum contaminant levels (MCLs) for VOCs, metals, perchlorate, or radionuclides, except as indicated in Table 3-1. Further discussion on the radionuclides in groundwater at former MCAS El Toro is presented in Section 3.7 of this Report.

Table 3-1: Summary of Detected Analytes Exceeding MCLs – Groundwater Sampling – Previous Investigation

Well ID	Sample ID	Sampling Date	TDS Secondary MCL = 500 mg/L (mg/L)	Manganese Secondary MCL = 50 µg/L (µg/L)	Gross Alpha MCL = 15 pCi/L (pCi/L)	Total Uranium MCL = 20 pCi/L (pCi/L)
MW01	20242-987	11/4/1999	**1,760**	**80.2**	**34.6** ± 5.27	NA
	20242-1123	4/20/2000	NA	20 U	**27.6** ± 6.0	**38.4**
MW02	20242-984	11/4/1999	**1,920**	**259**	**23.5** ± 4.29	NA
	20242-1124[a]	4/20/2000	NA	43.3	**28.3** ± 6.0	**31.63**
MW03	20242-989[b]	11/4/1999	**1,740**	20.9	**35.5** ± 5.23	NA
	20242-1120	4/20/2000	NA	20 U	**35.7** ± 6.8	**50.02**
MW04	20242-981	11/4/1999	**2,290**	48.1	**45.9** ± 8.5	**56.01**
	20242-1122	4/20/2000	NA	20 U	Greater than 15	NA

Notes:
NA = not analyzed
µg/L = micrograms per liter
mg/L = milligrams per liter
ID = identification
MCL = maximum contaminant level
Values shown in bold text are above MCLs.
[a] Chromium was reported at 357 µg/L.
[b] Selenium was reported at 50.3 µg/L.
pCi/L = picocuries per liter
U = not detected
TDS = total dissolved solids

3.3 PERIMETER SOIL GAS SAMPLING

Two rounds of soil vapor sampling were conducted on 4 November 1999 and 24 July 2000 at each of the three wells (PZ-1 through PZ-3). The samples were analyzed for VOCs and fixed gases (carbon dioxide, carbon monoxide, methane, nitrogen, and oxygen).

Methane was not detected in any of the samples; all VOCs that were detected were at concentrations below 1 microgram per liter (µg/L). The detected compounds for each vadose zone well for both sampling events are given in Table 3-2.

Table 3-2: Summary of Detected Analytes – Perimeter Soil Gas Sampling – Previous Investigation

Well ID	Sampling Date	Detected Compounds
PZ1	11/4/1999	Dichlorodifluoromethane
	7/24/2000	Chloromethane, m/p-xylene, toluene
PZ2	11/4/1999	Acetone, dichlorodifluoromethane, tetrachloroethene
	7/24/2000	1,2,4-trimethylbenzene, acetone, carbon disulfide, chloromethane, m/p-xylene, toluene
PZ3	11/4/1999	All sample results were below the reporting limit
	7/24/2000	1,1-dichloroethane, 4-ethyltoluene, 1,2,4-trimethylbenzene, acetone, benzene, carbon disulfide, chloromethane, chloroethane, chloroform, dichlorodifluoromethane, ethylbenzene, m/p-xylene, o-xylene, toluene, vinyl chloride

Notes:
ID = identification

SENSITIVE RECORD

PORTIONS OF THIS RECORD ARE CONSIDERED SENSITIVE AND ARE NOT AVAILABLE FOR PUBLIC VIEWING

FIGURE 3-1 – PREVIOUS INVESTIGATION SAMPLING LOCATIONS AND RESULTS

FOR ADDITIONAL INFORMATION, CONTACT:

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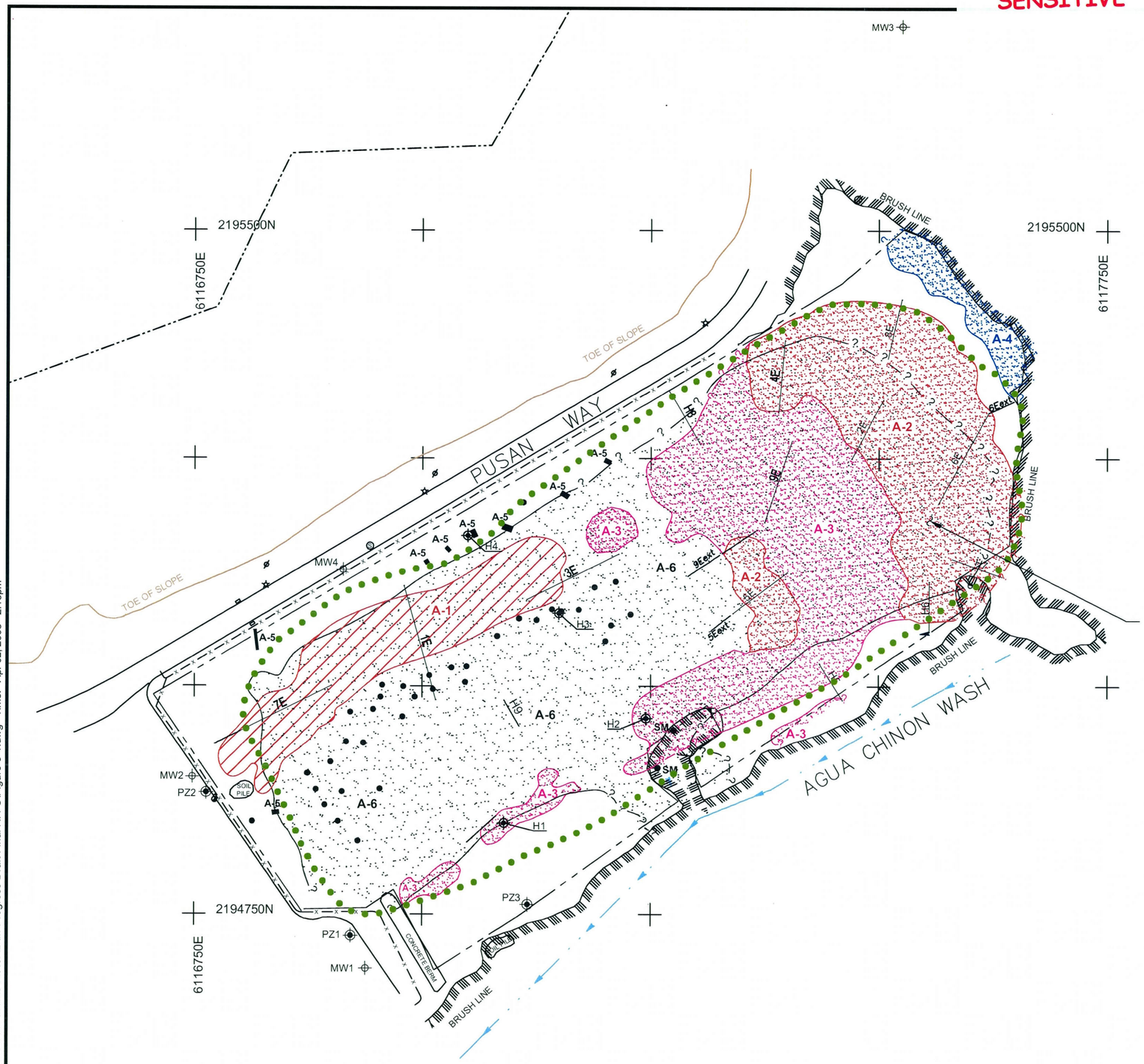
PRIMARY SOURCE OF INFORMATION:
TECHNICAL INFORMATION PACKAGE (OHM 2000)



LEGEND

- BOUNDARY OF GEOPHYSICAL SURVEY AREA
- ESTIMATED EXTENT OF WASTE PLACEMENT BOUNDARY FOR RSE INVESTIGATION
- CHAIN-LINK FENCE
- AGUA CHINON WASH
- SEWER MANHOLE
- LIGHT POLE
- POWER POLE
- STORM DRAIN
- MW2 GROUNDWATER MONITORING WELL
- PZ2 VADOSE ZONE VAPOR WELL
- ? LINE INDICATES UNCERTAIN BOUNDARY

GEOPHYSICAL SURVEY RESULTS

- VERY SMALL BURIED METALLIC OBJECT/DEBRIS
- SM SURFACE METALLIC OBJECT/DEBRIS
- 5E TRENCH LOCATIONS
- H4 TRENCH/POTHOLE LOCATIONS
- A-1 LARGE TRENCH CONTAINING HIGH CONCENTRATION OF DEEP BURIED METALLIC/CONSTRUCTION DEBRIS
- A-2 DISPOSAL AREA CONTAINING HIGH CONCENTRATION OF DEEP BURIED METALLIC/CONSTRUCTION DEBRIS
- A-3 DISPOSAL AREA CONTAINING SCATTERED DEEP BURIED METALLIC/CONSTRUCTION DEBRIS
- A-4 AREA CONTAINING SHALLOW BURIED METALLIC/ CONSTRUCTION DEBRIS
- A-5 LARGE BURIED METALLIC OBJECT OR SMALL ACCUMULATION OF BURIED METALLIC DEBRIS
- A-6 AREA CONTAINING POSSIBLE IMPORTED FILL

NOTES:

1. COORDINATES ARE IN CALIFORNIA STATE PLANE COORDINATE SYSTEM, NAD83, ZONE 6.
2. INTERPRETED BOUNDARIES OF SUBSURFACE ANOMALIES ARE APPROXIMATE, QUERIED WHERE INFERRED OR UNCERTAIN.

NORTH

60 0 60 120 FEET

SCALE: 1"=120'

RI/FS Report — Draft Final

Previous Investigation Sampling Locations and Results

Anomaly Area 3

Date: 04-08	Former MCAS El Toro	Figure
Project No. 29307	EarthTech — A tyco International Ltd. Company	3-1

File: L:\work\29307\work\AA3\CAD\In-Progress Draft Final RI FS\Figure 3-1.dwg Time: Apr 02, 2008 - 2:16pm

3.4 GEOPHYSICAL INVESTIGATION

A geophysical investigation was conducted between 9 and 18 February 2000, by IT/OHM to screen the site for buried metallic debris and fill soil. Geophysical techniques included magnetic and electromagnetic (EM) induction. The magnetic data revealed the presence of several large areas (indicative of the presence of buried metallic debris), including a large trench in the southwest portion of the survey area (anomaly A-1) and a large disposal area in the northeast portion of the survey area (anomalies A-2 and A-3) (Figure 3-1). Buried debris also appeared to have accumulated at the Station at a slope along the northeastern edge of the survey area (anomaly A-4). Additionally, several buried metallic objects or small accumulations of debris (anomaly A-5) were identified southwest of the trench (referred to as anomaly A-1), and numerous very small pieces of metallic debris were identified southeast of Trench A-1. The low magnitudes of the magnetic anomalies indicated that the metallic debris to be deeper than 5 feet in much of the site.

The EM-31 conductivity data revealed the presence of a large area of elevated electrical conductivity in the central portion of the survey area (Anomaly A-6). This area was interpreted as containing fine-grained, clayey soil near the surface. Because much of the native soil at the site appears to consist of low-conductivity, clean sands deposited by the Agua Chinon Wash, it is likely that the conductive soil in the middle of the site is imported fill material. The surface area over which geophysical surveys were conducted encompasses nine acres, and anomalies were identified over much of the surveyed area. Figure 3-1 shows the results of this geophysical investigation.

3.5 EXPLORATORY TRENCHING AND SUBSURFACE SOIL SAMPLING

Exploratory trenching was conducted during March 2000 and generally confirmed the results of the geophysical survey. Eighteen trenches/pits (1E to 8E, H1, H3 to H9, and, 9E and H2, each of which consists of two trenches) were excavated at the site. Subsurface soil sampling was conducted during trenching.

Twenty-two soil samples (plus two duplicates) were collected from the trenches at depths ranging from 4 feet to 35 feet bgs. One-third of the soil samples analyzed were collected from depths of 4 feet to 10 feet bgs, with all remaining samples collected from greater depths. These soil samples were analyzed for TPH (both gasoline and diesel ranges), VOCs, semivolatile organic compounds (SVOCs), and metals (including mercury). Two of the 24 soil samples were also analyzed for dioxins/furans, asbestos, and perchlorate.

The analytes that were detected in the samples were predominantly TPH and arsenic. Two of the 24 samples analyzed for arsenic exceeded both the background levels and the preliminary remediation goals (PRGs). The remaining detections of arsenic were within the Station-wide background levels. Lead and benzo[a]pyrene (B[a]P) were detected in a single sample each, and both analytes had concentrations that exceeded the residential PRGs (EPA 2004b). The two soil samples (Trench 4E at 6 feet bgs and Trench H3 at 4 feet bgs) that were analyzed for dioxins and furans had detected concentrations of 1,2,3,4,6,7,8-heptachlorodibenzodioxin (HPCDD), HPCDD (total), heptachlorodibenzofuran (HPCDF) (total), hexachlorodibenzofuran (HXCDF) (total), octachlorodibenzodioxin (OCDD), and octachlorodibenzofuran (OCDF). The calculated toxicity equivalency quotients (TEQs) for the samples (0.424 picograms per gram [pg/g] – 6 feet sample from Trench 4E and 0.0476 pg/g – 4 feet sample from Trench H3) were below the residential PRG of 3.9 pg/g for dioxins/furans. Table 3-3 presents the details of the subsurface soil sampling and Table-3-4 presents the summary of detected analytes of samples collected at various depths. Trench locations are shown on Figure 3-1.

Table 3-3: Details of Subsurface Soil Sampling from Trenches – Previous Investigation

Trench Number	Reason	Location	Materials Found	Sample ID	Depth (feet bgs)
1E	Bisected a portion of Anomaly A-1	Orientation - NW to SE Location - Southwestern portion of A-1, approximately 24 feet from the fence demarcating the boundary.	Excavated material was found to consist of clays and sands. Abundant quantities of concrete, rebar, and metallic debris.	20242-1096	16
				20242-1101	20
				20242-1099	22
2E	Intersecting anomalies A-2 and A-3	Orientation - SW to NE Location - Northeastern portion of the site.	A strong petroleum odor was noted at 5 feet to 7 feet bgs. Soil sample, 20242-1102, was collected at the location of strong petroleum odor and analyzed for TPH diesel, gasoline, VOCs, SVOCs, metals, perchlorate, asbestos, dioxins and furans. Detected analytes included TPH as diesel (5,600 mg/kg), acetone (100 µg/kg), methylene chloride (9.2 µg/kg) and inorganic compounds. Construction debris was encountered from 9 feet to 22 feet bgs.	20242-1102	4
				20242-1103	22
3E	Intersecting Anomalies A-1 and A-6	Orientation – NE to SW Location - North-central portion of the site.	Debris was encountered from 16 feet to 23 feet bgs. However, minor debris was encountered between 6 feet and 16 feet bgs.	20242-1110	22
				20242-1114	22
				20242-1115	35
4E	Intersecting Anomaly A-2	Orientation – North to East Location – NE corner of the site near the northern edge.	A strong, sweet chemical odor was noted from 3 feet to 5 feet bgs. Soil sample, 20242-1109, was collected at the location of strong sweet chemical odor and analyzed for TPH diesel, gasoline, VOCs, SVOCs, metals, perchlorate, asbestos, dioxins and furans. Detected analytes included TPH as diesel (170 mg/kg), acetone (46J µg/kg), methylene chloride (9.2 µg/kg),	20242-1109	6

Table 3-3: Details of Subsurface Soil Sampling from Trenches – Previous Investigation

Trench Number	Reason	Location	Materials Found	Sample ID	Depth (feet bgs)
4E (Contd')			low concentrations of dioxins and furans, and inorganic compounds. Concrete, rebar, polyvinyl chloride (PVC) plastic bags, and heavy construction debris were encountered from 8 feet to 23 feet bgs.		
5E	Intersecting Anomalies A-2, A-3 and A-6	Orientation – NE to SW Location – Central portion of the site.	Heavy construction debris and large granodiorite boulders were encountered from 7 feet to 20 feet bgs. The extension trench had scattered debris and contained asbestos pipe.	20242-1108	10
				20242-1107	22
				20242-1117	22
				20242-1118 (dup)	22.5
6E	Intersecting Anomaly A-2	Orientation – The orientation of the trench was NE to SW Location – NE portion of the site, near the hill. The northeastern extension of the trench extended to the northeasterly toe of the slope.	Construction, rubble, and metal debris were encountered from 2 feet to 20 feet bgs.	20242-1104	22
7E	Bisecting a portion of Anomaly A-1	Orientation – NE to SW Location – SW portion of the site close to the fence demarcating the study area.	A single soil pile was located near the trench. Construction debris, plastic, metal pipes, and asbestos pipes were encountered from 4 feet to 22 feet bgs.	20242-1116	22
8E	Intersecting portion of Anomaly A-2	Orientation – North to South Location – NE portion of the site.	Asphalt concrete, with thicknesses ranging from 2 inches to 3.5 inches, was located at depths of 10 feet to 12 feet bgs and was logged as a possible road or a cover.	—	—
9E	Bisecting a portion of Anomaly A-3	Orientation – NE to SW Location – NW portion of the site.	Construction debris, plastic, metal pipes, and asbestos pipes were encountered from 4 feet to 22 feet bgs.	—	—

Table 3-3: Details of Subsurface Soil Sampling from Trenches – Previous Investigation

Trench Number	Reason	Location	Materials Found	Sample ID	Depth (feet bgs)
H1	Intersecting Anomaly A-3 and was extended beyond A-3 until the limits of debris were delineated	Orientation – East to West Location – Lower SE portion of the site.	Metal and plastic debris were encountered in the trenches.	20242-1098	10
H2	Trench and its extension bisect Anomalies A-3 and A-6.	Orientation – NE to SW Location – Central portion of the site toward Agua Chinon Wash.	Concrete, wood, metal debris, and plastic were encountered in the trenches.	20242-1097	6
H3	Intersecting Anomaly A-6	Orientation – NW-SE to E-W Location – Central portion of the site.	Some concrete debris was encountered in the trench.	20242-1095	4
H4	Intersects Anomalies A-5, A-6, and A-1	Orientation – NW-SE to E-W Location – Central portion of the site south of Pusan Way.	Construction debris and domestic refuse, such as milk containers, were encountered in the trench.	20242-1112	7
				20242-1113 (dup)	7.5
H5	Intersects Anomaly A-3	Orientation – NW to SE Location – Center of southeastern boundary near Agua Chinon Wash.	Construction debris including concrete rebar, metal debris, plastic, and rubber were encountered in the trench.	20242-1111	7
H6	Intersects Anomaly A-2	Orientation – North to South Location – Near the boundary of the site along Aqua Chinon Wash.	Some debris was encountered in the trench.	20242-1106	6
H7	Intersects Anomaly A-2	Orientation – NE to SW Location – Near the boundary of the site along Aqua Chinon Wash.	Some debris was encountered in the trench.	20242-1105	18
H8	Intersects Anomaly A-3	Orientation – NW to SE Location – Near the NW boundary of the site along Pusan Way.	Some debris was encountered in the trench.	20242-1100	14
H9	Intersects Anomaly A-6	Orientation – NW to SE Location – Central portion of the site.	Some debris was encountered in the trench.	—	—

Notes:
µg/kg = micrograms per kilogram
bgs = below ground surface
ID = identification
mg/kg = milligrams per kilogram
NE = northeast
NW = northwest
SE = southeast
SW = southwest
SVOCs = semivolatile organic compounds
TPH = total petroleum hydrocarbons

Table 3-4: Summary of Detected Analytes - Subsurface Soil Sampling- Previous Investigation

	Sample ID:	20242-1095	20242-1102	20242-1109	20242-1106	20242-1097	20242-1112	20242-1111	20242-1113	20242-1098	20242-1108	20242-1100	20242-1105	20242-1096	20242-1099	20242-1101	20242-1103	20242-1110	20242-1114
	Location ID:	AA3-H3-01	AA3-2E-01	AA3-4E-01	AA3-H6-01	AA3-H2-01	AA3-H4-01	AA3-H5-01	AA3-H4-01	AA3-H1-01	AA3-5E-02	AA3-H8-01	AA3-H7-01	AA3-1E-01	AA3-1E-02	AA3-1E-03	AA3-2E-02	AA3-3E-01	AA3-3E-02
	Sample Type:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular
	Sample Date:	03/06/96	03/07/96	03/07/96	03/07/96	03/06/96	03/08/96	03/08/96	03/08/96	03/06/96	03/07/96	03/06/96	03/07/96	03/06/96	03/06/96	03/06/96	03/07/96	03/08/96	03/08/96
Parameter	Sample Depth :	4.0 feet	4.0 feet	6.0 feet	6.0 feet	6.0 feet	7.0 feet	7.0 feet	7.5 feet	10.0 feet	10.0 feet	14.0 feet	18.0 feet	16.0 feet	22.0 feet	20.0 feet	22.0 feet	22.0 feet	22.0 feet
TPH (EPA Method 8015M)	Units																		
TPH as Diesel	mg/kg	11 U	5600	170	10.7 U	150	42	12	79	10.9 U	15	10.6 U	150	160	61	12 U	130	63	110
VOCs (EPA Method 8260)																			
2-Butanone (MEK)	µg/kg	160 U	79 U	62 U	53 U	120 U	64 U	53 U	65 U	60 U	50 U	59 U	160 U	73 U	90 U	78 U	66 U	67 U	52 J
Acetone	µg/kg	160 U	100	46 J	53 U	120 U	50 J	37 J	80	60 U	66	59 U	33 J	73 U	90 U	78 U	50 J	40 J	230 J
Benzene	µg/kg	16 U	7.9 U	6.2 U	5.3 U	12 U	6.4 U	5.3 U	1.7 J	6 U	5 U	5.9 U	16 U	7.3 U	9 U	7.8 U	6.6 U	6.7 U	6.3 U
Methylene chloride	µg/kg	16 U	9.2	6.2 U	5.3 U	12 U	6.4 U	5.3 U	6.5 U	6 U	5 U	5.9 U	14 J	7.3 U	9 U	7.8 U	7.7	6.7 U	6.3 U
Styrene	µg/kg	16 U	7.9 U	6.2 U	5.3 U	12 U	6.4 U	5.3 U	6.5 U	6 U	5 U	5.9 U	16 U	7.3 U	9 U	7.8 U	6.6 U	6.7 U	6.3 U
SVOCs (EPA Method 8270)																			
Benzo[a]anthracene	µg/kg	360 U	21000 U	1800 U	350 U	1800 U	1800 U	270 J	1800 U	360 U	380 U	350 U	3500 U	1700 U	390 U	400 U	2000 U	400 U	3800 U
Benzo[a]pyrene	µg/kg	280 U	16000 U	190 U	35 U	1400 U	1300 U	230	1400 U	270 U	38 U	270 U	2700 U	140 J	39 U	300 U	1500 U	310 U	2900 U
Benzo[b]fluoranthene	µg/kg	360 U	21000 U	1800 U	350 U	1800 U	1800 U	440	1800 U	360 U	380 U	350 U	3500 U	1700 U	390 U	400 U	2000 U	400 U	3800 U
Chrysene	µg/kg	360 U	21000 U	1800 U	350 U	1800 U	1800 U	250 J	1800 U	360 U	380 U	350 U	3500 U	1700 U	390 U	400 U	2000 U	400 U	3800 U
Diethyl phthalate	µg/kg	360 U	21000 U	1800 U	96 J	1800 U	1800 U	260 J	1800 U	360 U	380 U	350 U	3500 U	1700 U	390 U	100 J	2000 U	400 U	3800 U
Fluoranthene	µg/kg	360 U	21000 U	1800 U	350 U	1800 U	1800 U	600	1800 U	360 U	380 U	350 U	3500 U	1700 U	390 U	400 U	2000 U	400 U	3800 U
Indeno[1,2,3-cd]pyrene	µg/kg	360 U	21000 U	190 U	35 U	1800 U	1800 U	81	1800 U	360 U	38 U	350 U	3500 U	63 J	39 U	400 U	2000 U	400 U	3800 U
Phenanthrene	µg/kg	360 U	21000 U	1800 U	350 U	1800 U	1800 U	140 J	1800 U	360 U	380 U	350 U	3500 U	1700 U	390 U	400 U	2000 U	400 U	3800 U
Pyrene	µg/kg	360 U	21000 U	1800 U	350 U	1800 U	1800 U	460	1800 U	360 U	380 U	350 U	3500 U	1700 U	390 U	400 U	2000 U	400 U	3800 U
Metals (EPA Method 6010B)																			
Antimony	mg/kg	11 UJ	10.5 U	11.2 U	10.7 U	11 UJ	10.7 U	10.6 U	10.9 U	10.9 UJ	11.4 U	10.6 UJ	10.7 U	46 J	12 UJ	12 UJ	12.1 U	12.2 U	11.5 U
Arsenic	mg/kg	3.05	2.12	2.49	1.81	4.63	4.59	2.85	4.35	3.45	3.23	3.98	1.85	211	4.04	6.78	6.47	4.92	6.56
Barium	mg/kg	112	79.4	76	73	101	104	62.3	106	98.3	83.5	79.7	83.9	360	156	156	101	86.8	100
Beryllium	mg/kg	.459 U	.294 U	.298 U	.219 U	.361 U	.459 U	.215 U	.407 U	.419 U	.391 U	.533 U	.253 U	.63 U	.558 U	.618 U	.419 U	.35 U	.467 U
Cadmium	mg/kg	1.1 U	1.05 U	1.12 U	1.07 U	1.1 U	1.07 U	1.06 U	1.09 U	1.09 U	1.14 U	1.06 U	1.07 U	2.42	1.2 U	1.2 U	1.35	1.22 U	1.15 U
Chromium	mg/kg	10.2	10.4	7.04	4.4	13.2	15.8	12.9	16.9	12.3	9.16	13.2	6.88	53.1	14.9	21.1	23.8	16	14.1
Cobalt	mg/kg	3.73	5.33	3.09	2.54	4.18	5.8	2.97	4.52	4.32	3.5	6.1	2.92	72.8	6.74	4.97	4.03	2.21	4.31
Copper	mg/kg	6.56	10.7	6.48	3.04	9.28	12.7	5.82	12.6	6.56	6.2	11.3	4.35	2040	12.4	7.9	17.2	4.3	25.8
Lead	mg/kg	5.47	9.36	9.72	2.22	12.4	14.7	3.87	11.9	3.58	3.56	3.4	6.47	677	4.42	5.1	24.6	2.96	6.13
Manganese	mg/kg	211 J	231	156	144	214 J	250	145	213	181 J	123	125 J	149	1350 J	270 J	185 J	175	124	169
Molybdenum	mg/kg	2.2 UJ	2.1 U	2.24 U	2.14 U	2.19 UJ	2.15 U	2.13 U	2.17 U	2.19 UJ	2.29 U	2.13 J	2.14 U	490 J	3.2 UJ	2.4 UJ	7.81	2.45 U	2.3 U
Nickel	mg/kg	7.14	13.7	5.03	2.14 U	8.79	11.6	7.98	10.3	8.07	5.15	9.71	4.92 U	25.4	10.7	11.5	9.87	6.61	8.51
Selenium	mg/kg	1.1 U	1.05 U	1.12 U	1.07 U	1.1 U	1.07 U	1.06 U	1.09 U	1.09 U	1.14 U	1.06 U	1.07 U	3.4	1.2 U	1.2 U	1.21 U	1.22 U	1.15 U
Thallium	mg/kg	1.19 U	1.05 U	1.12 U	1.07 U	1.32 U	1.07 U	1.06 U	1.09 U	1.09 U	1.14 U	1.06 U	1.07 U	3.98	1.2 U	1.22 U	1.21 U	1.22 U	1.15 U
Vanadium	mg/kg	27.4	35.6	19.7	16.9	27.3	29.5	18	26.9	32.6	22.8	37.9	20	38.1	43.4	43.2	39.7	25.8	33.8
Zinc	mg/kg	37.7 J	45.9 J	35.9	26.2	43 J	50.7	26.2	45.9	36.4 J	32.5	34.1 J	27.5 J	6030 J	88 J	52.6 J	72 J	34.7	37.6
Dioxins/Furans (EPA Method 8290)																			
1,2,3,4,6,7,8-HPCDD	pg/g	4.3 J	NA	39	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-HPCDF	pg/g	1.7 U	NA	2.7 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-HPCDF	pg/g	0.72 U	NA	0.99 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HCDD	pg/g	0.64 U	NA	0.86 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HCDF	pg/g	0.41 U	NA	0.68 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-HCDD	pg/g	0.68 U	NA	1.5 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-HCDF	pg/g	0.39 U	NA	0.66 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-HCDD	pg/g	0.91 U	NA	1.1 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-HCDF	pg/g	0.77 U	NA	0.80 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-PECDD	pg/g	0.82 U	NA	1.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-PECDF	pg/g	0.49 U	NA	0.74 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6,7,8-HCDF	pg/g	0.42 U	NA	0.71 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,7,8-PECDF	pg/g	0.48 U	NA	0.73 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDD	pg/g	0.79 U	NA	0.78 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDF	pg/g	0.42 U	NA	0.66 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HPCDDs (total)	pg/g	8.6	NA	66	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HPCDFs (total)	pg/g	1.8	NA	6.8 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HCDDs (total)	pg/g	0.88 U	NA	4.1 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HCDFs (total)	pg/g	0.77 U	NA	1.6 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OCDD	pg/g	40	NA	330 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OCDF	pg/g	5.9 J	NA	10 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PECDDs (total)	pg/g	0.82 U	NA	1.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PECDFs (total)	pg/g	0.77 U	NA	2.0 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TCDDs (total)	pg/g	0.79 U	NA	0.78 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TCDFs (total)	pg/g	0.54 U	NA	0.66 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TEQ (Total 2,3,7,8-TCDD)	pg/g	0.048	NA	0.424	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NOTES:

U = indicates the analyte was not detected at or above the stated limit.
UJ = indicates the analyte was not detected at or above the stated limit. The sample detection limit is an estimated value.
J = indicates an estimated value.
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
pg/g = picograms per per kilogram
NA = not analyzed
ID = identification

TPH = total petroleum hydrocarbons
EPA = Environmental Protection Agency
PRG = preliminary remediation goal
VOCs = volatile organic compound
SVOC = semivolatile organic compound
AA3 = Anomaly Area 3
RSE = Removal Site Evaluation
TEQ = toxicity equivalency quotient

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Table 3-4: Summary of Detected Analytes - Subsurface Soil - Previous Investigation

	Sample ID:	20242-1107	20242-1117	20242-1118	20242-1104	20242-1116	20242-1115
	Location ID:	AA3-5E-01	AA3-5E-03	AA3-5E-03	AA3-6E-01	AA3-7E-01	AA3-3E-03
	Sample Type:	Regular	Regular	Duplicate	Regular	Regular	Regular
	Sample Date:	03/07/96	03/09/96	03/09/96	03/07/96	03/08/96	03/08/96
Parameter	Sample Depth :	22.0 feet	22.0 feet	22.5 feet	22.0 feet	22.0 feet	35.0 feet
TPH (EPA Method 8015M)	Units						
TPH as Diesel	mg/kg	13	220	130	260	370	1100
VOCs (EPA Method 8260)							
2-Butanone (MEK)	µg/kg	52 U	10 J	13 J	100 U	52 U	11 J
Acetone	µg/kg	46 J	31 J	98	100 J	52 U	77
Benzene	µg/kg	5.2 U	5.9 U	5.9 U	10 U	5.2 U	5.9 U
Methylene chloride	µg/kg	5.2 U	3.2 J	34	11	3 J	2.7 J
Styrene	µg/kg	5.2 U	5.9 U	5.9 U	10 U	32	5.9 U
SVOCs (EPA Method 8270)							
Benzo[a]anthracene	µg/kg	390 U	780 U	390 U	3800 U	10000 U	390 U
Benzo[a]pyrene	µg/kg	290 U	590 U	290 U	2900 U	1000 U	290 U
Benzo[b]fluoranthene	µg/kg	390 U	780 U	390 U	3800 U	10000 U	390 U
Chrysene	µg/kg	390 U	780 U	390 U	3800 U	10000 U	390 U
Diethyl phthalate	µg/kg	390 U	780 U	390 U	3800 U	10000 U	390 U
Fluoranthene	µg/kg	390 U	780 U	390 U	3800 U	10000 U	390 U
Indeno[1,2,3-cd]pyrene	µg/kg	390 U	780 U	390 U	3800 U	1000 U	390 U
Phenanthrene	µg/kg	390 U	780 U	390 U	3800 U	10000 U	390 U
Pyrene	µg/kg	390 U	780 U	390 U	3800 U	10000 U	390 U
Metals (EPA Method 6010B)							
Antimony	mg/kg	11.7 U	11.8 U	11.7 U	11.5 U	10.4 U	11.7 U
Arsenic	mg/kg	7.74	3.25	3.05	2.99	2.6	4.82
arium	mg/kg	68.5	88.6	93.5	95.5	55.5	98.1
Beryllium	mg/kg	.378 U	.357	.383	.302 U	.29	.499
Cadmium	mg/kg	1.17 U	1.18 U	1.17 U	1.15 U	1.84	1.17 U
Chromium	mg/kg	8.3	7.29	8.08	9.34	10.8	11.2
Cobalt	mg/kg	3.43	3.27	3.6	3.55	6.97	4.36
Copper	mg/kg	4.79	7.48	7.12	6.92	11.1	7.91
Lead	mg/kg	3.7	4.73	3.93	5.53	122	4.39
Manganese	mg/kg	91.2	138	136	168	181	107
Molybdenum	mg/kg	2.35 U	2.37 U	2.35 U	2.29 U	2.07 U	2.34 U
Nickel	mg/kg	5.32	7.28	7.4	6.79	8.26	7.12
Selenium	mg/kg	1.17 U	1.18 U	1.17 U	1.15 U	1.04 U	1.17 U
Thallium	mg/kg	1.17 U	1.18 U	1.17 U	1.15 U	1.04 U	1.17 U
Vanadium	mg/kg	20.8	20.6	22.6	25.9	21.6	26.8
Zinc	mg/kg	21.9	37.5	34.7	39.2 J	146	32.5
Dioxins/Furans (EPA Method 8290)							
1,2,3,4,6,7,8-HPCDD	pg/g	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-HPCDF	pg/g	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-HPCDF	pg/g	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HCDD	pg/g	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HCDF	pg/g	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-HCDD	pg/g	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-HCDF	pg/g	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-HCDD	pg/g	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-HCDF	pg/g	NA	NA	NA	NA	NA	NA
1,2,3,7,8-PECDD	pg/g	NA	NA	NA	NA	NA	NA
1,2,3,7,8-PECDF	pg/g	NA	NA	NA	NA	NA	NA
2,3,4,6,7,8-HCDF	pg/g	NA	NA	NA	NA	NA	NA
2,3,4,7,8-PECDF	pg/g	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDD	pg/g	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDF	pg/g	NA	NA	NA	NA	NA	NA
HPCDDs (total)	pg/g	NA	NA	NA	NA	NA	NA
HPCDFs (total)	pg/g	NA	NA	NA	NA	NA	NA
HCDDs (total)	pg/g	NA	NA	NA	NA	NA	NA
HCDFs (total)	pg/g	NA	NA	NA	NA	NA	NA
OCDD	pg/g	NA	NA	NA	NA	NA	NA
OCDF	pg/g	NA	NA	NA	NA	NA	NA
PECDDs (total)	pg/g	NA	NA	NA	NA	NA	NA
PECDFs (total)	pg/g	NA	NA	NA	NA	NA	NA
TCDDs (total)	pg/g	NA	NA	NA	NA	NA	NA
TCDFs (total)	pg/g	NA	NA	NA	NA	NA	NA
TEQ (Total 2,3,7,8-TCDD)	pg/g	NA	NA	NA	NA	NA	NA

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3.5.1 Radiological Screening During Trenching

Radiological screening was conducted as part of the trenching activity. The radiological screening was categorized as an initial characterization. The screening log indicates that the radiological readings of beta/gamma and alpha were within or equal to background concentrations. A detailed soil radiological evaluation of the site is presented in Section 3.7 as part of the Station-wide radiological survey.

3.6 DELINEATION OF WASTE PLACEMENT

The primary objective of the trenching in March 2000 was to supplement and verify the results of the geophysical survey conducted during February 2000. The results of trenching also provided information on the characteristics and delineation of the debris placed at the site. However, even though waste delineation was not the primary objective, a few of the trenches were excavated to the limits of waste placement (Table 3-3 and Figure 3-1).

In order to provide boundaries for the sampling design of the RSE investigation, tentative waste placement boundaries were estimated using the pre-waste placement and post-waste placement topographs. The record search revealed the existence of pre-waste placement (circa 1972, with 2-foot contour intervals) and post-waste placement (1990, with 2-foot contour intervals), (Figures 3-1 and 3-2, respectively, of the Work Plan). The pre- and post-waste placement topographic maps and the cross sections generated using these topographs were used to estimate the lateral extent of the waste placement, the interface of the fill material with the native soil, the volume of the fill, and depth of water relative to the fill material.

The lateral extent (boundary) was further verified by evaluating the borehole logs. A review of the borehole logs of the vadose zone wells (PZ1, PZ2, and PZ3) and the monitoring wells (MW01, MW02, and MW04) did not reveal any evidence of debris. Logs of Trenches H4, H5, H6, H7, H8, 7E, and 8E (which extended across the perimeter of AA 3) also defined the limits of waste placement. A detailed description of waste delineation is presented in the RSE Work Plan (Earth Tech 2002a).

As a result of this delineation activity, the maximum depth of waste was estimated at approximately 25 feet to 30 feet bgs. Figure 3-1 shows the lateral extent of waste. These cross sections and the tentative waste placement boundary were used in the decision-making process for the RSE sampling design. However, the waste placement boundaries were refined based on the RSE trenching activity and are presented in Section 6.1 of this Report.

3.7 EVALUATION OF RADIONUCLIDES

3.7.1 Groundwater

Investigations previously conducted at former MCAS El Toro identified radionuclides (gross alpha and gross beta emissions) in groundwater at concentrations exceeding Federal drinking water standards (Earth Tech 2001). Table 3-1 shows the radionuclide concentrations exceeding the drinking water standards in the groundwater collected from AA 3. The Phase I radionuclide evaluation at the former landfill sites (IRP Sites 2, 3, and 5) and the Explosive Ordnance Disposal (EOD) Range (IRP Site 1) concluded that the origin of the radionuclides in the groundwater is natural, and not anthropogenic. An additional Phase II investigation was conducted by Earth Tech in 2001 and was documented in a Technical Memorandum (Earth Tech 2001). The study confirmed that there was no evidence that the gross alpha and gross beta emissions detected at former MCAS El Toro were caused by Marine Corps activities. The report recommended that once the results of the

ongoing radiological survey are available, the current monitoring for radionuclides be reevaluated. In addition, no further evaluation of the origin of the radionuclides in groundwater was deemed necessary.

3.7.2 Soil

3.7.2.1 Historical Radiological Assessment

The Historical Radiological Assessment (HRA) was conducted to identify sources of radioactive material/contamination and assess the likelihood of contaminant migration, thereby identifying sites that needed further action. The HRA also provided initial classification (impacted or non-impacted) for former MCAS El Toro sites. The HRA included the review of the Navy, former MCAS El Toro, and NAVFAC SW correspondence, historical files and related reports, personnel interviews, site inspections, and limited informal surveys. The HRA for former MCAS El Toro was issued in May 2000 (Weston 2000a).

3.7.2.2 Radiological Survey Plan

Based on information provided in the HRA, a Radiological Survey Plan (Weston 2000b) was prepared to outline the specifications for additional radiological characterization of sites selected based on the HRA at former MCAS El Toro. The HRA and the Radiological Survey Plan identified the main radioisotopes of concern at former MCAS El Toro, as radium (Ra-226) and strontium (Sr-90), which were historically used in aircrafts stationed at the Station. Other radioisotopes that may have been present at former MCAS El Toro include thorium (Th-232), cobalt (Co-60), krypton (Kr-85), and tritium (Hydrogen [^{3}H]).

A Sampling Amendment to the Radiological Survey Plan was issued in February 2004 for final radiological characterization of the Station. The on-site radiological characterization and laboratory analyses were conducted in June 2001 through November 2001 and March 2004. Results of the surveys were presented in the Draft Radiological Release Report (Weston 2004) for IRP Sites 3 and 5, AA 3, and Building 244 at former MCAS El Toro.

The radiological surveys for the sites were performed using high-density techniques to detect surface radiation in accordance with the guidelines contained in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), Nuclear Regulatory Commission (NRC) and Regulatory Guide (NURGE 1575). The high-density survey electronically mapped all survey data using global positioning system (GPS) coordinates. Solid samples were collected from each outdoor site and analyzed for radionuclides of interest to augment the scan survey data.

The derived concentration guideline level (DCGL) for the sites was established. For outdoor sites, including AA 3, the property was acceptable for unrestricted use if residual radioactivity in soil distinguishable from background radiation met the following criteria:

- Radionuclide Concentration

  Based on the proposed reuse of AA 3 site, the DON established the residual radiological release criteria, $DCGL_w$ which is the DCLG for average areas over a wide area, used with statistical tests, for Ra-226 at 1 picocuries per gram (pCi/g) above former MCAS El Toro background. This level was established as a result of discussions with the EPA and the California DHS during the BCT meeting of 6 February 2003.

The radiological analyses performed on 15 reference soil samples collected throughout the Station, yielded a background soil concentration of Ra-226 at former MCAS El Toro of 1.05 pCi/g. Using a $DCGL_w$ of 1 pCi/g, the total Ra-226 DGCL for the Station was set at 2.05 pCi/g.

- Dose

  Residual radioactivity (due to Ra-226) distinguishable from background radiation results in a total effective dose equivalent (TEDE) to an average member of the residential receptor that does not exceed 25 millirem per year (mrem/y), as required by 10 Code of Federal Regulations (CFR) 20, Subpart E, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA) (10 CFR 20.1402).

  To ensure ALARA was met, the DON demonstrated that the radiological surveys and sampling results not only yielded a TEDE less than 25 mrem/y, but the average Ra-226 concentration did not exceed the "Interim Screening Value for soil surface contamination level" specified in Table 3 of the Federal Register Volume 64, Number 234, Page 68395.

- Risk

  Residual Ra-226 corresponds to the NCP defined risk range of 10^{-4} to 10^{-6} and consideration of uncertainties, including inherent spatial and measurement variability in Ra-226 concentration, and uncertainties in risk assessment, indicates that the level of Ra-226 exposure at the sites is in the range of the background for a residential receptor.

3.7.2.2.1 AA 3

A detailed description of the survey activities, results, analyses and recommendations are presented in the Draft Radiological Release Report for IRP Sites 3 and 5, AA 3 and Building 244 (Weston 2004).

A total of 56,270 survey readings were recorded over the survey area of approximately nine acres using the tractor-trailer eight-detector assembly and the single detector backpack GPS survey. The highest individual detector reading was 26,156 counts per minute (cpm).

A sample was collected from the area with the highest reading in contiguous homogenous locations that were representative of several areas in question. Subsequent to the sampling of the area containing the elevated readings, 21 additional random-systematic/judgmentally located samples were collected to ensure that sufficient solid samples were analyzed to fully characterize the site. The Ra-226 concentrations in the samples ranged from 0.97 pCi/g to 2.29 pCi/g (slightly above the DCGL of 2.05 pCi/g). Two of the 21 solid samples contained Ra-226 concentrations slightly above the DCGL of 2.05 pCi/g (2.17 pCi/g and 2.29 pCi/g). The survey and sampling data from the site resulted in an average Ra-226 concentration of 1.54 pCi/g, which is below the DCGL.

Using the two survey points that exceeded the DCGL, a Wilcoxon Rank Sum (WRS) test was performed for the high-density survey at AA 3. The results indicate that the site passed the statistical test and met the release criterion. The WRS test was performed on the solid sample results and it was determined that the alternate hypothesis was met and that the site meets the release criterion.

Based on the average solid sampling results, a NRC DandD Screening Code program calculation was performed. For a residual Ra-226 soil concentration of 0.49 pCi/g (1.54 pCi/g minus 1.05 pCi/g [background]), the DandD Screening Code Residential Scenario Program yielded a TEDE of

20.1 mrem/y. The 95 percent confidence interval for the 0.9 percentile value of the TEDE is 19 mrem/y to 20.9 mrem/y (i.e., within the annual limit of 25 mrem/y specified in the 10 CFR 20).

Based on the average incremental Ra-226 concentration of 0.49 pCi/g, the assessed risk to a residential receptor, using the residential scenario for the PRGs Superfund Risk Calculator, is 3.95×10^{-5}, within the NCP defined range of 10^{-4} to 10^{-6} to a residential receptor.

Based on the survey data, soil sample analyses results, statistical test results, and TEDE and risk calculations, it was concluded that the surface of AA 3 contains radiation levels which are present as a result of natural radioactivity contained in ground surface materials (e.g., gravel, crushed rock, etc.). The AA 3 surface is therefore considered to meet the radiological criteria for unrestricted use. It was also concluded that the level of Ra-226 exposure at AA 3 is in the range of the Station-wide background for a residential receptor. Therefore, it was recommended that Ra-226 be removed from the list of chemicals of potential concern (COPCs) for AA 3 and further evaluation under the CERCLA process. The California Department of Health services concurred with these conclusions and stated that historical documentation indicated that the sites could be reclassified as non-impacted and therefore are acceptable for unrestricted release (CDHS 2007). These findings will be presented in the AA 3 Record of Decision (ROD).

4. RSE INVESTIGATION

The field investigation program for AA 3 was developed using the EPA DQO process (EPA 2000a). The RSE field investigation program was designed to supplement the data gathered from previous investigations and also assist in providing enough information to evaluate future response action for the site.

This section describes the procedures employed to address the DQO questions identified in the RSE Work Plan (Earth Tech 2002a). All RSE investigation activities were performed in accordance with the Sampling and Analysis Plan (SAP), Appendix A (Earth Tech 2002a), quality assurance procedures listed in the Work Plan (Earth Tech 2002a) and the Final Health and Safety Plan (Earth Tech 2002b).

In addition, field activities were performed in general accordance with the following guidance documents: CLEAN Health and Safety Manual; CLEAN II Standard Operating Procedure (SOP) 3, *Borehole Logging*; CLEAN II SOP 4, *Soil Sampling*; CLEAN II SOP 5, *Monitoring Well Installation and Development*; CLEAN II SOP 6, *Instrument Calibration and Use*; CLEAN II SOP 7, *Water and Free-Product Level Measurements in Wells*; CLEAN II SOP 8, *Groundwater Sampling*; CLEAN II SOP 9, *Sample Containers, Preservation and Handling*; CLEAN II SOP 10, *Sample Custody, Transfer and Shipment*; CLEAN II SOP 11, *Decontamination of Equipment*; CLEAN II SOP 12, *Surface Water Sampling*; CLEAN II SOP 13, *Abandonment of Boreholes and Wells*; CLEAN II SOP 16, gINT System: *Boreholes and Wells*; CLEAN II SOP 17, *Logbook Protocols*; CLEAN II SOP 22, *IDW* (BNI 1999).

4.1 PURPOSE AND SCOPE OF RSE WORK

The purpose of the AA 3 RSE field investigation program was to collect data necessary for preparation and selection of the response action for the site. The scope of the Work Plan (Earth Tech 2002a) included the following:

- Collecting soil vapor, soil, groundwater, surface water, and sediment samples to evaluate the impact, if any, due to waste placement;
- Confirming the lateral limits of the waste placement;
- Evaluating human health and ecological risks; and,
- Collecting soil samples to conduct a geotechnical assessment of the existing soil cover.

The Work Plan was prepared in compliance with the requirements of CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, the NCP, Title 40 CFR Part 300, and the California Health and Safety Code, Section 6.8.

4.2 SAMPLING DESIGN

The sampling design for the AA 3 RSE investigation was based on the EPA DQO process. The principal questions for the RSE field investigation (Earth Tech 2002a) were the following:

6. Are adequate data available to complete an RSE, including the design of a cover system?
7. What is the risk posed by the site to human health and/or the environment?

The project decisions that were considered to resolve these principal study questions were the following (Earth Tech 2002a):

1. Have the waste boundaries been adequately delineated, or is further evaluation required?
2. Has the existing soil cover been adequately characterized (thickness and soil properties), or is further evaluation required?
3. Are adequate data available to characterize if the existing soil cover is sufficient to either protect human health and/or environment, or if not, to serve as a foundation layer for a soil cover system?
4. Has the impact to groundwater, surface water, and sediments been adequately characterized, or are additional data required?
5. Is soil vapor being produced within the waste, and if yes, does it exceed threshold levels listed as decision inputs and requires a waste placement gas collection system?
6. Does soil vapor migrate from the site to impact adjacent property?
7. Has the nature of the waste present been adequately characterized using soil vapor, soil, groundwater, surface water, and sediment data, or is further evaluation required to characterize risk and evaluate response actions?
8. Have potential human and ecological receptors been identified, and are they likely to be at risk for adverse health effects at this site?

4.2.1 Study Boundaries

The study boundary for the AA 3 site is approximately nine acres, bordered to the northeast by Pusan Way and to the southeast by Agua Chinon Wash (Figure 3-1); the former Wherry Housing Area is further to the southeast and northeast. Construction debris placement extends from near the surface to approximately 25 feet to 30 feet bgs. The construction debris placement boundary for AA 3 was a result of delineation activity as presented in Section 3.6. Groundwater at the site is found at approximately 20 feet to 40 feet bgs (approximately 60 feet bgs at abandoned Well MW03).

According to the Work Plan, the vertical extent of the investigation would progress to approximately the first encountered groundwater if the analytical results of the sample collected from the preceding depths indicated contamination.

4.2.2 Decision Inputs

All the physical and analytical data from previous investigations, including soil, soil vapor, groundwater, and results from geophysical and trenching investigations were used to develop the scope and served as decision inputs to resolve the project decision questions of the RSE investigation. Sampling performed at AA 3 as part of the RSE was also used to resolve the project decision questions. In addition, EPA Region 9 PRGs (EPA 2004b) (residential and industrial) were used as screening criteria for risk to human health. Results from the radiological survey (Weston 2000b) were also proposed as decision inputs in the Work Plan to assess if additional radiological sampling is required.

The following threshold levels were used as screening criteria for the assessment of detected analytes:

- Former MCAS El Toro area background metals and selected organic compound concentrations in soil (BNI 1996). Concentrations of analytes that exceeded the background threshold (95th quantile) were compared to the residential and industrial soil PRGs.
- EPA Region 9 (California [Cal]-EPA modified) PRGs and soil screening levels (SSLs) for industrial and residential use scenarios for analytes other than metals.
- For groundwater and surface water, federal and California MCLs or drinking water advisory thresholds for drinking water, where available. In the absence of MCLs, EPA Region 9 PRGs for tap water were used.
- Target compounds for dioxin and dioxin-like compounds were the analytes in the World Health Organization (WHO) list of compounds.
- California DHS action levels for perchlorate (4 µg/L) in groundwater and surface water.
- California Air Resources Board (CARB) study median concentrations that were proposed for the integrated and ambient air samples in the Phase II RI Work Plan (BNI 1995).
- Title 27 of the California Code of Regulations (CCR) stipulated the lower explosive limit (LEL) for methane (5 percent by volume or 50,000 parts per million by volume [ppm_v]) for soil vapor.
- Soil vapor hot spot threshold for total VOC concentration (300 µg/L) as established in the Phase II RI Work Plan (BNI 1995) for typical landfill sites.

4.2.3 Sampling Objectives

Figure 4-1 shows the sampling locations for the RSE investigation at AA 3. Data gathering objectives for the RSE investigation included the following:

- Verification of currently demarcated waste placement boundaries by trenching;
- Installation of perimeter vapor monitoring and groundwater wells;
- A cone penetrometer test (CPT) survey;
- Integrated and ambient air sampling to evaluate the impact of the waste on air quality;
- Shallow and subsurface soil vapor sampling to determine if soil vapor hot spots are present and to evaluate the need for a landfill gas collection system;
- Perimeter soil vapor sampling to verify whether soil vapor is migrating from the subsurface soil to the perimeter of the waste;
- Surface soil sampling and analysis for COPCs to aid in the evaluation of human health risk;

- Geotechnical soil testing to evaluate the engineering properties of the foundation soil;
- Groundwater sampling to evaluate impacts to groundwater and evaluation of the hydraulic gradient and direction of flow by water level measurements;
- Evaluation of the impact of the waste on Agua Chinon Wash by collecting sediment samples from the Wash;
- Surface water sample collection from Agua Chinon Wash to evaluate impact to surface water; and,
- Land survey of coordinates of trenches, soil vapor and soil sampling locations, and perimeter vapor and groundwater monitoring well locations.

4.3 EXPLORATORY TRENCHING

Decision Rule #1 of the project DQO process was formulated in response to Decision Question #1.

> **Decision Question #1:** Have the waste boundaries been adequately delineated, or is further evaluation required?

Decision Rule #1 stipulates that additional trenching be performed as part of the RSE investigation to define the debris placement boundaries if the debris placement boundary has not been adequately delineated previously. Since the debris delineation was performed using the pre- and post-waste placement aerial topographs and no physical delineation of boundaries was performed previously, exploratory trenching was performed as part of the RSE activity.

From 17 to 23 October 2002, 12 trenches (TR01 through TR12) were excavated to determine the limit of debris, if encountered, and the thickness of the soil cover. A project geologist recorded the trench descriptions and lithologic description of soils encountered in the trenches in accordance with CLEAN SOP 3, *Borehole Logging* (BNI 1999) and American Society of Testing and Materials (ASTM) D 2487 and 2488. Trench alignments were measured with a compass and a standard 100-foot tape, to a resolution of 0.5-foot. Field readings of a flame ionization detector (FID), dust and radiation measurements were recorded in the logbook. Trenches were backfilled upon completion of logging. None of the trenches was left unattended or open overnight.

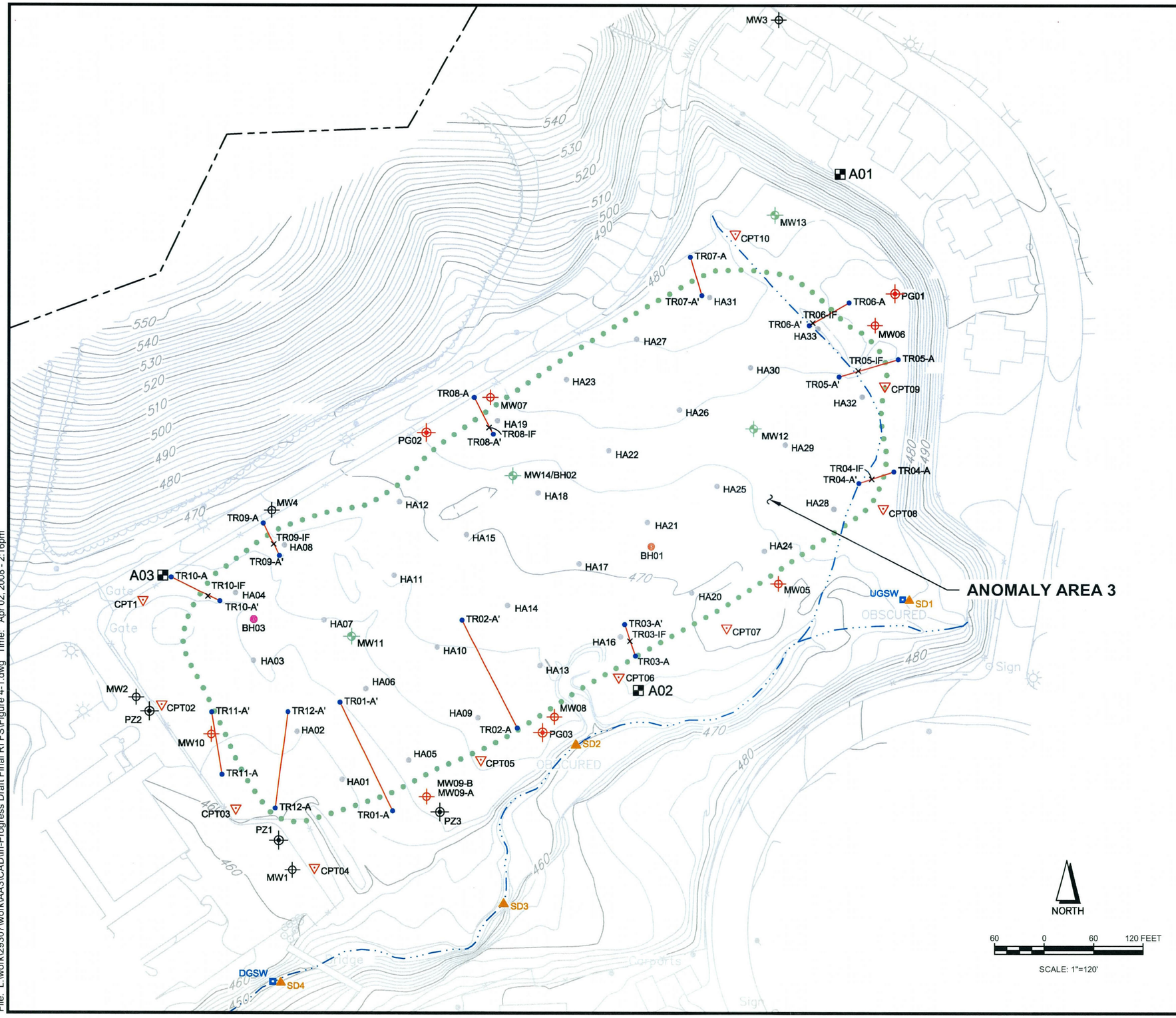
The trench excavation logs are presented in Appendix A of this Report. Some geotechnical soil samples were collected from the trenches based on the recommendations of the project geotechnical engineer and submitted to the laboratory for geotechnical analysis (for further details, see Section 4.7.3).

4.4 WELL INSTALLATION

4.4.1 Groundwater Monitoring Wells

The groundwater monitoring well installation was conducted to adequately respond to Decision Questions #4 and #7.

> **Decision Question #4:** Has the impact to groundwater, surface water, and sediments been adequately characterized, or are additional data required?



LEGEND

	MINOR SURFACE ELEVATION: 2-FOOT INTERVALS
460	MAJOR SURFACE ELEVATION: 10-FOOT INTERVALS
	MCAS EL TORO BOUNDARY
	EXISTING STREAM OR WASH
	ESTIMATED EXTENT OF WASTE PLACEMENT BEFORE RSE INVESTIGATION (EARTH TECH 2001)
HA31	RSE DIRECT PUSH SOIL/SOIL VAPOR SAMPLING LOCATIONS
TR08-A TR08-A'	RSE TRENCH LOCATION AND DESIGNATION
TR08-IF	INTERFACE OF DEBRIS AND FILL SOIL
MW06	RSE GROUNDWATER MONITORING WELL LOCATION
CPT01	RSE CONE PENETROMETER TEST LOCATION
PG01	RSE PERIMETER GAS MONITORING WELL LOCATION
MW4	EXISTING GROUNDWATER MONITORING WELL
PZ3	EXISTING VADOSE ZONE VAPOR WELL
A03	AMBIENT AIR SAMPLING LOCATIONS
UGSW	SURFACE WATER SAMPLE LOCATION
SD1	SEDIMENT SAMPLE LOCATION
MW12	ADDITIONAL GROUNDWATER MONITORING WELL LOCATIONS - FEBRUARY 2005
BH01	ADDITIONAL BOREHOLE LOCATION FEBRUARY 2005
BH03	BOREHOLE LOCATION NOT DRILLED

NOTES

1. TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHOD FROM AERIAL PHOTOGRAPHY DATED DECEMBER 2001 BY SAN-LO AERIAL SURVEYS.
2. COORDINATES ARE IN CALIFORNIA STATE PLANE COORDINATE SYSTEM, NAD 83, ZONE 6.
3. ELEVATIONS IN FEET; BENCHMARK BASED ON NORTH AMERICAN VERTICAL DATUM 1988.

NORTH

60 0 60 120 FEET

SCALE: 1"=120'

RI/FS Report — Draft Final

Sampling Locations - RSE Investigation

Anomaly Area 3

Date: 04-08	Former MCAS El Toro	Figure
Project No. 29307	EarthTech — A tyco International Ltd. Company	4-1

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Decision Question #7: Has the nature of the waste present been adequately characterized using soil vapor, soil, groundwater, surface water, and sediments data, or is further evaluation required to characterize risk and evaluate response actions?

In order to adequately respond to these questions, seven monitoring wells (MW05 through MW10) were installed during November 2002 at AA 3 in addition to existing Wells MW01, MW02, MW03, and MW04. These well installations were used to confirm the water levels, direction of groundwater flow and hydraulic gradient at the site, and also adequately characterize the groundwater quality at the site. None of the new groundwater monitoring wells that were installed during November 2002 was located within the limits of waste placement due to risk of creating a conduit for downward vertical migration of any potential contamination. These wells are located at the perimeter of the site so as to detect off-site migration of potential contaminants.

Groundwater Monitoring Wells MW05 through MW10, including MW09A and MW09B, were installed from 29 October to 6 November 2002. The locations of the newly installed monitoring wells are shown on Figure 4-1.

Groundwater Monitoring Well MW-06 was installed as an upgradient monitoring well, as was existing Well MW03. Groundwater sampling results from Wells MW02, MW04, and MW10 were used to characterize the groundwater from the deepest section of the fill (south and northeast of intersection of cross section lines AA 3-2 and AA 3-12 [presented in the Work Plan]). Dual-nested groundwater Monitoring Wells, MW09A and MW09B (initially proposed to be screened in alluvium and bedrock, respectively) was to be installed close to the debris, between existing Well MW01 and proposed Well MW08, to verify the groundwater flow regime (i.e., multiple water bearing zones) at the site. These wells were also designed to assess if there is any radial migration of the leachate from the lowest portion of the site. However, at the location of Well MW09, bedrock was not encountered; therefore, the dual nested Wells MW09A and MW09B were installed in alluvium.

Groundwater Monitoring Well MW10 was installed in bedrock between existing Wells MW01 and MW02. Since the presence of multiple water bearing zones beneath the site was not confirmed, the original intent to install new groundwater monitoring wells to assess groundwater gradient in alluvium and bedrock was not performed.

Air rotary drilling technology was used to drill boreholes to install wells screened in bedrock (MW09B and MW10). Boreholes for installing other wells (MW05 though MW08) were drilled using the hollow-stem auger (HSA) drilling technology. Soil samples were collected every 5 feet during drilling solely for field screening and lithologic description. Based on the recommendations of the geotechnical engineer, some soil samples were collected from the borehole at 5-foot intervals and submitted to the laboratory for geotechnical analysis (see Section 4.7.3 for further details).

Samples were collected in accordance with CLEAN SOP 4, *Soil Sampling* (BNI 1999). The lithology was described in accordance with the Unified Soil Classification System (USCS) as specified in CLEAN SOP 3, *Borehole Logging* (BNI 1999). The well installation procedures were in accordance with CLEAN SOP 5, *Monitoring Well Installation and Development* (BNI 1999) and Section A-2.2.3 of the Work Plan (Earth Tech 2002a). Borehole logs and monitoring well construction logs are presented in Appendix A of this Report. A summary of the well construction details is presented in Table 4-1.

These monitoring wells were developed from 11 through 15 November 2002, in accordance with CLEAN SOP 5, *Monitoring Well Installation and Development* (BNI 1999). Following installation,

measurements of total well depth and static water levels were recorded with a tape measure equipped with an electronic product/water interface detector to an accuracy of 0.01-foot. A minimum of four well-bore volumes were extracted to remove fine-grained materials and to promote the movement of formation waters into the wells. Specific conductivity, temperature, and negative log of hydrogen ion concentration (pH) were monitored during well development to demonstrate that these properties were stabilized. These data measurements and calculated total well volume were recorded in each well development log.

Table 4-1: Summary of Groundwater Monitoring Well Construction Details – RSE Investigation

Well Identification	Well Diameter (inches)	Total Well Depth (feet below ground surface)	Screen Interval (feet below ground surface)	Screen Height (feet)	Depth to Groundwater after Well Installation (feet below ground surface)
MW05	4	56.65	40–55	15	26.2
MW06	4	41.65	20–40	20	26.6
MW07	4	51.25	30–50	20	32.5
MW08	4	57.09	25–55	30	26.2
MW09A	2	51.70	20–50	30	26.7
MW09B	2	76.60	60–75	15	26.7
MW10	4	76.72	60–75	15	35.5
MW11	4	60.00	22-37	15	27.0
MW12	4	60.00	24-39	15	30.9
MW13	4	48.00	25-45	20	31.5
MW14	4	40.00	25-40	15	29.6

4.4.1.1 Additional Groundwater Monitoring Well Installation – February 2005

The results of seven groundwater sampling events (from December 2002 through October 2004 - groundwater samples collected from 10 AA 3 groundwater monitoring wells) conducted under the purview of the RSE investigation highlighted the need for installing additional groundwater monitoring wells within the waste placement area. These wells were proposed to be located within the waste placement area at the topographic lows (per the pre-waste placement topograph) to document impact to groundwater. Figure 4-1 presents the locations of the additional Wells MW11 through MW14. The proposal to install additional groundwater monitoring wells within the waste placement boundary was also intended to provide confirmation that the waste placed at the site was predominantly construction debris (continuous core photographs in Appendix A). The requirement for installing groundwater monitoring wells within the waste placement area was also highlighted by the regulatory agencies during their review of the RSE Work Plan (Earth Tech 2002a). The DQO process (project decision rules, input and threshold values) that was designed for the AA 3 RSE investigation was still valid for the installation of these additional groundwater monitoring wells.

A review of the pre-waste placement topograph yielded two locations of topographic lows within the waste placement area. These locations were also where the groundwater was suspected to be in contact with the waste. In order to verify if the waste at these locations is impacting the groundwater, two groundwater monitoring wells (MW11 and MW12), were proposed at these two locations. These two wells were proposed to be completed as 4-inch wells to facilitate any aquifer testing, if the

necessity arises. Installing an upgradient well (MW13; Figure 4-1) was also proposed as part of this additional drilling/well installation effort to provide upgradient groundwater characteristics. The previous upgradient Well MW03 was abandoned to facilitate transfer of property. This upgradient well was proposed to be located west of existing upgradient well, MW06, to supplement upgradient groundwater data.

The drilling methodology for installing wells was the HSA drilling. Previously, during borehole drilling, the lithology description was recorded by collecting soil samples every 5 feet bgs. Given the heterogeneity of the subsurface at the site, this resulted in significant data gaps. Therefore, as part of this additional groundwater monitoring well installation activity, continuous cores were extracted from the boreholes. The HSA drilling methodology facilitated the extraction of continuous soil cores. These continuous cores assisted in accurate lithology logging of the borehole.

The drilling crew was mobilized to drill boreholes and install three 4-inch groundwater monitoring wells (MW11, MW12, and MW13; upgradient). The boreholes for installing these additional wells were advanced until competent bedrock was encountered, i.e., to a depth of approximately 70 feet bgs, in order to evaluate the thickness of alluvium and to evaluate potential migration pathways. The boreholes were then grouted back and 4-inch groundwater wells installed and screened across the groundwater-waste interface. During the drilling activity, precautionary measures were employed so as to not provide a conduit for contamination during well installation.

However, the lithologic results gathered during the drilling of additional Wells MW 11 through MW13 indicated that the thickness of waste at MW 11 and MW12 was less than anticipated. In addition, the lithology logging at these locations indicated that there was a layer of fill material, classified as a silty clay, ranging in thickness from 5 feet to 10 feet between the bottom of the waste and the groundwater. Based on this observation, up to three additional boreholes were proposed by the DON to evaluate whether this fill material is present at other locations within the waste placement boundary and to install a groundwater monitoring well if the proposed drilling location has waste in contact with the groundwater.

A review of the pre-waste placement topograph, geophysical survey results and trenching performed within the waste yielded three additional locations characterized as having deep metallic/construction debris. A borehole at each of these three locations were proposed (AA 3-BH01, AA 3-BH02, AA 3-BH03) (Figure 4-1). These locations were also where there is a high probability of having groundwater in contact with the waste. If groundwater was in contact with the waste then the borehole was proposed to be completed as a 4-inch groundwater monitoring well at that location, with a screened interval 5 feet above and 10 feet below the water table. If a location met the conditions stated above, at that point, the investigation will be completed and no additional boreholes will be advanced.

The purpose of the boreholes was to either find groundwater in contact with waste or confirm a trend noted at groundwater Monitoring Wells MW11 and MW12, where fill was encountered between the waste and the groundwater. In addition, during the drilling of the borehole, methane monitoring was performed.. Consistent with the ongoing phase of groundwater monitoring well installation, continuous cores were extracted from the surface to the total depth. The first borehole to be drilled was located at AA 3-BH01. Continuous cores were collected from the ground surface to first groundwater encounter. However, waste-groundwater interface was not observed at this location. A groundwater monitoring well was not installed at this location. The drill crew moved to the second borehole location, AA 3-BH02. Continuous cores were collected from the ground surface to first groundwater encounter, and since waste-groundwater interface was observed at this location, a

groundwater monitoring well (MW14) was installed at this location. Borehole AA3-BH03 was not drilled.

After well installation, the wells were developed and subsequently sampled. These groundwater samples were analyzed for the same suite of analysis as proposed in the RSE Work Plan for groundwater samples. The analyses suite included VOCs, SVOCs, total metals, total petroleum hydrocarbons and perchlorate.

The analytical results from groundwater sampled collected from these wells (MW11, MW12, and MW14) installed within the waste placement area and screened below the waste results, verified if the waste is impacting groundwater.

4.4.2 Perimeter Gas Wells

The perimeter gas wells were installed to adequately respond to Decision Questions #5, #6, and #7 of RSE DQO process.

> **Decision Question #5:** Is soil vapor being produced within the waste, and if yes, does it exceed threshold levels listed as decision inputs and require a waste placement gas collection system?
>
> **Decision Question #6:** Does soil vapor migrate from the site to impact adjacent property?
>
> **Decision Question #7:** Has the nature of the waste present been adequately characterized using soil vapor, soil, groundwater, surface water, and sediments data, or is further evaluation required to characterize risk and evaluate response actions?

In order to adequately respond to these decision questions, three triple nested perimeter gas wells (PG01 through PG03) were installed at the site. The location, number, and installation of the vapor monitoring wells were designed to meet the CIWMB requirements of Title 27 CCR, Section 20925 and the South Coast Air Quality Management District (SCAQMD) Rule 1150 Compliance Plan.

The wells were drilled and installed from 6 to 8 November 2002. The boreholes were drilled using HSA drilling techniques prior to installing triple-nested 1-inch polyvinyl chloride (PVC) diameter gas Wells PG01 through PG03. At each location, the vapor monitoring wells were installed at depths to coincide with the shallow zone (5 feet to 7 feet bgs), intermediate zone (14 feet to 16 feet bgs), and the zone at or near the greatest depth of the debris (between 20 feet and 28 feet bgs). Soil samples were collected every 5 feet during drilling solely for field screening and lithologic description. Some of these soil samples were selected by the geotechnical engineer and submitted to the laboratory for geotechnical evaluation (see Section 4.7.3). Samples for lithologic logging were collected in accordance with CLEAN SOP 4, *Soil Sampling* (BNI 1999). The lithology was described in accordance with the USCS as specified in CLEAN SOP 3, *Borehole Logging* (BNI 1999).

Figure 4-1 shows locations of these gas wells. Table 4-2 shows the well construction details. Borehole logs and monitoring well construction logs are presented in Appendix A of this Report.

Table 4-2: Summary of Perimeter Gas Well Construction Details – RSE Investigation

Vapor Well Identification	Well Diameter (inches)	Total Well Depth (feet below ground surface)	Screen Interval (feet below ground surface)	Screen Height (feet)
PG01S	1	7	5–7	2
PG01I	1	16	14–16	2
PG01D	1	22	20–22	2
PG02S	1	7	5–7	2
PG02I	1	16	14–16	2
PG02D	1	30	28–30	2
PG03S	1	7	5–7	2
PG03I	1	16	14–16	2
PG03D	1	22	20–22	2

4.4.3 Cone Penetrometer Test Survey

The CPT was performed to respond to Principal Study Question # 1.

> **Principal Study Question #1:** Are adequate data available to complete an RSE, including the design of a cover system?

This survey was conducted to obtain stratigraphic information and depth-to-water information. Lithologic information was inferred from the CPT output based on correlations involving cone tip resistance, sleeve resistance, and pore-water pressure. These results also assisted in the geotechnical analysis (stability evaluation) of AA 3. The CPT survey was performed prior to drilling so that stratigraphy and depth-to-water information obtained from the survey could be used for designing the screened intervals for the monitoring wells. Pertinent information was used in refining the site conceptual model in regard to the groundwater hydrology and contaminant pathways.

Drilling for the CPT survey was conducted on 17 and 18 October 2002, to evaluate the properties of soil in and around AA 3. Up to eight CPT soundings were proposed in the Work Plan (Earth Tech 2002a). However, two more CPT locations (CPT01 through CPT10) were advanced based on the recommendations of the project geotechnical engineer. The CPT drilling locations are shown on Figure 4-1. The cross sectional graphical representation of the results of the CPT survey is presented in Section 5.4.

4.5 AIR SAMPLING

Air sampling was conducted to establish air quality conditions at the site in order to adequately respond to Decision Questions # 5 and #6.

> **Decision Question #5:** Is soil vapor being produced within the waste, and if yes, does it exceed threshold levels listed as decision inputs and require a waste placement gas collection system?

> **Decision Question #6:** Does soil vapor migrate from the site to impact adjacent property?

Air sampling was proposed for the site to assess the potential emissions from the surface of the waste and the potential impact of the waste emissions, if any, on the surrounding air quality. Integrated

surface air sampling and ambient air sampling were conducted at AA 3. Figure 4-2 shows the ambient air sampling and the walking pattern for integrated air sampling. Figure 4-2 also shows a wind rose diagram for October 2002 wind conditions.

Twenty-four hour ambient air sampling at the site perimeter and integrated surface air sampling from the surface was conducted on 8 and 9 October 2002. Air sampling was performed in accordance with the SCAQMD Rule 1150.1. Along with the air sampling, continuous meteorological measurements were collected prior to and during the sampling program to ensure that wind speed and direction patterns across the site on the sampling days were in compliance with the SCAQMD requirements.

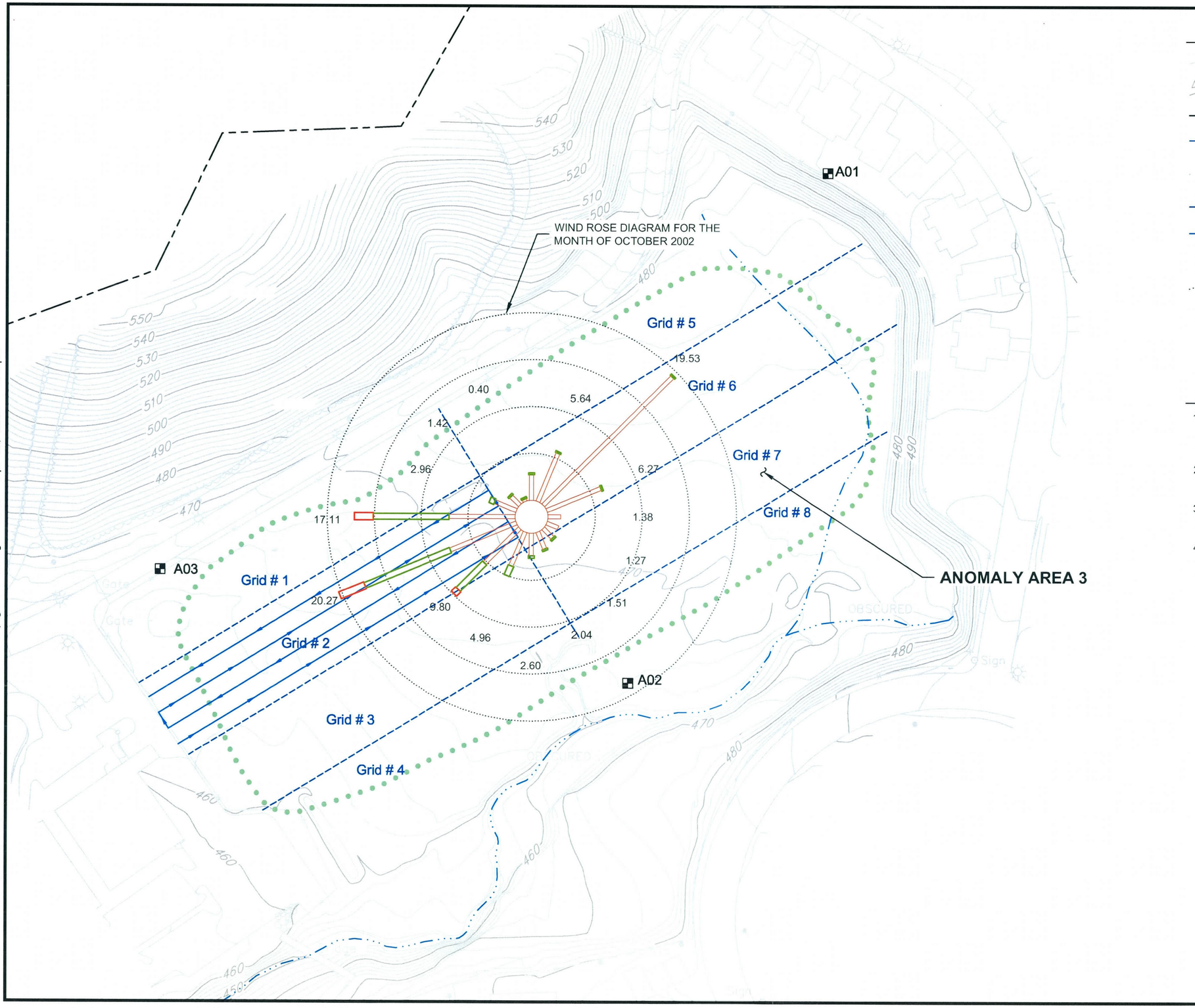
4.5.1 Meteorological Monitoring

Meteorological monitoring was conducted using the Vantage Pro 6150C semi-permanent meteorological monitoring station mounted onto a 3-foot-tall post at the center of the site (Figure 4-2). The weather station was located in an open area at the center of the site to obtain the most representative meteorological data possible. Meteorological data collected from 28 March through 30 April 2002 were also taken into consideration for determining the upgradient, downgradient, and general wind pattern conditions of the site. The instantaneous weather data were recorded at 5-minute intervals and later downloaded to a laptop using Weatherlink 5.1 software. Peak and average wind speed data were recorded during sample collection to confirm that meteorological conditions were consistent with sampling criteria specified in the SCAQMD Rule 1150.1. During ambient air sampling, the SCAQMD requires that the average wind speed does not exceed 15 miles per hour (mph), peak wind speed not to exceed 25 mph, and there is no measurable precipitation during sampling. During integrated surface air sampling, the SCAQMD requires that the average wind speed not to exceed 5 mph, peak wind speed not to exceed 10 mph, and there is no measurable precipitation in the 72 hours prior to sampling.

4.5.2 Ambient Air Sampling

Ambient air sampling was conducted at the perimeter of the debris to assess the potential impact of gas emissions on the surrounding air quality, and to assess the background levels of constituents in air and meet the requirements of the SCQAMD Rule 1150.1. Air samplers were placed at the perimeter of the debris at three locations (one upwind and two downwind), and operated for two 12-hour periods (three locations, times two events for a total of six samples). Ambient air sampling locations, designated A-1 through A-3 (Figure 4-2), were located near the perimeter of the site. Since the wind pattern during the day and night differed, Location A1 was designated as upwind, while Locations A2 and A3 were designated as downwind for samples collected during the day. However, for the samples collected during the night, Location A3 was designated as upwind and Locations A1 and A2 were designated as downwind. Prevailing wind directions were based on weather data collected from the fixed weather station located at the center of the site 24 hours prior to sampling. Samples were designated A1-S01: Ambient Air Location 1 - Sample 01. One-liter Summa™ canisters were placed in upwind (one canister) and downwind (two canisters) areas of the site based on observed wind patterns.

Meteorological parameters were measured during sampling to verify wind speed and direction. The first batch of two consecutive 12-hour periods of ambient air sampling was conducted on 8 August 2002 from 6:45 p.m. to 9 August 2002 until 6:39 a.m. The second batch was conducted on 9 August 2002 at 6:39 a.m. to 7:30 p.m. Summa™ canisters were placed near the site perimeter and sample inlets were placed approximately 6 feet above the ground surface.



LEGEND

- MINOR SURFACE ELEVATION: 2-FOOT INTERVALS
- 460 MAJOR SURFACE ELEVATION: 10-FOOT INTERVALS
- MCAS EL TORO BOUNDARY
- EXISTING STREAM OR WASH
- ESTIMATED EXTENT OF WASTE PLACEMENT BEFORE RSE INVESTIGATION (EARTH TECH 2001)
- GRID DIVISION
- WALK PATTERN FOR INTEGRATED AIR SAMPLING
- AMBIENT AIR SAMPLING LOCATIONS
- RINGS AT 5% OCCURRENCE INTERVAL

NOTES

1. TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHOD FROM AERIAL PHOTOGRAPHY DATED DECEMBER 2001 BY SAN-LO AERIAL SURVEYS.
2. COORDINATES ARE IN CALIFORNIA STATE PLANE COORDINATE SYSTEM, NAD 83, ZONE 6.
3. ELEVATIONS IN FEET; BENCHMARK BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
4. FOR WIND ROSE, CALMS EXCLUDED. WIND FLOW IS FROM THE DIRECTIONS SHOWN. LENGTH OF SEGMENTS IN WIND ROSE INDICATES DISTRIBUTION OF OBSERVATIONS, WITH FREQUENCY IN PERCENT (E.G., 19.53)

0.1 3.5 6.9 11.5
Wind Speed (Miles per Hour)

NORTH

60 0 60 120 FEET
SCALE: 1"=120'

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Ambient Air Sampling Locations and Integrated Air Sampling Walk Pattern

Anomaly Area 3

Date: 04-08	Former MCAS El Toro	Figure
Project No. 29307	EarthTech — A tyco International Ltd. Company	4-2

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Sample collection was controlled with a laboratory-provided flow regulator at a rate of 1.44 cubic centimeter per minute (cc/min) and Summa™ canisters were supplied at a vacuum of 30 inches of mercury (in. Hg). One duplicate sample (LK004) was collected from Location A3 (southwest corner of the site).

Field measurements and sample collection details for this event are presented in Appendix B. Each sample was analyzed for fixed gases and VOCs using ASTM-D1946 and EPA Method TO-14, respectively. Complete data set for ambient air sampling are presented in Appendix B. A discussion and summary of the analytical results of ambient air samples is presented in Section 6.2.1.

4.5.3 Integrated Surface Air Sampling

Integrated surface sampling was conducted in accordance with the SCAQMD guidance for waste sampling (SCAQMD 1989). Integrated surface air samples, designated IN-1 through IN-8, were collected to assess potential emissions of VOCs and methane from the surface of AA 3. The walk pattern adopted for collecting the integrated air samples meets the requirements of the SCQAMD Rule 1150.1. Integrated surface samples were collected on 8 and 9 October 2002 from eight 50,000 square foot grids (approximately 500 feet by 100 feet), numbered Grid 1 through Grid 8 as shown on Figure 4-2.

Integrated air sampling consisted of traversing a grid over a 25-minute period with a 1-liter Summa™ canister while holding the sample inlet approximately 3 inches above AA 3 site surface. Sample collection was controlled with a laboratory-provided flow regulator at a rate of 40 cc/min Summa™ canisters were supplied at a vacuum of 30 in. Hg. Each grid was traversed one time during the sampling period. One duplicate integrated air sample (10 percent of integrated air samples) was collected at Grid 8 (LK013). All samples, including the duplicate sample, were analyzed for VOCs using EPA Method TO-14 and fixed gases using ASTM D1946. A discussion and summary of the analytical results of integrated air samples is presented in Section 6.2.2.

Surface air monitoring data were recorded using the portable weather station, multigas meter, and FID during sampling in Grids 1 through 4. Instantaneous data were collected using only the portable weather station during sampling at Grids 5 through 8. The SCAQMD Rule 1150.1 does not specify the use of a multigas meter and FID. However, the RSE sampling design specified that all samples containing more than 50 ppm_v as methane, as reported by a field instrument, should be submitted to the laboratory for analysis.

However, even though the FID readings from Grids 1 through 4 were less than 50 ppm_v, a field decision was made to submit all samples collected from 8 grids (~50,000 square foot grids) to the laboratory for analysis. Since a decision to submit all samples to the laboratory was made, field measurements were ceased after Grid 4. Field measurements and sample collection details for this event are presented in Appendix B along with complete data sets for ambient and integrated air sampling.

During sample collection, readings of wind speed were monitored and recorded every five minutes by a fixed weather station. The average wind speed did not exceed 5 mph, and the instantaneous wind speed exceeded 10 mph on one reading (11.8 mph) at IN-2 after 24 minutes.

4.6 SOIL GAS SAMPLING

The soil gas sampling (shallow and subsurface) resolved the Decision Questions #5 and #6, and was conducted in response to Decision Rule #6.

Decision Question #5: Is soil vapor being produced within the waste, and if yes, does it exceed threshold levels listed as decision inputs and require a waste placement gas collection system?

Decision Question #6: Does soil vapor migrate from the site to impact adjacent property?

The sampling design developed for the soil gas survey was based on a grid sampling approach. This approach used a centrally aligned grid to allow uniform coverage of the site and is based on common practice for investigations of typical former landfill sites. The site was divided into 33 grids measuring 100 feet by 100 feet and samples were collected from the center of each grid. A grid of this dimension was expected to identify a circular hot spot having a radius of 50 feet or greater. Figure 4-1 shows the proposed sampling locations at AA 3.

Direct Push Technology (DPT) were used to drill boreholes for collecting soil vapor samples. Shallow and subsurface soil gas sampling was conducted across AA 3 to characterize soil vapors within the debris, to determine whether soil hot spots were present and to check for the necessity of a landfill gas collection system at the site.

If a particular soil vapor sampling location at the center of a 100-foot by 100-foot grid showed evidence of contamination (VOC concentrations exceeding the threshold concentration of 300 μg/L, as established in the Phase II RI Work Plan [BNI 1995]), then additional soil vapor samples would be collected from centers of a 50-foot by 50-foot grid around the hot spot. This would result in adequate characterization of the hot spot.

Thirty-three boreholes (centers of the thirty-three 100-foot by 100-foot grid divisions – HA01 through HA33) were drilled using the DPT equipment. The soil vapor samples were collected at depths of 5 feet (shallow) and 15 feet (subsurface) bgs as proposed in the Work Plan, and as approved by the BCT. Only one vapor sample was collected at 25 feet bgs from the location HA11, based on results of field screening readings of methane. The RSE sampling was designed to collect soil gas samples at 10-foot intervals based on mobile laboratory VOC results of soil gas samples collected from the preceding depths. If the result indicated contamination, then sampling would continue to the estimated depth of debris placement or to the first groundwater encounter.

Samples were collected in accordance with the SOP developed for this project (Attachment 1 of the Work Plan [Earth Tech 2002a]), which was based on the CRWQCB, Los Angeles Region, Interim Guidance for Active Soil Gas Surveys (1997).

At each location, a soil gas sampling probe was advanced to the first soil gas sampling interval of 5 feet bgs. A bentonite seal was placed at the surface around the stainless steel probes and hydrated. The soil gas evacuation from the sampling interval was initiated and fixed gas readings were recorded using a landfill gas monitor - field instrument (GEM 500) during evacuation. Approximately 3 Tedlar™ bags of soil gas were evacuated from each borehole before sample collection. Carbon dioxide and oxygen values, as well as detectable concentrations of methane, were monitored to qualitatively evaluate whether the subsurface readings were affected by ambient air. After the readings stabilized and data suggested that the soil gas sample was not affected by ambient air, a soil gas sample was collected in a Tedlar™ bag for analysis.

Deeper soil gas samples were collected by advancing a probe adjacent to the first one to a particular sampling interval (i.e., 15 feet bgs or 25 feet bgs) and similar soil gas sampling procedures were employed.

The borehole logs detailing the field screening parameter (using landfill gas monitor and handheld FID) concentration details are presented in Appendix A of this Report. The soil gas survey report is presented in Appendix B of this Report.

Since none of the mobile laboratory VOC analytical results of 76 shallow and subsurface soil vapor samples exceeded the threshold concentration of 300 µg/L of total VOCs, additional sampling at centers of the 50-foot by 50-foot grid was not deemed necessary. A detailed discussion and summary of the analytical results of the shallow and subsurface soil gas survey are presented in Section 6.3 of this Report.

4.6.1 Shallow Soil Gas

Thirty-three shallow soil gas samples were collected at a depth of 5 feet bgs from the site and analyzed in a mobile analytical laboratory stationed at the site for VOCs (EPA Method 8260). Shallow soil gas sample details are presented in Appendix B along with complete data sets for shallow soil gas samples.

4.6.2 Subsurface Soil Gas

Forty-three subsurface soil gas samples were collected at a depth of 15 feet bgs (including 9 duplicate samples and one soil gas sample at 25 feet bgs). These samples were analyzed for VOCs (EPA Method 8260) in the field by using a mobile analytical laboratory. Subsurface soil gas sample details are presented in Appendix B along with complete data sets for subsurface soil gas samples.

In accordance with the Work Plan, approximately 10 percent of the total soil gas samples collected (33 shallow samples and 43 subsurface samples) were to be analyzed for fixed gases in a fixed laboratory based on the field screening results (methane) of the gas monitor. Since none of the shallow soil gas results showed an indication of methane, none was sent to the fixed laboratory. However, nine subsurface soil gas samples, including one duplicate sample that showed an indication of methane were sent to the fixed laboratory for methane analysis using ASTM D-1946.

4.6.3 Perimeter Soil Gas Sampling

Perimeter subsurface soil vapor sampling was conducted to verify if there were any vapors migrating to and beyond the boundaries of the debris. This perimeter vapor sampling results along with the results of the subsurface soil gas survey within the limits of waste placement assisted in resolving the Project Decision Question #6 (necessity of a soil vapor collection system for the site). Four quarterly sampling events were proposed in the Work Plan (Earth Tech 2002a). All samples collected during the first and the second rounds of soil vapor sampling were sent to the fixed laboratory for VOC and fixed gases analysis. However, the third and fourth round of soil gas samples were to be sent to the laboratory only if the field measurements of VOCs using a photoionization detector (PID) field instrument exceed the threshold of 25 ppm_v, in accordance with the SAP (Earth Tech 2002a).

The first and second round of the perimeter soil vapor samples were collected in December 2002 and March 2003, respectively, from the existing vadose zone probes (PZ1, PZ2, and PZ3) and from the newly constructed triple-nested perimeter soil vapor monitoring wells (PG01, PG02, and PG03). A single soil vapor sample was collected from each well and two duplicate samples were collected during each of these soil vapor sampling events. The third round of perimeter soil vapor sampling was conducted in July 2003. Since the field VOC measurements using a PID did not exceed 25 ppm_v threshold value, none of the samples was sent to the fixed laboratory for VOC and fixed gas analysis.

Field measurements of VOC concentrations with a PID and fixed gas monitor (GA-90) were recorded in the logbook. Round 1 and Round 2 sample collection details are presented in Appendix B. All perimeter soil gas samples were submitted to the laboratory for VOC analysis using EPA Method TO-14 and fixed gas analysis using ASTM-D1946. Complete data sets for Round 1 and Round 2 subsurface soil gas samples are presented in Appendix B. A detailed discussion and summary of the analytical results are presented in Section 6.3.3 of this Report.

4.7 SOIL SAMPLING

4.7.1 Soil Sampling for Risk Assessment

The principal objective of soil sampling was to resolve the Decision Questions #3 and #7 of the project.

> **Decision Question #3:** Are adequate data available to characterize if the existing soil cover is sufficient to either protect human health and environment, or if not, to serve as a foundation layer for a soil cover system?
>
> **Decision Question #7:** Has the nature of the waste present been adequately characterized using soil vapor, soil, groundwater, surface water, and sediments data, or is further evaluation required to characterize risk and evaluate response actions?

In accordance with Decision Rule #3 and since adequate data were not available to complete a screening-level human health and ecological risk evaluation for AA 3, surface soil samples were collected from the soil gas survey boreholes (centers of 100-foot by 100-foot grids).

Thirty-seven surface soil samples, including four duplicate samples, were collected from 0-foot to 1-foot depths using a macrocore sampler. Six trip blanks (one per cooler) and four equipment rinsate samples (one per day) were also collected during sampling activities. One field blank (source water) was also collected as part of this sampling event. Sample collection details are presented in Appendix B. The borehole logs for these 33 locations are presented in Appendix A and the complete results of surface soil sampling are presented in Appendix B. All samples collected were analyzed for Title 22 metals, VOCs, SVOCs, and petroleum hydrocarbons. Approximately 25 percent of the surface soil samples (10 soil samples, including 1 duplicate) collected were analyzed for dioxins/furans. The samples for dioxin analysis were based on the field PID readings and review of analytical results from previous investigations.

As per the Work Plan, subsurface soil samples (8 feet to 9 feet bgs) are collected only if the soil vapor sample at the 5-foot depth has detected concentrations of target analytes and that the soil sampling would continue to the base of the fill at 10-foot intervals if analysis of the preceding soil sample shows reportable concentrations of target analytes. Since the soil vapor samples collected at 5 feet bgs from all 33 locations had no detected concentrations of target analytes, soil sample collection beyond 1-foot bgs was not necessary.

4.7.2 Soil Cover Thickness Evaluation

This activity was conducted in response to Project Decision Question #2.

> **Decision Question #2:** Has the existing soil cover been adequately characterized (thickness and soil properties), or is further evaluation required?

Historically, the AA 3 site was used as a source of borrow material. Records indicate that some of the borrow pits and trenches were backfilled with construction debris and later covered with 5 feet or more of fill soil (IT/OHM 2000).

Even though the existing soil cover (fill soil) at AA 3 was physically characterized to some extent at the locations of previous trenching activity, a comprehensive soil cover thickness evaluation was not conducted. Therefore, during drilling of boreholes to collect soil gas and soil samples, continuous core soil samples were collected to evaluate the thickness of fill soil. Also, in order to resolve the Project Decision Question #2 of the Work Plan and in response to Decision Rule #2, continuous core samples were collected from locations HA02, HA03, HA07, HA10, HA12, HA15, HA17, HA20, HA22, HA25, HA27, HA28, and HA30 during DPT drilling (Figure 4-1). These locations provided coverage of the entire site. These continuous cores were collected from 0-foot to 4 feet bgs. This cover thickness evaluation from continuous core samples was also supplemented with the logs of the soil gas survey boreholes and trench logs.

The borehole logs for these continuous cores are presented in Appendix A of this Report. A summary of the soil cover lithology and thickness evaluation is presented in Table 4-3. Graphical presentation of this soil cover evaluation is presented in figures referenced in Section 6.1.

4.7.3 Soil Sampling for Geotechnical Analysis

Geotechnical analysis of the existing soil cover and the subsurface soil at the site was conducted in response to Project Decision Questions #2 and #3.

> **Decision Question #2:** Has the existing soil cover been adequately characterized (thickness and soil properties), or is further evaluation required?
>
> **Decision Question #3:** Are adequate data available to characterize if the existing soil cover is sufficient to either protect human health and the environment, or if not, to serve as a foundation layer for a soil cover system?

As part of the Work Plan (Earth Tech 2002a), five surface soil samples were to be collected from AA 3 for geotechnical characterization in order to support the design criteria for final static and seismic stability, settlement of the final cover system, and grading of the site. Shallow and subsurface soil samples were collected based on the recommendations of the geotechnical engineer for complete geotechnical evaluation. The geotechnical data at AA 3 were collected for the purpose of evaluating the following:

1. Near-surface (shallow) soil conditions, for the purpose of

- Evaluating existing cover (man-made fill) soil, near-surface native soil (such as alluvium, colluvium, outcropping bedrock, if any)

Near surface soil samples were collected during continuous core sampling and exploratory trenching. Details of shallow geotechnical soil sample collection are presented in Appendix F.

2. Subsurface (deep) soil, for the purpose of

- Understanding stratigraphic conditions under the site, including approximate depth, thickness, and nature of manmade fill, and native materials (namely, the Agua Chinon Wash alluvium and underlying bedrock), groundwater depth, and

- Collecting soil samples at selected locations for classification, index, and engineering property testing in the laboratory.

Geotechnical laboratory test reports are included in Appendix F. Subsurface geotechnical samples were collected during drilling for groundwater monitoring well and perimeter gas well installations. Details of geotechnical soil sample collection from the subsurface are also presented in Appendix F.

4.8 GROUNDWATER SAMPLING

To resolve RSE Project Decision Questions #4 and #7, Decision Rule #4 recommended additional groundwater sampling if the groundwater was not adequately characterized.

> **Decision Question #4:** Has the impact to groundwater, surface water, and sediments been adequately characterized, or are additional data required?
>
> **Decision Question #7:** Has the nature of the waste present been adequately characterized using soil vapor, soil, groundwater, surface water, and sediments data, or is further evaluation required to characterize risk and evaluate response actions?

New groundwater monitoring wells were proposed and installed at strategic locations. Groundwater sampling was performed and samples were collected from all four existing monitoring wells (MW01, MW02, MW03, and MW04) and the newly constructed wells (MW05, MW06, MW07, MW08, MW09A, MW09B, and MW10). Four additional groundwater monitoring wells (MW11 through MW14) were installed in February 2005. The well locations are presented on Figure 4-1.

Eight rounds (November 2002, March 2003, November 2003, March 2004, June 2004, October 2004, February 2005 and April 2005) of groundwater sampling were performed at the site as part of the RSE investigation.

All groundwater samples were analyzed for petroleum hydrocarbons, VOCs, SVOCs, and metals. Groundwater samples collected during the initial rounds were also analyzed for perchlorate. As part of these sampling events, trip blanks (one per cooler), equipment rinsate (one per day of sampling) and one field blank for each sampling event were also collected.

The individual target analytes for groundwater samples are presented in Appendix A of the Work Plan. Round 1 and Round 2 groundwater sample collection details are presented in Appendix B, along with complete data sets for all rounds.

Concurrently, water levels were recorded on the sampling logs during sampling. The recorded water levels assist in confirming the hydraulic gradient at the site. A detailed discussion of the groundwater levels and gradient (hydrogeology) at the site and a figure mapping the gradient are presented in Section 5.3 of this Report.

4.9 SEDIMENT SAMPLING

Sediment sampling was proposed at AA 3 in response to Decision Questions #4 and #7, and in accordance to Decision Rule #5 of the RSE investigation.

> **Decision Question #4:** Has the impact to groundwater, surface water, and sediments been adequately characterized, or are additional data required?

Table 4-3: Lithology of Continuous Core Soil Samples–RSE Investigation

Location	Logging Date	Depth (feet bgs)	Lithology
HA02	10/15/2002	0–4	**0-foot–2 feet:** Sand (SP); pale yellow fine-grained sand, poorly graded, dense, compacted, and dry. No debris. **2 feet–4 feet:** Sand (SP); pale yellow fine-grained sand, poorly graded, dense, compacted, and dry. No debris.
HA03	10/15/2002	0–4	**0-foot–2 feet:** Silty sand (SM); light olive brown, medium to fine sand, low plasticity fines, trace sub-angular gravel, compacted, and dry. No debris. **2 feet–4 feet:** Silty sand (SM); light olive brown, medium to fine sand, low plasticity fines, trace sub-angular gravel, compacted, and dry. No debris.
HA07	10/15/2002	0–5	**0-foot–2 feet:** Silty sand (SM); light olive brown, fine-grained sand, low plasticity fines, compacted, and dry. No debris. **2 feet–5 feet:** Clayey sand to sandy clay (SC/CLs); greenish olive gray, medium plasticity clay, slightly moist. No debris.
HA10	10/15/2002	0–4	**0-foot–2 feet:** Silty sand (SM); light olive brown, fine-grained sand with low plasticity fines, dry, trace of sub-angular gravel. No debris. **2 feet–4 feet:** Silty sand (SM); light olive brown, fine-grained sand with low plasticity fines, dry, trace of sub-angular gravel. No debris.
HA12	10/15/2002	0–5	**0-foot–2 feet:** Silty sand (SM); light yellowish brown fine-grained sand with low plasticity fines, loose and dry. No debris. **2 feet–5 feet:** Silt to silty sand (MLs/SM); brown, low plasticity silt, slightly moist. No debris.
HA15	10/15/2002	0–4	**0-foot–2 feet:** Silty sand (SM); olive brown fine-grained sand with low plasticity fines, dry. No debris. **2 feet–4 feet:** Silty sand (SM); olive brown fine-grained sand with low plasticity fines, slightly moist. No debris.
HA17	10/15/2002	0–4.5	**0-foot–2 feet:** Silty sand (SM); light olive brown fine-grained sand with low plasticity fines, medium compacted, and dry. No debris. **2 feet–4.5 feet:** Sandy silt to silty sand (MLs/SM); brown, low plasticity silty with fine- grained sand, slightly moist. No debris.
HA20	10/15/2002	0–4.5	**0-foot–2 feet:** Silty sand (SM); light yellowish brown fine-grained sand, low plasticity fines, loose, and dry. Trace gravel. No debris. **2 feet–4.5 feet:** Poorly graded sand (SP); light yellowish brown, medium to fine grained sand with some low plasticity silt, slightly moist. No debris.
HA22	10/15/2002	0–4	**0-foot–2 feet:** Silty sand (SM); light olive brown, fine-grained sand with low plasticity fines, medium compacted, and dry. No debris. **2 feet–4 feet:** Sandy silt (MLs), light olive brown, non-plasticity silt, slightly moist. No debris. **8 feet:** Refusal
HA25	10/15/2002	0–4.5	**0-foot –2 feet:** Silty sand (SM); yellowish brown fine-grained sand with low plasticity fines, compacted, and dry. No debris. **2 feet–4 feet:** Sandy silt to silty sand (MLs/SM); light yellowish brown. No debris. **9 feet:** Refusal
HA27	10/15/2002	0–4	**0-foot–2 feet:** Silty sand (SM); dark yellow-brown fine-grained sand with low plasticity fines, compacted, and dry. No debris. **2 feet–4 feet:** Silty sand to sandy silt (MLs/SM); brown low plasticity silt, slightly moist. No debris.
HA28	10/15/2002	0–4	**0-foot–2 feet:** Silty sand (SM); light olive brown fine-grained sand with low plasticity fines, and dry. Traces of sub-angular gravel. No debris.

Table 4-3: Lithology of Continuous Core Soil Samples–RSE Investigation

Location	Logging Date	Depth (feet bgs)	Lithology
			2 feet–4 feet: Silt (ML); light yellowish brown, medium plasticity silt, slightly moist. No debris.
HA30	10/15/2002	0–4	**0-foot–2 feet:** Poorly graded sand (SP-SM); light yellowish brown fine-grained with some low plasticity fines, medium compacted, and dry. No debris. **2 feet–4 feet:** Sandy silt (MLs); light yellowish brown, medium plasticity silt with medium to fine grained sand, slightly moist. No debris.

Notes:
bgs = below ground surface

> **Decision Question #7:** Has the nature of the waste present been adequately characterized using soil vapor, soil, groundwater, surface water, and sediment data, or is further evaluation required to characterize risk and evaluate response actions?

Four sediment samples (upstream and downstream locations) were collected on 23 February 2003. These were analyzed for the same suite of analyses (Title 22 metals, VOCs, SVOCs, and petroleum hydrocarbons) as the surface soil samples. Any impact to the Agua Chinon Wash sediments was determined by comparing the upstream sediment analyte concentrations with the downstream analyte concentrations, as well as by comparing the sediment analyte concentrations with the surface soil analyte concentrations from within the waste placement boundaries. The sediment sample collection details are presented in Appendix B, along with complete data sets for both of these rounds.

4.10 SURFACE WATER SAMPLING

Surface water soil sampling was proposed at AA 3 in response to Decision Questions #4 and #7, and in accordance to Decision Rule #5 of the RSE investigation.

> **Decision Question #4:** Has the impact to groundwater, surface water, and sediments been adequately characterized, or are additional data required?

> **Decision Question #7:** Has the nature of the waste present been adequately characterized using soil vapor, soil, groundwater, surface water, and sediments data, or is further evaluation required to characterize risk and evaluate response actions?

The proposed sampling locations for surface water runoff were designed to evaluate analyte concentrations in surface water at the upstream location and at a downstream location within the Agua Chinon Wash; samples were analyzed for the full suite of analyses (petroleum hydrocarbons, VOCs, SVOCs, metals, and perchlorate) similar to the groundwater samples. These surface water sample results were evaluated based on comparison to groundwater quality criteria.

The analytical results of these samples help in evaluating whether the debris placed at the site has impacted Agua Chinon Wash. The surface water sample collection details are presented in Appendix B, along with complete data sets for both these rounds.

4.11 ANALYTICAL LABORATORY DATA VALIDATION

Laboratory data were validated by Laboratory Data Consultants of Carlsbad, California, in accordance with the cited method, and:

- EPA Contract Laboratory National Functional Guidelines for Organic Data Review, October 1999c

- EPA Contract Laboratory National Functional Guidelines for Inorganic Data Review, February 1999d

- EPA SW 846 Third Edition, Test Methods for Evaluating Solid Waste, update I, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996)

- EPA Method TO-14A, January 1999

Laboratory data were validated as specified in the NAVFAC SW, Environmental Work Instruction EW#1. Level IV validation was performed on 20 percent or more of the samples, with the balance validated at Level III. The data validation reports for all samples collected during the RSE investigation are presented in Appendix D. The data validation findings are summarized, indicating the findings of the review process. Data are reported flagged with appropriate qualifiers to indicate their usability.

Data were assigned the following qualifiers as appropriate:

J estimated concentration

U not detected (including not present or adjusted detection limit because of blank contamination)

R Data are not usable

Combinations of qualifiers such as UJ are possible.

The field duplicate pairs were compared and the results were within the acceptance criteria except as noted in the data validation reports. The results that are significantly different are believed to be a result of variability inherent in the sampling procedures and the media sampled, and do not appear to represent consistent or systematic errors.

The following specific issues were identified for the groundwater and perimeter soil gas, sediment and surface water samples in the validation process.

- Some results were flagged as estimated (J) based on the quality control analysis performed with the samples. However, the qualifiers do not alter the use of the data.

- In specific cases, in accordance with Contract Laboratory Program guidance and Navy procedures, analyte reporting limits were adjusted due to the presence of the target analyte in the laboratory method blank or the field blank and the values qualified as estimated non-detect (UJ). The guidance indicates that if concentrations detected in the sample are less than 5 times the concentration in the blank (10 times for common laboratory contaminants), the sample is reported as non-detect. In general, this occurred when the laboratory reported detectable values above the Method Detection Limit in both the field sample and the associated laboratory or field blank. The findings were reviewed during the data assessment and the qualification was warranted in light of the concentrations reported.

All data were found usable for the purposes intended and no data were rejected. The qualification assigned to data was incorporated into the conclusions or recommendations of the investigation.

4.12 INVESTIGATION DERIVED WASTE MANAGEMENT AND DISPOSAL

During the initial RSE investigation activities that included drilling of boreholes for the installation of perimeter gas wells and groundwater monitoring wells, and the corresponding decontamination activities, approximately 5 cubic yards of soil cuttings and 23 drums of water were generated as IDW. The soil cuttings were placed in a 5-yard roll-off bin, water was placed in 55-gallon drums, and miscellaneous debris was placed in a containerized 2-cubic-yard trash bin. The IDW solid waste personal protective equipment (PPE), plastic sheeting, paper towels, and field test kit waste were stored in plastic bags.

4.12.1 IDW Soil

Soil samples from different locations of the roll-off bin were collected and composited to form a single composite soil sample (LK167). This composite sample was submitted to the analytical laboratory for VOCs, petroleum hydrocarbons and metals analyses.

No VOCs were detected in the roll-off bin composite soil sample. With the exception of selenium that was detected at 1.7 milligrams per kilogram (mg/kg), all other metals were within the former MCAS El Toro background concentrations (Table 4-4). With the exception of arsenic, all metals were also less than the regulatory threshold concentrations. The analytical results of the composite soil sample indicated very low detection of petroleum hydrocarbons.

The IDW soil was classified as nonhazardous based on the knowledge that IDW soil was a result of installing wells outside the debris placement perimeter and the comparison of composite soil sample analytical results with regulatory thresholds (PRGs, total threshold limit concentrations [TTLCs], toxicity characteristic leaching potential [TCLP] and soluble threshold limit concentration [STLC] criteria values). Therefore, based on this evaluation and consistent with the Station-wide IDW Management Plan (CDM 1995), soil cuttings were placed at AA 3.

4.12.2 IDW Water

Since the IDW water stored in the drums was produced during the installation and development of perimeter soil gas and groundwater monitoring wells, and during the sampling of groundwater monitoring wells, the analytical results of the groundwater samples collected during December 2002 groundwater sampling event were used to characterize the IDW water drums. The groundwater samples were analyzed for VOCs, SVOCs, metals and petroleum hydrocarbons. Based on the comparisons, the IDW water was classified as nonhazardous waste. It was proposed that the IDW water be transported and disposed at an appropriate facility as nonhazardous waste.

4.12.3 IDW Disposal

A memo detailing the IDW disposal plan for the management of IDW generated at AA 3 during the RSE field activities was presented to the BCT members on 7 May 2003. The BCT members concurred with recommendations of the memorandum (Earth Tech 2003b) and on 4 August 2003, IDW soil was placed at the site and IDW water was shipped for treatment at the D/K Environmental recycling facility in Los Angeles, California. All other solid wastes were disposed of as municipal waste.

Table 4-4: Summary of Detected Analytes and Comparison With Regulatory Threshold Concentrations–Composite Soil Sampling–RSE Investigation

Analyte	Concentration (Composite Sample LK167)	Former MCAS El Toro Background Concentrations (95th quantile)	Residential PRGs	Total Threshold Limit Concentrations (TTLC)	Toxicity Characteristic Leaching Potential (TCLP) x 20*	Soluble Threshold Limit Concentration (STLC) x 10
METALS (mg/kg)						
Aluminum	4,260	14,800	76,000	-	-	-
Arsenic	3.3	6.86	0.39	500	100	50
Barium	60.6	173	5,400	10,000	2,000	1000
Cadmium	0.38	2.35	37	100	20	10
Calcium	4,290	46,000	-	-	-	-
Chromium	11.3	26.9	211	500	100	50
Cobalt	2.8	6.98	903	8,000	-	-
Copper	4.8	10.5	3,129	2,500	-	-
Iron	7,070	18,400	23,463	-	-	-
Lead	1.6	15.1	150	1,000	100	50
Magnesium	2,590	8,370	-	-	-	-
Manganese	78.2	291	1,762	-	-	-
Mercury	0.039 J	0.22	23.5	20	4	2
Nickel	5.0	15.3	1,564	2,000	-	-
Potassium	884	4,890	-	-	-	-
Selenium	1.7	0.32	391	100	20	10
Vanadium	16.7	71.8	547	2,400	-	-
Zinc	18.2	77.9	23,463	5,000	-	-
PETROLEUM HYDROCARBONS (PHC) (µg/kg)						
PHC as diesel	5 J	-	-	-	-	-
Motor Oils	23	-	-	-	-	-

Notes:
- = not established
J = indicates an estimated value
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
PRGs = preliminary remediation goals
RSE = removal site evaluation
* = Criteria for IDW soil based on the extraction methodology for the TCLP, where the weight of the extraction fluid is equal to 20 times the weight of the solid sample. Therefore, the derived criterion for waste is equivalent to 20 times the regulatory level for TCLP.

5. PHYSICAL CHARACTERISTICS

5.1 SURFACE FEATURES

A geologist performed a site walk to verify the surface features. The results of the physical feature observations and geologic literature review are presented in this section. Surface deposits in the vicinity of the site are predominantly young alluvial fan deposits of Holocene/late Pliestocene age, consisting primarily of unconsolidated gravels, sand, and silt. Surface deposits to the immediate north of the site consist of interbedded marine sandstone, conglomerate sandstone, and siltstone from the Niguel Formation of Pliocene Age. Most of the surface is covered with vegetation and loose soil, but bedrock crops out near the summit on the south side of a hill adjacent to the site. This bedrock, identified as the Niguel Formation, consist of interbedded marine sandstone, conglomeratic sandstone and conglomerate of Pliocene age. The strata strike and dip in the vicinity of the Site are north 5 east and 22 north west, respectively. The bedrock appears indurated and competent, although highly weathered at the surface. Fractures were not observed.

The Niguel Formation is underlain by the Monterey Formation, consisting of marine siltstone and sandstone of Miocene age. The Niguel Formation has a maximum thickness of 350 feet. Deposits to the southwest of the site, across Agua Chinon Wash, consist of alluvial fan deposits of Mid-to-Early-Pleistocene age. The lithology is sandy, well indurated and well dissected by erosion.

However, a housing tract is currently located at that location and no outcrop was readily visible. A local geologic map (Figure 5-1) was created using the U.S. Geographical Survey digital geologic map database of the Santa Ana 30-foot by 60-foot quadrangle as the map source for former MCAS El Toro region showing the geologic formations, contact, fault, strike and dip information in standard notation. The topography in the immediate vicinity of AA 3 has a relief of 400 feet to 600 feet above mean sea level (msl) generally dipping to the south and southwest. The site is located at an elevation of approximately 460 feet above msl.

5.2 REFINED GEOLOGY

During drilling of boreholes for the installation of monitoring wells (as part of the RSE investigation), bedrock was encountered at 32 feet bgs in MW07 and 56 feet bgs in MW10. A figure showing a measured section of the subsurface lithology and equivalent measured section of the stratigraphy of the site was provided as part of the RSE Work Plan (Figures 2-4 and 2-5 of the Work Plan). A figure showing the plan view of these cross sections is presented in Figure 5-2. The cross sections were revised based on the information collected as part of this RSE investigation and are presented in Figures 5-3, 5-4, and 5-5. These cross sections provide sufficient alluvium and bedrock contact information.

Subsurface stratigraphy in this area was inferred from drilling logs provided in the AA 3 technical information package (IT/OHM 2000), CPT survey, and the boreholes drilled to install the groundwater and perimeter gas monitoring wells as part of this RSE investigation. Subsurface stratigraphy consists of fine-to-coarse-grained sediments overlying bedrock (sandstone, siltstone, and claystone). Unconsolidated sediments were identified as well-graded gravel, gravelly sand, well-graded and poorly graded sand, silty sand, and clayey sand. Sediments were generally brown, yellowish brown, olive-brown, and greyish brown, with local iron staining.

The depth to bedrock for the entire site can be inferred from extrapolated cross sections (see Figures 5-3, 5-4, and 5-5) of this Report. The drilling logs for the 10 monitoring wells identify the bedrock as Pliocene Niguel Formation. Sandstone is generally light to dark gray and light olive-brown with

yellowish mottling, with very fine- to medium-grained sand, poorly indurated, and dense to very dense. Siltstone bedrock is generally light brown, olive, or gray with local yellowish mottling. Claystone bedrock is generally brown to olive to very dark gray.

As shown in Figures 5-3 through 5-5, two topographic low areas were apparently present in the southwestern and northeastern portions of the site, prior to debris placement. A southwestern topographic low area was located along cross section AA 3-2-2', between cross sections AA 3-12-12' and AA 3-13-13' (see Figure 5-7). A northeastern topographic low area was located along cross section AA 3-14-14', between cross-sections AA 3-9-9' and AA 3-10-10'.

5.3 REFINED HYDROGEOLOGY

Ten groundwater gauging events (November 2002, December 2002, January 2003, March 2003, November 2003, March 2004, June 2004, October 2004, February 2005, and April 2005) were conducted after the installation the monitoring wells (MW05 through MW14). All AA 3 wells (MW01 through MW14) were gauged prior to groundwater sampling. Table 5-1 presents the historical depth to groundwater information (14 gauging events) at the site.

The April 2005 depth to water readings in these wells ranged from 26.56 feet below the top of casing (TOC) in Well MW01 to 40.58 feet below the TOC in Well MW02. Groundwater elevations were calculated based on well casing elevations and ranged from 423.16 feet above msl in Well MW02 to 447.84 feet above msl in Well MW06 (April 2005 gauging event). Figure 5-6 shows the groundwater elevation contours from April 2005 gauging event and its corresponding flow direction.

In order to verify if more than one water-bearing unit was present at AA 3, Well MW09 was to be installed as a dual nested well (with one screen in alluvium [MW09A] and the other screen in the bedrock [MW09B]), and Well MW10 was screened in bedrock. However, at the location of Well MW09, bedrock was not encountered; therefore, both the dual nested Wells MW09A and MW09B were installed in alluvium. Since the recent groundwater gauging events indicate that the bedrock and alluvial aquifers encountered appear to be fully hydraulically connected and can be considered a single water-bearing unit, all wells (MW01 through MW10) were used to infer the groundwater flow and gradient information in Figure 5-6.

In February 2005, groundwater Monitoring Wells MW11 through MW14, and an exploratory borehole (BH01) were installed in the AA 3 area. All of these penetrations were continuously cored. Wells MW11, MW12 and MW14 were installed within the filled area. Well MW13 was installed outside of the northern corner of the estimated waste placement area. During the installation of Well MW11, Niguel Formation sandstone was encountered at 55 feet bgs, with construction debris fill materials identified to a depth of 32 feet bgs. Native alluvial silty sands and well-graded sands were identified between the base of fill and bedrock. The borehole was plugged back to 40 feet bgs and the well screen placed from 22 feet to 37 feet bgs. Well MW-11 was therefore screened across fill and native alluvium with static groundwater gauged during the February 2005 event at 28.50 feet bgs, approximately 3.5 feet above the native alluvium within the fill.

Well MW12 was placed in the upgradient, northeast portion of the waste fill area. The well was bored to 60 feet bgs, encountering construction debris fill materials from the near surface to the bedrock contact at 40 feet bgs. The 20 feet of bedrock penetrated in this boring was logged as containing all three facies of the Niguel Formation; sandstone, siltstone and claystone. Well MW-12 was screened from 24 feet to 39 feet bgs with static water gauged at 30.14 feet bgs in the gauging event of February 2005.

SENSITIVE RECORD

PORTIONS OF THIS RECORD ARE CONSIDERED SENSITIVE AND ARE NOT AVAILABLE FOR PUBLIC VIEWING

FIGURE 5-1 – MAP OF GEOLOGIC INFORMATION

FOR ADDITIONAL INFORMATION, CONTACT:

DIANE C. SILVA, RECORDS MANAGER
NAVAL FACILITIES ENGINEERING COMMAND, SOUTHWEST
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132

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Explanation:

Quaternary

Qyfa, Qyfsa	Young alluvial fan deposits (Holocene/Late Pleistocene). Gravel, sand, silt, unconsolidated
Qvofa	Very old alluvial fan deposits (Middle to Late Pleistocene). Sandy alluvium, reddish brown, well indurated, fan surfaces well-dissected.

Tertiary

Tn	Niguel Formation (Pliocene). Interbeded marine sandstone, conglomerate sandstone, conglomerate.
Tco	Capistrano Formation, Oso Member (Miocene to Early Pliocene). Sandstone, medium to coarsegrained, massively bedded, friable.
Tps	Puente Formation, Soquel Member (Miocene). Sandstone, siltstone.
Tplv	Puente Formation, La Vida Member (Miocene). Sandstone, siltstone.
Tm	Monterey Formation (Miocene). Marine siltstone, sandstone, siliceous, diatomaceous.
Tt	Topanga Formation (Middle Miocene). Marine sandstone, siltstone, locally conglomerate.
Tvs	Vacueros and Sespe Formations, undifferentiated (late Eocene, Oligocene, early Miocene). Interbedded sandstone and conglomerate, marine and nonmarine.

Cretaceous

Kw	Williams Formation (Upper Cretaceous). Feldspathic sandstone, pebbly sandstone, conglomerate sandstone, white, brown, poorly sorted, massively bedded, resistant, cliff-forming, marine

Legend

- Fault, dotted where covered
- 22 Strike and dip
- Syncline
- Anticline

Source:
Jacobs Engineering,
Bechtel Drawing No. 073H1214
OHM Drawing No. 18609043
USGS,
Open File Report 99-172
Santa Ana 30'x60' Quadrangle
Southern California, Version 1.0
D.M. Morlove

GN MN 0°17' 5 MILS 14° 249 MILS

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Map of Geologic Information

Anomaly Area 3

Date 02-08	Former MCAS El Toro	Figure 5-1
Project No. 29307	EarthTech, A tyco International Ltd. Company	

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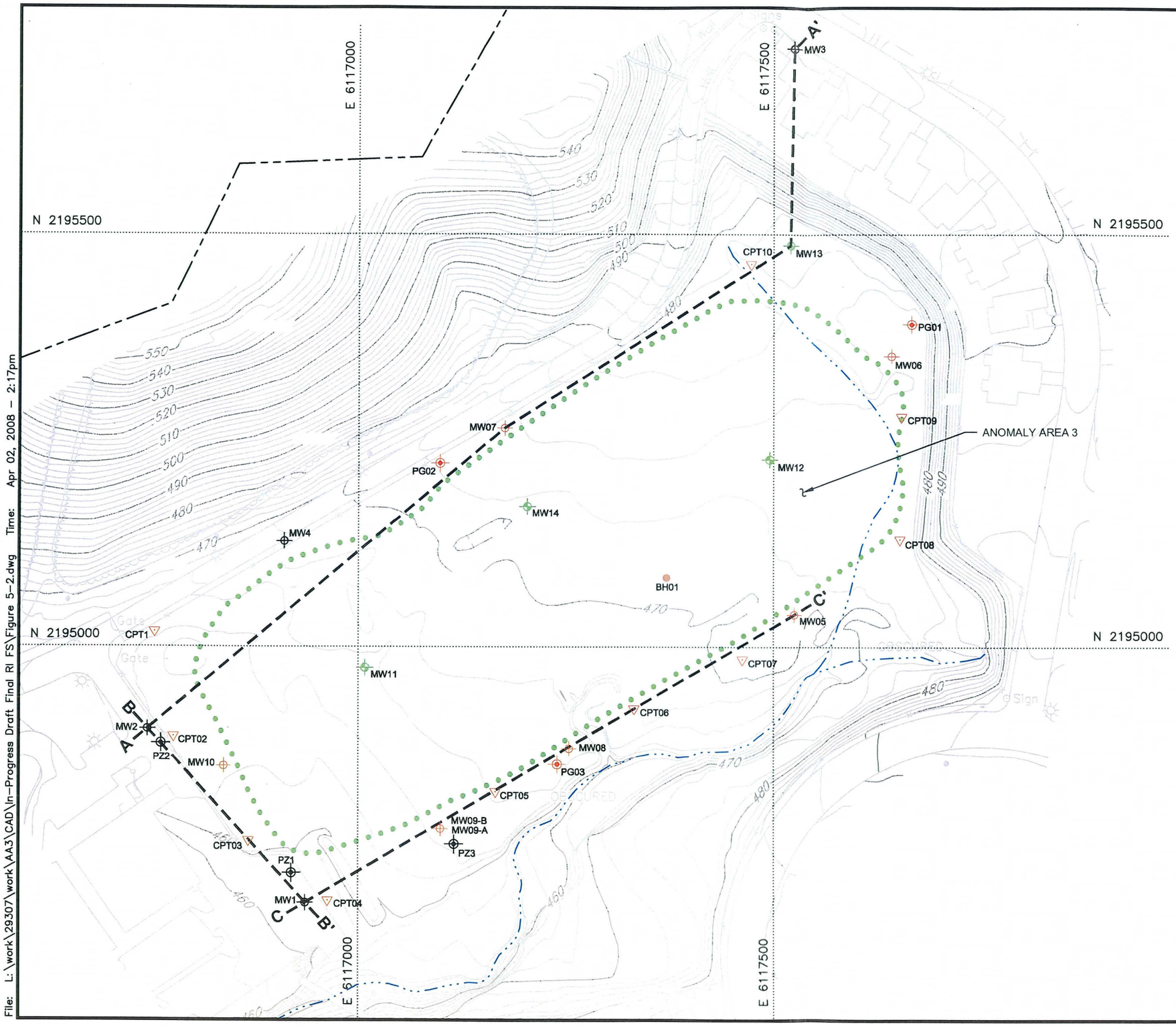

LEGEND

- MINOR SURFACE ELEVATION: 2-FOOT INTERVALS
- 460 MAJOR SURFACE ELEVATION: 10-FOOT INTERVALS
- MCAS EL TORO BOUNDARY
- EXISTING STREAM OR WASH
- ESTIMATED EXTENT OF WASTE PLACEMENT BEFORE RSE INVESTIGATION (EARTH TECH 2001)
- B- - -B' CROSS-SECTION LOCATION
- MW06 RSE GROUNDWATER MONITORING WELL LOCATION
- CPT01 RSE CONE PENETROMETER TEST LOCATION
- PG01 RSE PERIMETER GAS MONITORING WELL LOCATION
- MW4 EXISTING GROUNDWATER MONITORING WELL
- PZ3 EXISTING VADOSE ZONE WELL
- MW12 ADDITIONAL GROUNDWATER MONITORING WELL LOCATIONS
- BH01 ADDITIONAL BOREHOLE LOCATION FEBRUARY 2005

NOTES

1. TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHOD FROM AERIAL PHOTOGRAPHY DATED DECEMBER 2001 BY SAN-LO AERIAL SURVEYS.
2. COORDINATES ARE IN CALIFORNIA STATE PLANE COORDINATE SYSTEM, NAD 83, ZONE 6.
3. ELEVATIONS ARE IN FEET; BENCHMARK BASED ON NORTH AMERICAN VERTICAL DATUM 1988.

NORTH

60 0 60 120 FEET

SCALE: 1"=120'

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Site Plan Showing Geologic Cross-Sections A-A' Through C-C'

Anomaly Area 3

Date: 04-08	Former MCAS El Toro	Figure
Project No. 29307	EarthTech — A tyco International Ltd. Company	5-2

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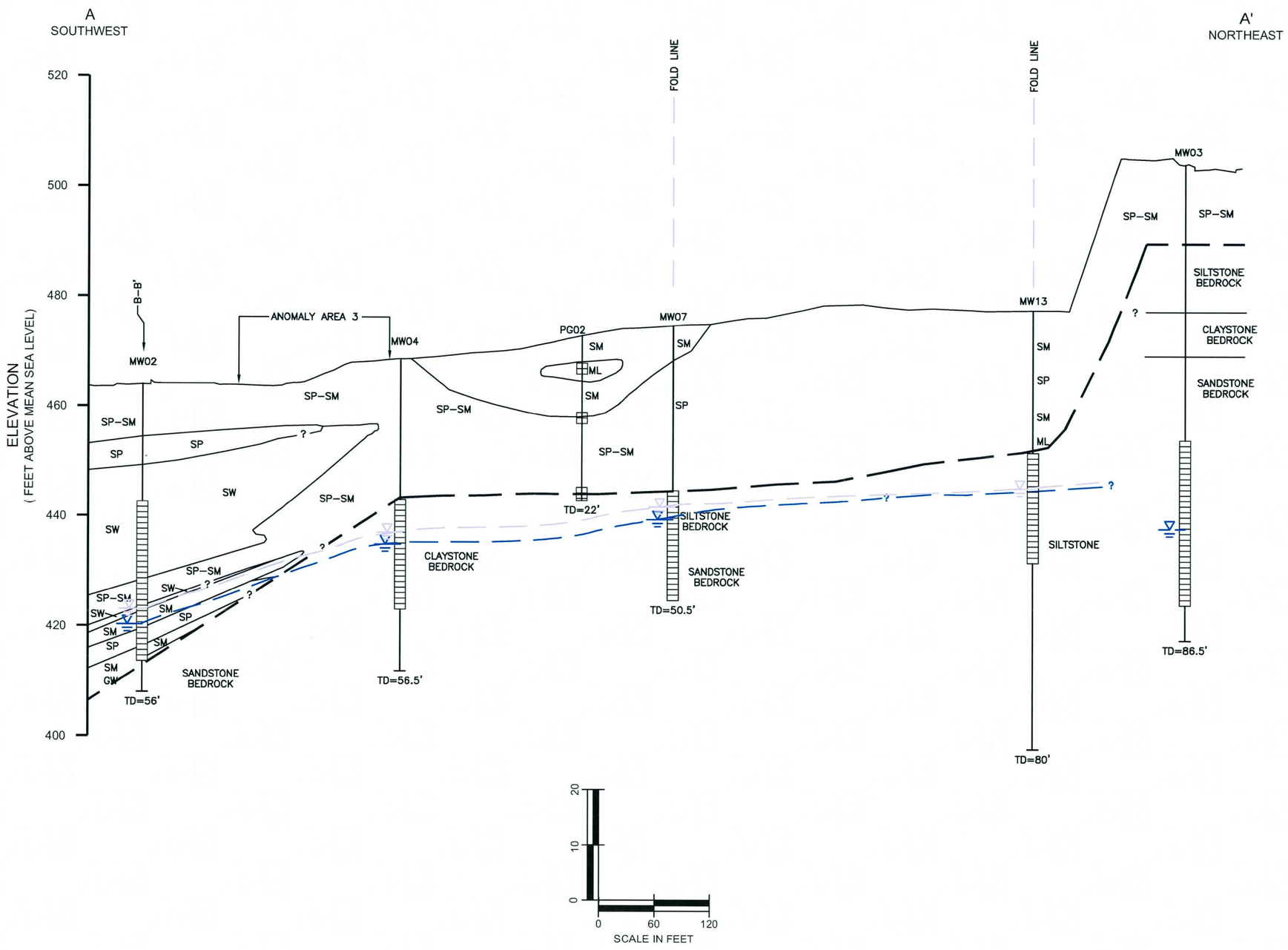

LEGEND

MW4 PG02	DESIGNATION FOR GROUNDWATER MONITORING WELL OR PERIMETER GAS WELL
	SCREENED INTERVAL OF MONITORING WELL (RED DENOTES AN RSE WELL)
TD=56'	TOTAL DEPTH OF WELL BORING IN FEET BELOW GROUND SURFACE
	STRATIGRAPHIC CONTACT
	TOP OF GROUNDWATER (MEASURED APRIL 2005)
	INFERRED GROUNDWATER SURFACE (APRIL 2005)
	TOP OF GROUNDWATER (MEASURED NOVEMBER 2003)
	INFERRED GROUNDWATER SURFACE (NOVEMBER 2003)
	TOP OF SAPORLITE (DEEPLY WEATHERED BEDROCK) (SEE NOTE 5)
GW	WELL-GRADED GRAVEL
ML	LOW-PLASTICITY SILT
SW	WELL-GRADED SAND
SP	POORLY GRADED SAND
SP-SM	POORLY GRADED SAND WITH SILT
SM	SILTY SAND

NOTES

1. LITHOLOGIC CONTACTS ARE BASED ON REVIEW OF BOREHOLE LOGS.
2. GROUND SURFACE ELEVATIONS ARE BASED UPON AN AERIAL SURVEY PERFORMED BY SAN-LO AERIAL SURVEYS DECEMBER 2001.
3. ELEVATIONS ARE IN FEET; BENCHMARK BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
4. MW03 ABANDONED ON 2003 GROUNDWATER ELEVATION BASED ON NOVEMBER 2003 MEASUREMENTS
5. AS BEDROCK WEATHERS IN PLACE IT DEVELOPS SOIL HORIZONS, WHICH OVER TIME CAN EXTEND QUITE DEEP INTO THE ORIGINAL FABRIC OF THE ROCK. BEDROCK, WHICH HAS UNDERGONE SUCH DEEP WEATHERING, IS REFERRED TO AS SAPROLITE. POROSITY AND PERMEABILITY OF SAPROLITES IS COMMONLY HIGHER THAN LESS WEATHERED BEDROCK.

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Geologic Cross Section A-A'

Anomaly Area 3

Date: 04-08	Former MCAS El Toro	Figure
Project No. 29307	EarthTech A tyco International Ltd. Company	5-3

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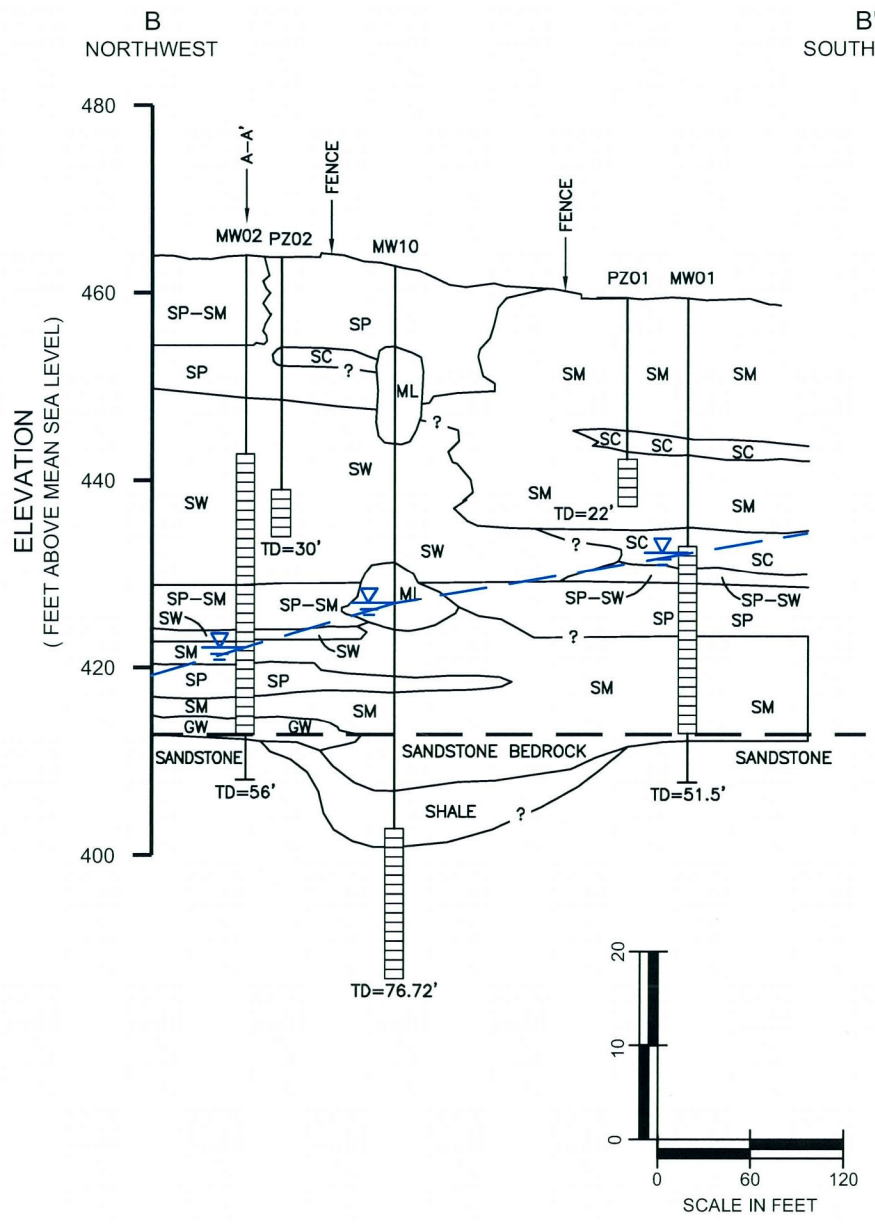

LEGEND

MW4 PZ02	DESIGNATION FOR GROUNDWATER MONITORING WELL OR PIEZOMETER
	SCREENED INTERVAL OF MONITORING WELL (RED DENOTES AN RSE WELL)
TD=56'	TOTAL DEPTH OF WELL BORING IN FEET BELOW GROUND SURFACE
	STRATIGRAPHIC CONTACT
	TOP OF GROUNDWATER (MEASURED FEBRUARY 2005)
	INFERRED GROUNDWATER SURFACE (FEBRUARY 2005)
	TOP OF SAPORLITE (DEEPLY WEATHERED BEDROCK) (SEE NOTE 5)
GW	WELL-GRADED GRAVEL
SW	WELL-GRADED SAND
SP-SW	POORLY TO WELL-GRADED SAND
SP	POORLY GRADED SAND
SP-SM	POORLY GRADED SAND WITH SILT
SM	SILTY SAND
SC	CLAYEY SAND
ML	INORGANIC SILTS AND VERY FINE SANDS

NOTES

1. LITHOLOGIC CONTACTS ARE BASED ON REVIEW OF BOREHOLE LOGS.
2. GROUND SURFACE ELEVATIONS ARE BASED UPON AN AERIAL SURVEY PERFORMED BY SAN-LO AERIAL SURVEYS DECEMBER 2001.
3. ELEVATIONS ARE IN FEET; BENCHMARK BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
4. AS BEDROCK WEATHERS IN PLACE IT DEVELOPS SOIL HORIZONS, WHICH OVER TIME CAN EXTEND QUITE DEEP INTO THE ORIGINAL FABRIC OF THE ROCK. BEDROCK, WHICH HAS UNDERGONE SUCH DEEP WEATHERING, IS REFERRED TO AS SAPROLITE. POROSITY AND PERMEABILITY OF SAPROLITES IS COMMONLY HIGHER THAN LESS WEATHERED BEDROCK.

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Geologic Cross Section B-B'

Anomaly Area 3

Date 04-08	Former MCAS El Toro	Figure
Project No. 29307	EarthTech A tyco International Ltd. Company	5-4

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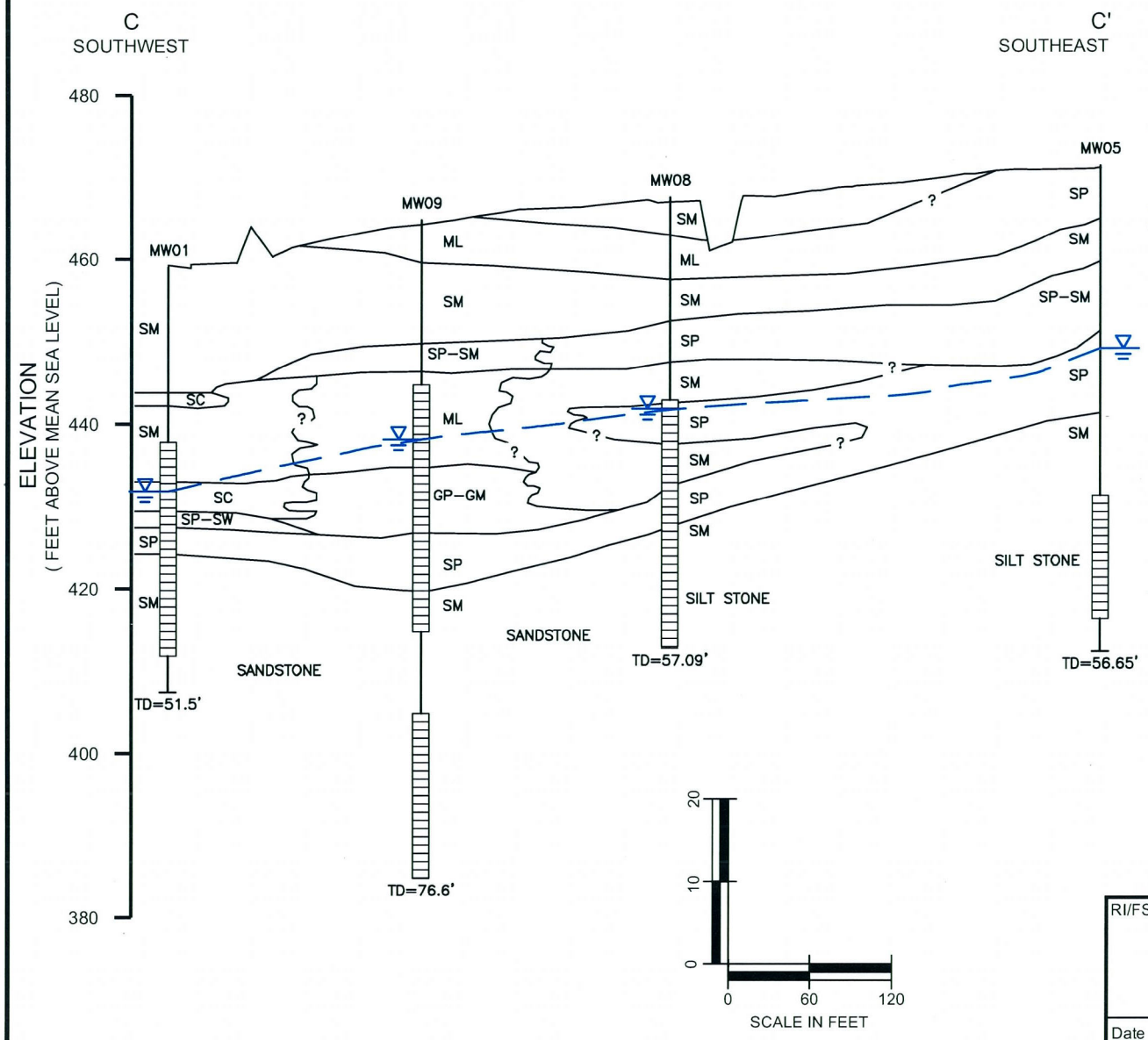

LEGEND

MW4	DESIGNATION FOR GROUNDWATER MONITORING WELL
	SCREENED INTERVAL OF MONITORING WELL (RED DENOTES AN RSE WELL)
TD=56'	TOTAL DEPTH OF WELL BORING IN FEET BELOW GROUND SURFACE
	STRATIGRAPHIC CONTACT
	TOP OF GROUNDWATER (MEASURED FEBRUARY 2005)
	INFERRED GROUNDWATER SURFACE (FEBRUARY 2005)
	TOP OF SAPORLITE (DEEPLY WEATHERED BEDROCK) (SEE NOTE 5)
GP-GM	POORLY-GRADED GRAVEL WITH SILT
GW	WELL-GRADED GRAVEL
ML	LOW-PLASTICITY SILT
SW	WELL-GRADED SAND
SP-SW	POORLY TO WELL-GRADED SAND
SP	POORLY GRADED SAND
SP-SM	POORLY GRADED SAND WITH SILT
SM	SILTY SAND
SC	CLAYEY SAND

NOTES

1. LITHOLOGIC CONTACTS ARE BASED ON REVIEW OF BOREHOLE LOGS.
2. GROUND SURFACE ELEVATIONS ARE BASED UPON AN AERIAL SURVEY PERFORMED BY SAN-LO AERIAL SURVEYS DECEMBER 2001.
3. ELEVATIONS ARE IN FEET; BENCHMARK BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
4. AS BEDROCK WEATHERS IN PLACE IT DEVELOPS SOIL HORIZONS, WHICH OVER TIME CAN EXTEND QUITE DEEP INTO THE ORIGINAL FABRIC OF THE ROCK. BEDROCK, WHICH HAS UNDERGONE SUCH DEEP WEATHERING, IS REFERRED TO AS SAPROLITE. POROSITY AND PERMEABILITY OF SAPROLITES IS COMMONLY HIGHER THAN LESS WEATHERED BEDROCK.

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Geologic Cross Section C-C'

Anomaly Area 3

Date 04-08	Former MCAS El Toro	Figure 5-5
Project No. 29307	EarthTech — A tyco International Ltd. Company	

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Table 5-1 - Anomaly Area 3 Historical Depth-to-Groundwater Measurements and Groundwater Elevation Information

Well ID	Screen Interval (feet below ground surface)	Northing	Easting	TOC Elevation (feet above msl)	November-99		December-99		February-01		August-01		November-02		December-02		January-03	
					Depth-to Water (feet below TOC)	Groundwater Elevation (feet above msl)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above msl)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above msl)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above msl)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above msl)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above msl)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above msl)
AA3-MW01	16.5 – 46.5	2194691.311	6116936.679	459.03	23.5	435.53	24.05	434.98	24.98	434.05	21.67	437.36	27.16	431.87	27.22	431.81	27.45	431.58
AA3-MW02	21 – 51	2194900.483	6116746.935	463.74	39.15	424.59	39.64	424.10	40.8	422.94	41.34	422.40	--	--	42.47	421.27	42.65	421.09
AA3-MW03	50 – 80	2194761.799	6117116.175	500.85	60.15	440.70	61.02	439.83	62.49	438.36	63.14	437.71	64.74	436.11	64.97	435.88	65.28	435.57
AA3-MW04	25 – 45	2195127.919	6116911.118	468.43	28.91	439.52	29.57	438.86	--	--	31.27	437.16	32.59	435.84	32.7	435.73	32.94	435.49
AA3-MW05	40 – 55	2195039.239	6117525.408	473.07	*	*	*	*	*	*	*	*	27.52	445.55	27.68	445.39	28.04	445.03
AA3-MW06	20 – 40	2195353.272	6117642.832	475.72	*	*	*	*	*	*	*	*	27.93	447.79	28.14	447.58	28.61	447.11
AA3-MW07	30 – 50	2195265.463	6117176.68	475.60	*	*	*	*	*	*	*	*	34.12	441.48	34.26	441.34	34.59	441.01
AA3-MW08	25 – 55	2194877.084	6117254.834	469.65	*	*	*	*	*	*	*	*	28.27	441.38	28.43	441.22	28.73	440.92
AA3-MW09A	20 – 50	2194780.357	6117099.868	466.52	*	*	*	*	*	*	*	*	28.17	438.35	28.38	438.14	28.56	437.96
AA3-MW09B	60 – 75	2194780.475	6117099.588	466.45	*	*	*	*	*	*	*	*	28.37	438.08	28.43	438.02	28.69	437.76
AA3-MW10	60 – 75	2194855.815	6116838.023	463.76	*	*	*	*	*	*	*	*	37.45	426.31	37.48	426.28	37.67	426.09
AA3-MW11	22 – 37	2194974.72	6117008.111	467.35	*	*	*	*	*	*	*	*	*	*	*	*	*	*
AA3-MW12	24 – 39	2195227.469	6117495.47	475.87	*	*	*	*	*	*	*	*	*	*	*	*	*	*
AA3-MW13	25 – 45	2195487.055	6117520.993	479.39	*	*	*	*	*	*	*	*	*	*	*	*	*	*
AA3-MW14	25 – 40	2195170.273	6117203.852	474.10	*	*	*	*	*	*	*	*	*	*	*	*	*	*

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Table 5-1 - Anomaly Area 3 Historical Depth-to-Groundwater and Groundwater Elevation Information

Well ID	Screen Interval (feet below ground surface)	Northing	Easting	TOC Elevation (feet above msl)	March-03		November-03		March-04		June-04		October-04		February-05		April-05	
					Depth-to Water (feet below TOC)	Groundwater Elevation (feet above msl)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above msl)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above msl)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above msl)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above msl)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above msl)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above ms)
AA3-MW01	16.5 – 46.5	2194691.311	6116936.679	459.03	26.54	432.49	28.28	430.75	28.22	430.81	28.51	430.52	28.89	430.14	26.55	432.48	26.56	432.47
AA3-MW02	21 – 51	2194900.483	6116746.935	463.74	42.42	421.32	43.30	420.44	43.04	420.70	43.45	420.29	43.80	419.94	41.40	422.34	40.58	423.16
AA3-MW03	50 – 80	2194761.799	6117116.175	500.85	65.43	435.42	66.33	434.52	Well Abandoned		Well Abandoned		Well Abandoned		Well Abandoned		Well Abandoned	
AA3-MW04	25 – 45	2195127.919	6116911.118	468.43	32.73	435.70	33.62	434.81	33.50	434.93	33.82	434.61	34.16	434.27	32.00	436.43	31.44	436.99
AA3-MW05	40 – 55	2195039.239	6117525.408	473.07	26.74	446.33	29.30	443.77	29.25	443.82	29.78	443.29	30.46	442.61	27.80	445.27	27.01	446.06
AA3-MW06	20 – 40	2195353.272	6117642.832	475.72	27.76	447.96	29.89	445.83	29.98	445.74	30.56	445.16	31.29	444.43	27.00	448.72	27.88	447.84
AA3-MW07	30 – 50	2195265.463	6117176.68	475.60	34.44	441.16	35.65	439.95	35.63	439.97	36.05	439.55	36.60	439.00	34.00	441.60	33.23	442.37
AA3-MW08	25 – 55	2194877.084	6117254.834	469.65	27.98	441.67	29.88	439.77	29.80	439.85	30.08	439.57	30.82	438.83	27.00	442.65	27.88	441.77
AA3-MW09A	20 – 50	2194780.357	6117099.868	466.52	27.77	438.75	29.59	436.93	29.46	437.06	29.86	436.66	30.32	436.20	27.90	438.62	26.22	440.30
AA3-MW09B	60 – 75	2194780.475	6117099.588	466.45	27.93	438.52	29.66	436.79	29.52	436.93	29.91	436.54	30.36	436.09	28.50	437.95	27.88	438.57
AA3-MW10	60 – 75	2194855.815	6116838.023	463.76	37.25	426.51	38.46	425.30	38.14	425.62	38.57	425.19	38.96	424.80	36.60	427.16	36.44	427.32
AA3-MW11	22 – 37	2194974.72	6117008.111	467.35	*	*	*	*	*	*	*	*	*	*	28.50	438.85	28.09	439.26
AA3-MW12	24 – 39	2195227.469	6117495.47	475.87	*	*	*	*	*	*	*	*	*	*	30.90	444.97	30.21	445.66
AA3-MW13	25 – 45	2195487.055	6117520.993	479.39	*	*	*	*	*	*	*	*	*	*	34.15	445.24	33.58	445.81
AA3-MW14	25 – 40	2195170.273	6117203.852	474.10	*	*	*	*	*	*	*	*	*	*	32.75	441.35	26.62	447.48

Notes:

* Wells MW05 though MW10 were installed during November 2002. Wells MW11 though MW14 were installed during February 2005.

-- Not recorded. Depth to groundwater measurements not collected due to obstruction (dead animal) in the well.

ID - identification

msl - mean sea level

TOC - top of casing

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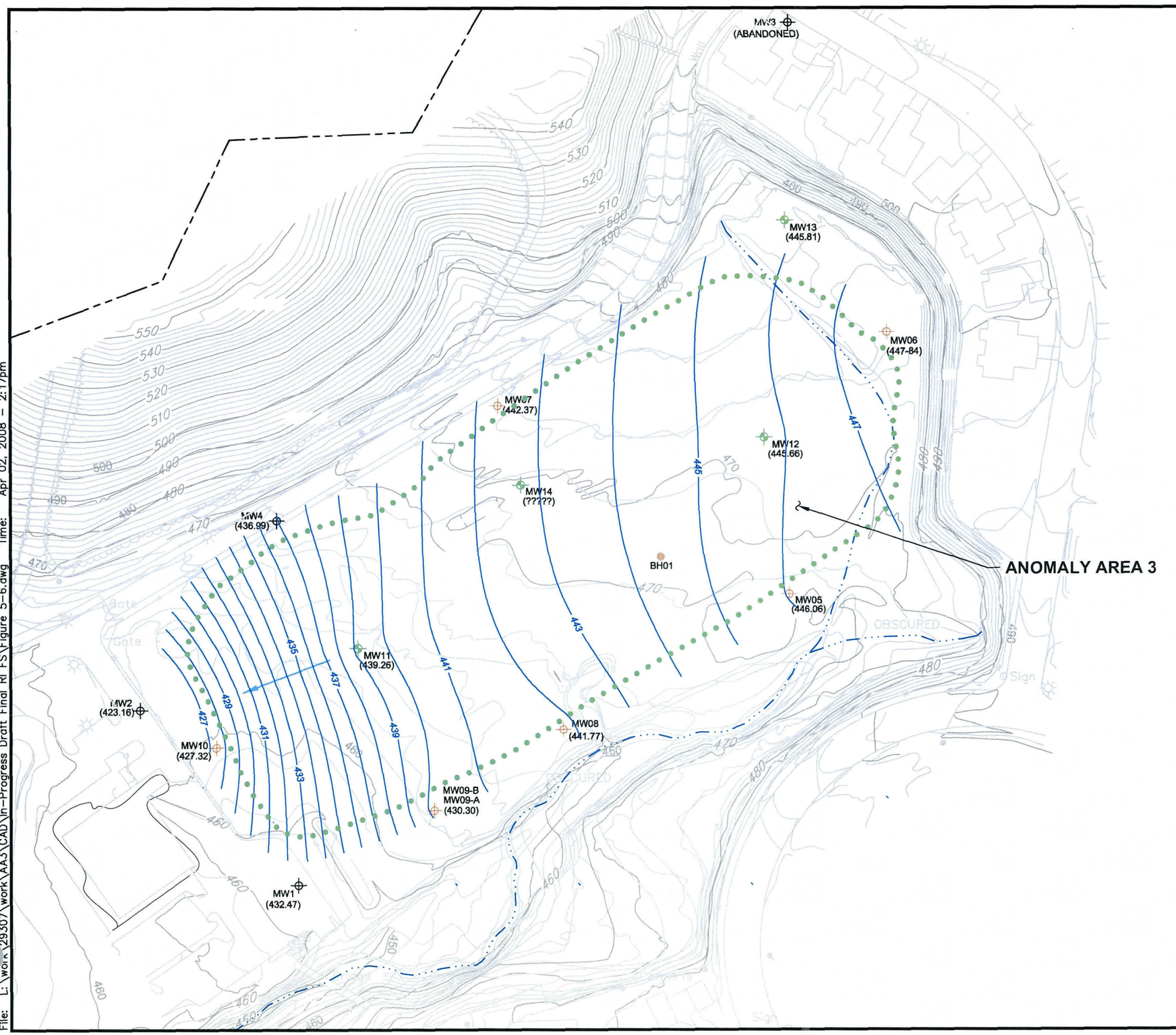

LEGEND

- MINOR SURFACE ELEVATION: 2-FOOT INTERVALS
- 460 — MAJOR SURFACE ELEVATION: 10-FOOT INTERVALS
- 427 — GROUNDWATER EQUIPOTENTIAL LINES USING GROUNDWATER LEVELS COLLECTED DURING APRIL 2005
- MCAS EL TORO BOUNDARY
- EXISTING STREAM OR WASH
- ESTIMATED EXTENT OF WASTE PLACEMENT BEFORE RSE INVESTIGATION (EARTH TECH 2001)
- MW06 — RSE GROUNDWATER MONITORING WELL LOCATION
- MW4 — EXISTING GROUNDWATER MONITORING WELL
- MW12 — ADDITIONAL GROUNDWATER MONITORING WELL LOCATIONS - FEBRUARY 2005
- BH01 — ADDITIONAL BOREHOLE LOCATION FEBRUARY 2005
- GROUNDWATER GRADIENT DIRECTION - APRIL 2005

NOTES

1. TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHOD FROM AERIAL PHOTOGRAPHY DATED DECEMBER 2001 BY SAN-LO AERIAL SURVEYS.
2. COORDINATES ARE IN CALIFORNIA STATE PLANE COORDINATE SYSTEM, NAD 83, ZONE 6.
3. ELEVATIONS IN FEET; BENCHMARK BASED ON NORTH AMERICAN VERTICAL DATUM 1988.

NORTH

60 0 60 120 FEET

SCALE: 1"=120'

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Groundwater Equipotential Map

Anomaly Area 3

Date: 04-08	Former MCAS El Toro	Figure
Project No. 29307	EarthTech — A tyco International Ltd. Company	5-6

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Groundwater at this location was approximately 10 feet above the bedrock surface and resident with the gravelly clay construction debris identified from 20 feet to 40 feet bgs. Monitoring Well MW13 was installed to the north and outside of the waste placement area. The siltstone facies of the Niguel Formation was encountered from 25 feet bgs down to 80 feet bgs. The well was screened from 25 feet to 40 feet bgs with static water noted during the February 2005 gauging event at 34.14 feet bgs within the siltstone bedrock. Well MW14 was installed approximately 100 feet south-southeast of existing Well MW07. The boring penetrated 30 feet of construction debris and fill materials and 10 feet of native alluvium. This well was screened from 25 feet to 40 feet bgs. Static water level was measured at 32.75 feet bgs during the gauging event in February 2005, indicating that the water table was standing within the native alluvium at that time.

The hydrostatic equipotential gradient for the April 2005 event (see Figure 5-6) indicates a more or less westerly flow direction in two regimes. A gradient of 0.01 was calculated between the eastern part of the study area to the vicinity of Well MW11. The groundwater gradient steepens to 0.06 from MW11 to MW02 but essentially maintains a westerly flow direction. It is just beyond MW02 that the Wash joins the Irvine Management Zone (IMZ) with the increase in hydraulic gradient probably associated with rapid increase in gradient associated with entry into alluvial fans associated with the IMZ.

Well MW-13 was screened entirely within the bedrock with water levels resident within the bedrock. No noticeable change in gradient can be determined in association with water levels within the bedrock and water levels within the fill or native alluvium. It seems reasonable to conclude that from all available data that fill, native alluvium and native bedrock are hydraulically interconnected.

The Niguel Formation, where penetrated, has shown evidence of deep weathering. Published reports of the load-bearing properties of the Niguel Formation indicate that even when fresh, the sandstone facies is not well consolidated, and the siltstone and claystone facies are typically weaker (Blanc and Cleveland, 1968; Morton and Miller, 1981; Barrows et al, 1993). The Niguel Formation was deposited in a near shore, tidal, partially enclosed embayment and has been noted to contain both gypsum and lime as cement. Where encountered with AA 3, the Niguel Formation has been found to be deeply weathered to fully decomposed almost to soil. Cores of the Niguel Formation facies indicate that there is probably a significant difference in hydraulic conductivity between the Niguel Formation and the fill/alluvium that overlies it, but there is no evidence of any sort of barrier to hydraulic communication. It is suspected from visual observations of the cores collected from the Niguel Formation that the weathered/decomposed Niguel Formation may be more hydraulically conductive than fresher specimens of the Niguel Formation found at greater depths nearby at IRP Site 2.

In order to assess groundwater dynamics at AA 3, a detailed comparison of precipitation data were conducted with head data recorded within AA 3 during the winter of 2004-2005. Head data were collected from dedicated pressure transducers placed in AA 3 wells which provided a fairly good record with readings collected every two hours. Four wells, in two sets of two wells, were chosen to assess the way in which recharge is occurring at AA 3. The well pairs were MW06 and MW10, corresponding to either end of AA 3, and Wells MW05 and MW01, corresponding to roughly the same distance but within the alluvium only. Some data were not available for three of the four selected wells corresponding to the period of approximately 24-28 February 2005. Hourly precipitation data were obtained from the National Weather Service for the period spanning November 2004 through April 2005 (see Appendix B5).

During the selected period, two major precipitation events were used for the analysis. The first event began on 8 January 2005 and continued through 11 January 2005, peaking at 5:00 pm on 9 January 2005. The second event began on 18 February 2005 and continued through 24 February 2005 peaking at 3:00 pm on 28 February 2005.

For the first rain event, when precipitation peaked at 5:00 pm on 9 January 2005, hydrographic data showed that Well MW06 (upgradient end of AA 3) reached its maximum head three days later with a rise of 6.7 feet in the aquifer surface gauged from 1 November 2004. For the same precipitation event, Monitoring Well MW10, located at the downgradient extent of AA 3, reached its maximum head 11 days after the precipitation maximum on 9 January 2005. The rise in MW10 was 2.3 feet above the reference head on 1 November 2004. Significantly, Well MW06 reached maximum head from this precipitation event some eight days earlier than Well MW10 located at the downgradient end of AA 3, and achieved only 2.3 feet of head rise, some 4.5 feet less than Well MW06. Both factors, differential delay of eight days in aquifer response, and head differential of over 4 feet strongly suggest that aquifer recharge takes place due to the much greater surface area of the total watershed feeding into the alluvial aquifer system as opposed to vertical percolation from the smaller surface area of AA 3. If direct surface recharge from just the surface of AA 3 was the dominant mechanism it is unlikely that either of the differentials (i.e., response time and magnitude) that were seen during the precipitation events would be observed (Appendix B5).

5.4 GEOTECHNICAL EVALUATION

For details of near-surface and subsurface geotechnical soil sample collection and analysis, refer to Section 4.7.3. Logs of CPT soundings are included in Appendix C. Logs of groundwater monitoring wells and perimeter gas wells are included in Appendix A. Geotechnical laboratory test reports are included in Appendix F.

5.4.1 Near-Surface Soil Data

Near-surface soil data were collected primarily for landfill cover design and construction considerations, including possible use of existing soil as a foundation layer and for actual monolithic soil cover. After observing soil specimens obtained from exploratory Trenches TR01 through TR12, and surficial sampling locations HA01 through HA33, soil samples were selected for subsequent testing in the laboratory. These locations are shown in Figure 4-1. A summary of the analytical results of these samples is presented in Table 5-2. Logs of exploratory trenches and boreholes are included in Appendix A.

Table 5-2: Summary of Shallow Geotechnical Soil Sampling Results – RSE Investigation

Sample ID	Moisture Content (%)	Dry Density (pcf)	Particle Size Distribution GR:SA:FI (%)	Percent Passing No. 200 Sieve	Atterberg Limits (LL, PL, PI)	Modified Proctor Compaction		Specific Gravity	Soil Classification/ Identification
						Maximum Dry Density (pcf/A, B, C)	Optimum Moisture Content		
LK141	3.9	118.9	2:58:40	NA	25, 18, 7	NA	NA	NA	SC-SM
LK142	3.3	NA	NA	12.5	NA	NA	NA	NA	SM
LK143	4.5	NA	2:71:27	NA	NA	125.0/A	9.5	2.65	SM
LK144	19	NA	NA	43	48, 30, 18	NA	NA	NA	SM
LK145	3.9	NA	1:70:29	NA	NA	NA	NA	NA	SM
LK146	4.6	NA	0:84:16	NA	NA	NA	NA	NA	SM
LK147	2	NA	8:72:20	NA	NA	NA	NA	NA	SM

Table 5-2: Summary of Shallow Geotechnical Soil Sampling Results – RSE Investigation

Sample ID	Moisture Content (%)	Dry Density (pcf)	Particle Size Distribution GR:SA:FI (%)	Percent Passing No. 200 Sieve	Atterberg Limits (LL, PL, PI)	Modified Proctor Compaction		Specific Gravity	Soil Classification/ Identification
						Maximum Dry Density (pcf/A, B, C)	Optimum Moisture Content		
LK148	11.3	NA	NA	NA	NA	NA	NA	NA	SM
LK149	6.7	NA	6:66:28	NA	NA	NA	NA	NA	SM
LK150	5.1	NA	9:65:26	NA	NA	NA	NA	NA	SM
LK151	3.6	115.5	NA	37	31, 19, 12	118.5/A	11.5	2.64	SC-SM
LK152	3.9	NA	2:79:22	NA	NA	NA	NA	NA	SM
LK153	6.8	NA	NA	50.7	NA	NA	NA	NA	s(ML)
LK154	4.5	112.3	NA	49.1	NA	NA	NA	NA	SM
LK155	1.5	NA	4:74:22	NA	Nonplastic	NA	NA	NA	SM
LK156	11.2	128	NA	NA	NA	NA	NA	NA	SC
LK157	2	NA	NA	NA	NA	NA	NA	NA	SM
LK158	20.9	125	NA	NA	NA	NA	NA	NA	CL
LK159	2.8	NA	NA	31.5	NA	NA	NA	NA	SM
LK160	3.9	NA	1:77:22	NA	NA	NA	NA	NA	SM
LK161	3.2	NA	0:61:39	NA	NA	NA	NA	NA	SM
LK162	7.5	NA	NA	NA	NA	NA	NA	NA	SM
LK163	3.1	NA	NA	32.6	NA	NA	NA	NA	SM
LK164	5.3	NA	NA	17.4	NA	NA	NA	NA	SM
LK165	3.8	NA	NA	32.7	NA	NA	NA	NA	SM
LK166	8.8	NA	1:66:33	NA	NA	NA	NA	NA	SM

Notes:
% = percent
ID = identification
NA = not analyzed
pcf = pounds per cubic foot

5.4.2 Subsurface Soil Data

Subsurface soil data were collected to aid in assessing:

- Compressibility characteristics and potential for static and seismically induced settlement, and
- Shear strength characteristics and evaluation of slope stability and lateral displacements under static and seismic loading conditions.

A summary of the analytical results of these samples is presented in Table 5-3. Data were also obtained (October through December 2002) from CPT soundings CPT01 through CPT10, groundwater Monitoring Wells MW04 through MW10, and gas Wells PG01 through PG03. In addition, available data previously collected were reviewed and used in this assessment, including installation data of groundwater Monitoring Wells MW01 through MW04 and Piezometers PZ1 through PZ3, installed by IT/OHM in 2000.

Table 5-3: Summary of Subsurface Geotechnical Soil Sampling Results – RSE Investigation

Sample ID	Soil Classification/ Identification	Moisture Content (%)	Dry Unit Weight - Drive Cylinder (pcf)	Percent Passing No. 200 Sieve	Particle Size Distribution (GR:SA:FI, %)	Atterberg Limits (LL, PL, PI)
LK169	SP	5.2	96.3	NA	0:94:3	NA
LK170	SP*	2.6	97.6	NA	NA	NA
LK171	SM	6.1	106.5	NA	4:79:17	NA
LK172	SP-SM	5.2	99.3	NA	1:88:11	NA
LK173	SP-SM & SP	5.1	98.7	NA	NA	NA
LK174	(SM)g	8.2	120.7	NA	38:49:13	NA
LK175	SM & CL	29.7	98.2	NA	NA	NA
LK176	CL	23.2	102.6	NA	NA	NA
LK177	s(CL)	27.5	NA	NA	5:36:59	NA
LK178	MH(s)	48.3	NA	85	NA	96, 50, 46
LK179	CL	57.1	NA	NA	NA	NA
LK180	s(CL)	37.1	83	67.7	NA	NA
LK181	SM	4	99.5	29.5	NA	NA
LK182	SM*	8.4	90.6	NA	NA	NA
LK183	SM*	11.5	90.8	NA	NA	NA
LK184	SC	16.8	102.2	44.6	NA	41, 22, 19
LK185	s(ML)	24.1	95.4	NA	2:39:59	NA
LK186	SC & CL	21.1	97.4	NA	NA	NA
LK187	(SW-SM)g	9.6	128.9	NA	41:49:10	NA
LK188	CL	78.5	53	85.5	NA	NA
LK189	MH	73.3	NA	90.6	NA	84, 46, 38
LK190	SP-SM	2.6	100.3	NA	NA	NA
LK191	SW-SM	2.6	103.7	NA	0:88:12	NA
LK192	SP	2.7	96.5	NA	NA	NA
LK193	SP_SM	2.3	100.7	NA	1:93:6	NA
LK194	(SW-SM)g	4.2	112.6	NA	22:66:12	NA
LK195	SM	11.8	110.6	22.4	NA	NA
LK196	ML	27.9	92.4	NA	NA	36, 26, 10
LK197	SM	19.6	NA	34.4	NA	NA
LK198	ML	29.2	91.4	NA	NA	NA
LK199	SM	24	100.1	NA	0:86:14	NA
LK200	SP	1.9	93.1	NA	NA	NA
LK201	s(CL)	13.2	10.6	55.1	NA	NA
LK202	(ML)s	21.3	89.7	NA	2:15:83	NA
LK203	SM	8.3	104.3	NA	1:75:24	NA
LK204	SM	9.5	109.6	NA	NA	NA
LK205	SC	14.4	102.2	NA	5:79:16	NA
LK206	SM	3.9	99.6	NA	NA	NA

Table 5-3: Summary of Subsurface Geotechnical Soil Sampling Results – RSE Investigation

Sample ID	Soil Classification/ Identification	Moisture Content (%)	Dry Unit Weight - Drive Cylinder (pcf)	Percent Passing No. 200 Sieve	Particle Size Distribution (GR:SA:FI, %)	Atterberg Limits (LL, PL, PI)
LK207	SP-SM	4.3	105	NA	1:88:11	NA
LK208	SM*	7.7	108.4	NA	NA	NA
LK209	SM	11.8	96	NA	2:75:23	NA
LK210	SM	11.9	96.6	35.4	NA	NA
LK211	SC	12.1	108.3	NA	NA	NA
LK212	(GW-GM)s	7.3	126.7	NA	55:37:8	NA
LK213	(SP)g*	13	NA	NA	NA	NA
LK214	SP	16.7	NA	NA	1:97:2	NA
LK215	SP	17	NA	NA	NA	NA
LK216	SP-SM	21.5	NA	NA	1:93:6	NA
LK217	SP	12.1	NA	NA	NA	NA
LK218	SP	20	NA	NA	NA	NA
LK219	SP	17.4	NA	NA	1:95:4	NA
LK220	SP	13.9	NA	NA	NA	NA
LK221	SP	17.7	NA	NA	NA	NA
LK222	SP-SM	17	NA	NA	0:94:6	NA
LK223	CL	6.8	95.3	NA	NA	NA
LK224	(SC)g	5.5	109.3	NA	15:56:29	NA
LK225	CL	17.4	93.2	NA	NA	NA
LK226	SC	15.9	91.8	41.6	NA	49, 21, 28
LK227	SP-SM	2.4	104.9	NA	14:81:5	NA
LK228	SP	2.3	114.4	NA	NA	NA
LK229	SP-SM	2.8	105.6	NA	4:91:5	NA
LK230	SC	9.7	98.8	30.8	NA	NA
LK231	SP-SM	15.8	109.5	NA	0:93:7	NA
LK232	SP	8.9	NA	NA	1:95:4	NA

Notes:
% = percent
ID = identification
NA = not analyzed
pcf = pounds per cubic foot

In addition, previous topographic and groundwater level records that were available, as well as recent geotechnical laboratory test results, were used in "reconstructing" previous site history and subsurface conditions. A site plan with interpreted groundwater level contours is shown on Figure 5-6.

Interpreted stratigraphic conditions were summarized in cross sections AA 3-1-1' through AA 3-14-14'. These cross sections are shown on Figure 5-7 and are supplemented by subsurface soil exploration data, particularly CPT sounding records and borehole data. Specifically, CPT of tip resistance in tons per square foot (tsf), friction ratio (percent) and pore water pressure ratio (percent),

unified soil classification, and standard penetration test (SPT) blow count were added to those cross sections and are shown on Figures 5-8 through 5-11.

These data aid in interpreting geologic and stratigraphic conditions under the AA 3 perimeter, namely along the following: (1) Sections 1-1' and 10-10': southwest and northeast sides (Figure 5-8); (2) Section 12-12': northwest side (Figure 5-9); (3) Section 13-13': southeast side (Figure 5-10); and, (4) Section 14-14': southeast side (Figure 5-11).

The major subsurface soil strata identified, with the purpose of conducting geotechnical evaluations for the site, are shown on Figures 5-8, 5-9, 5-10, and 5-11.

Based on the lithological information (from continuous cores) gathered during the drilling activity of exploratory borehole (BH01) and for the installation of additional groundwater Monitoring Wells MW11 through MW14 and, an additional cross sectional figure using the cross section AA 3-13-13' was generated and presented in this Report as Figure 5-11. For additional information about the February 2005 drilling and well installation activities, refer to Section 4.4.1.1.

5.4.3 Interpreted Subsurface Soil Conditions

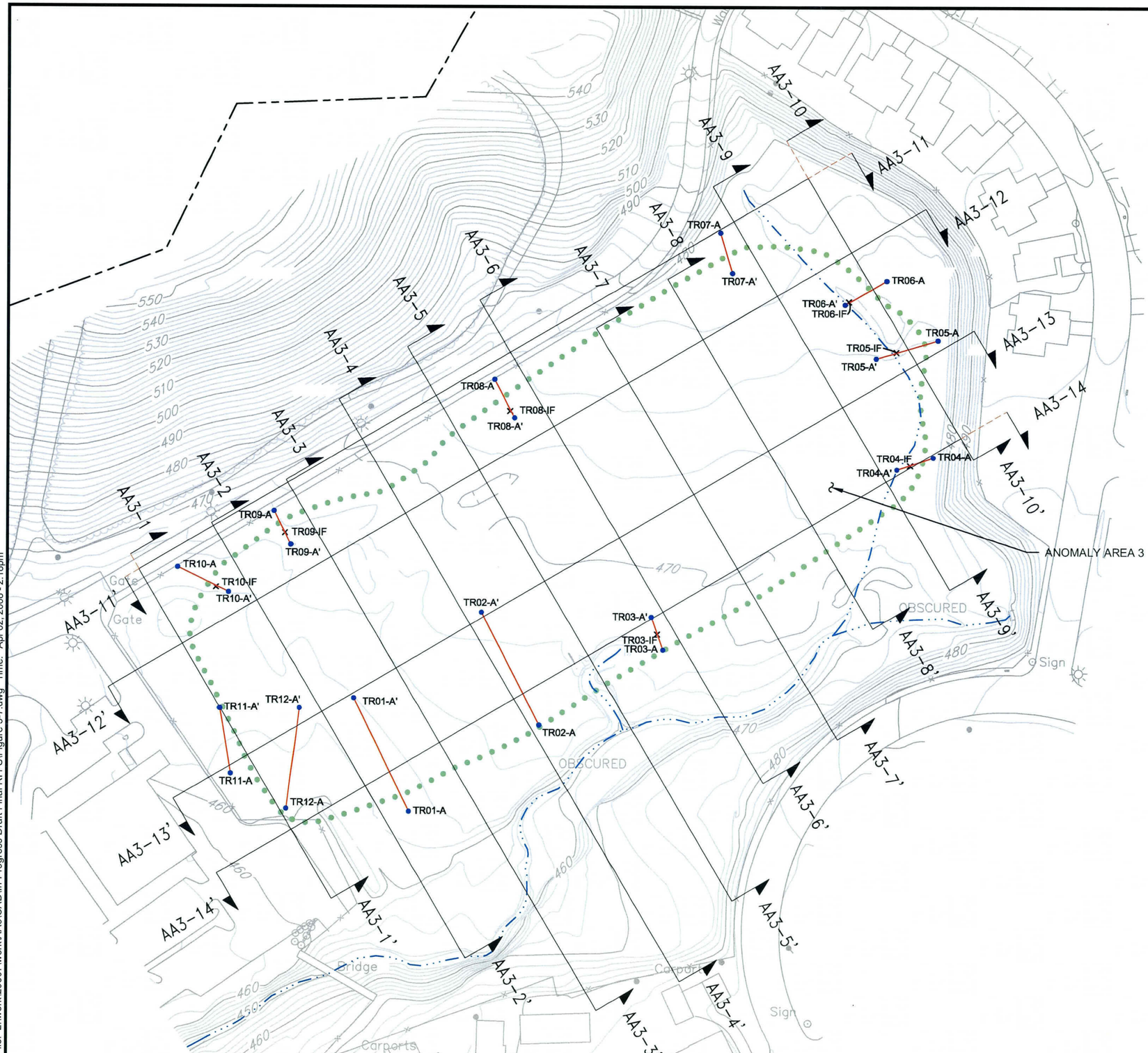
A summary of field explorations providing ("deep") subsurface soil conditions are provided in Table 5-4. Figures 5-8, 5-9, 5-10, and 5-11 show approximate limits of manmade fill (debris) underlying the Agua Chinon Wash alluvium, groundwater level, and the interpreted depth to bedrock.

It was noted during the performance of the geotechnical work that a previous exploration shows the bedrock location somewhat shallower than it appears from this investigation. As shown in the above mentioned profiles, bedrock was interpreted to be approximately 390 feet to 410 feet above msl beneath the AA 3, although at the location of CPT09, which penetrated nearly 110 feet below existing ground surface, bedrock was inferred to be at or below 365 feet above msl.

It is possible that the upper several feet of the bedrock formation (identified as the Niguel Formation in 1999 IT/OHM 2000 Report) is severely weathered under large portions of the site, and is therefore displaying a "soil-like (saprolite)" behavior. In this regard, the upper portion of the bedrock would be significantly softer, more compressible, and weaker than a fresh, unweathered bedrock formation. Profiles shown on Figures 5-8, 5-9, 5-10, and 5-11 roughly identify the interpreted location of relatively firmer and unweathered bedrock rather than "soil-like (saprolite)" bedrock.

In general, alluvial soil consist of loose to dense sands, interbedded with layers of medium stiff to very stiff fine-grained soils (silts and clays). Locally, sand layers were found to be very dense and gravelly. Similarly, a few fine-grained soil layers of a few feet in thickness were found to be relatively soft to medium stiff. Major identified subsurface soil strata from CPT soundings are presented in Table 5-5 with the purpose of conducting geotechnical evaluations for the site.

In addition, profiles of soil property characterization data versus depth and elevation are provided in Figures 5-12 and 5-13, respectively. These profiles include measured soil penetration resistance (raw blow count, without correction in blows per foot), equivalent SPT N-value, in situ moisture content (percent), dry unit weight (pcf), Atterberg Limits (liquid limit [LL] and plastic limit [PL]) and fines content (percent).



LEGEND

- MINOR SURFACE ELEVATION: 2-FOOT INTERVALS
- 460 — MAJOR SURFACE ELEVATION: 10-FOOT INTERVALS
- MCAS EL TORO BOUNDARY
- EXISTING STREAM OR WASH
- ESTIMATED EXTENT OF WASTE PLACEMENT BEFORE RSE INVESTIGATION (EARTH TECH 2001)
- TR08-A, TR08-A', TR08-IF — TRENCH LOCATION AND DESIGNATION
- INTERFACE OF DEBRIS AND FILL SOIL
- AA3-10, AA3-10' — CROSS-SECTION LOCATION AND DESIGNATION

NOTES

1. TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHOD FROM AERIAL PHOTOGRAPHY DATED DECEMBER 2001 BY SAN-LO AERIAL SURVEYS.
2. COORDINATES ARE IN CALIFORNIA STATE PLANE COORDINATE SYSTEM, NAD 83, ZONE 6.
3. ELEVATIONS IN FEET; BENCHMARK BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
4. TRENCHES THAT DO NOT SHOW THE INTERFACE OF DEBRIS AND FILL SOIL ARE TRENCHES WHERE WASTE WERE NOT IDENTIFIED UNTIL END A'.

NORTH

60 0 60 120 FEET

SCALE: 1"=120'

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Site Plan Showing Cross Sections AA3--1-1' through AA3--14-14'

Anomaly Area 3

Date: 04-08	Former MCAS El Toro	Figure
Project No. 29307	EarthTech, A tyco International Ltd. Company	5-7

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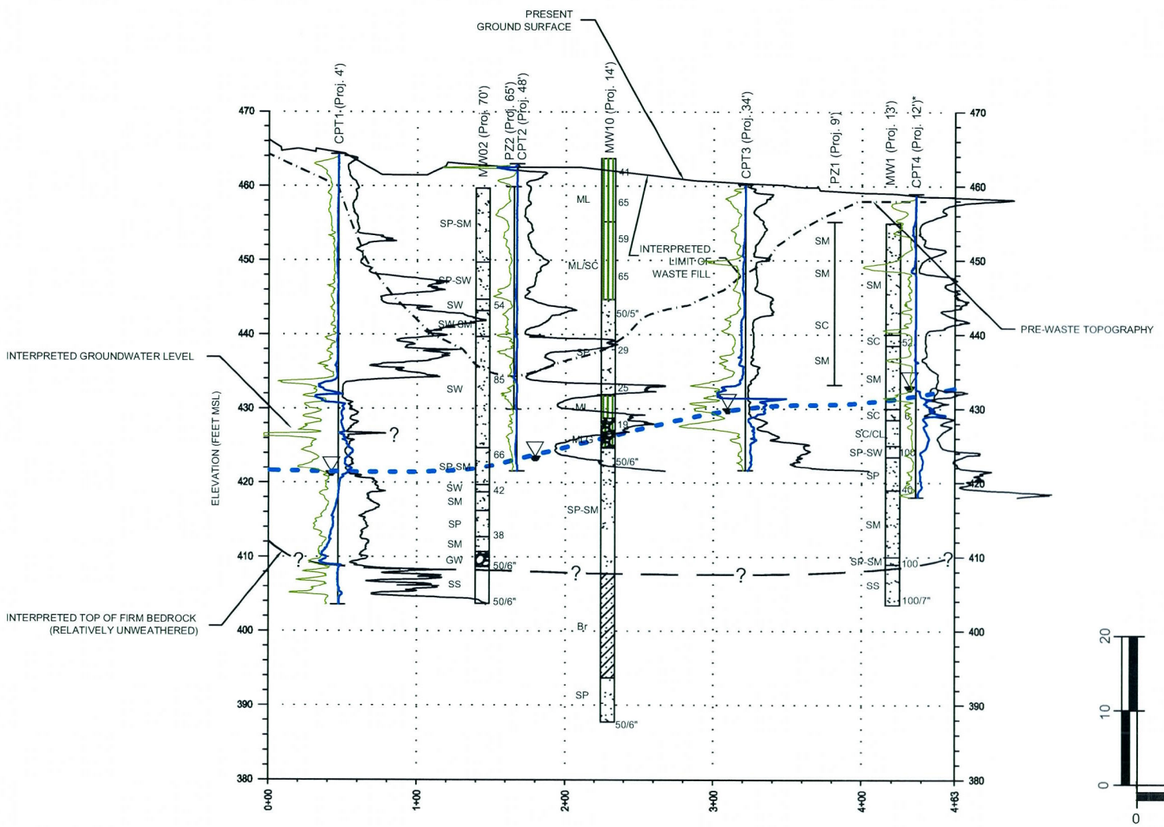
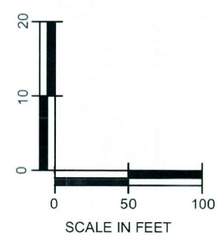
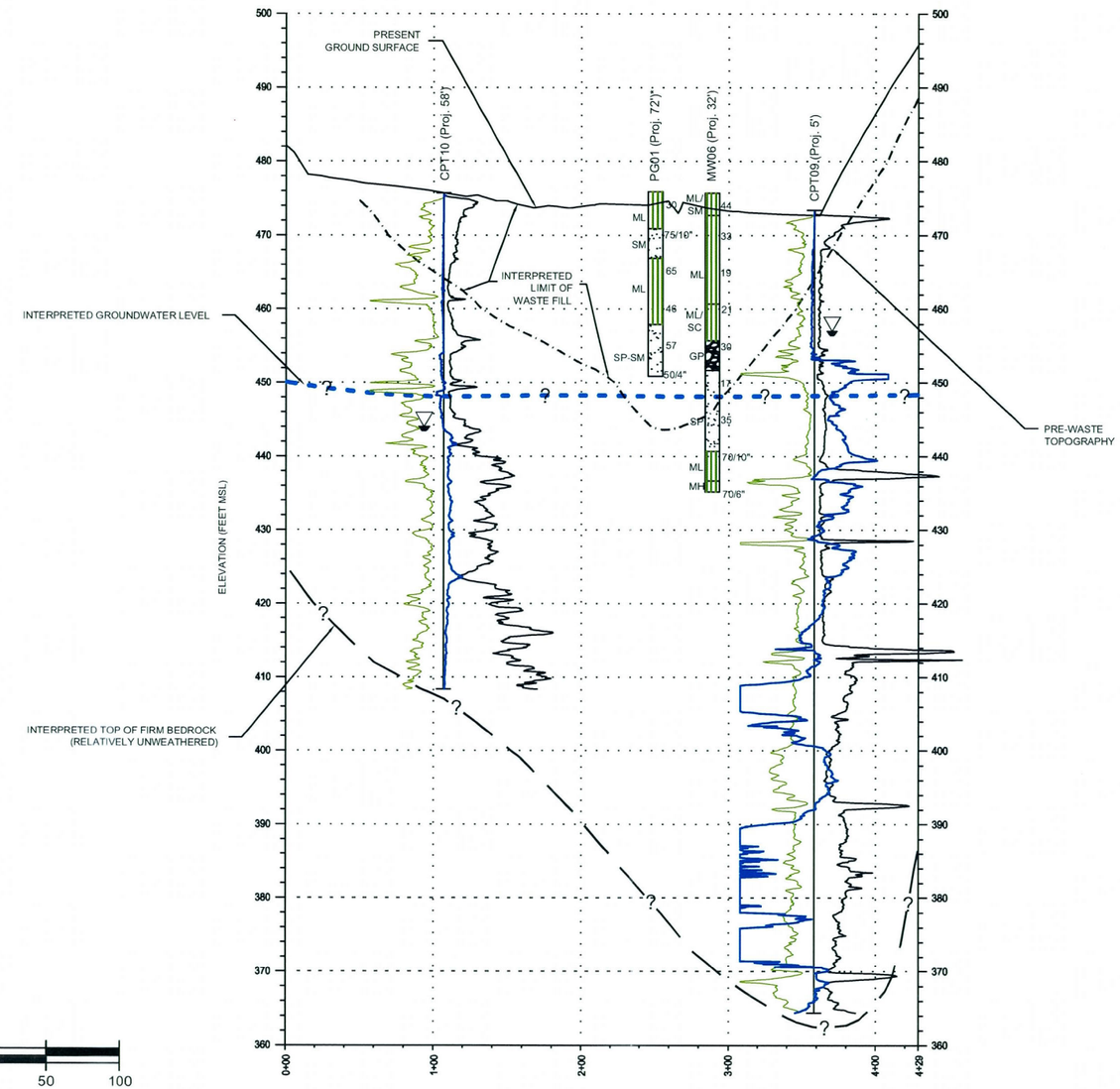
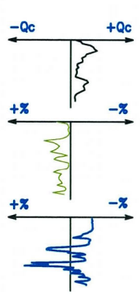


SECTION 1-1'
PROFILE STATION
(SOUTHWEST PERIMETER)





SECTION 10-10'
PROFILE STATION
(NORTHEAST PERIMETER)



LEGEND

Qc, TIP RESISTANCE
(SCALE: 1" = 300 TSF)

Fr, FRICTION RATIO
(SCALE: 1" = 10%)

PWPR, PORE WATER PRESSURE RATIO
(SCALE: 1" = 5%)

INTERPRETED GROUNDWATER LEVEL FROM GROUNDWATER MONITORING WELLS (FEBRUARY 2005)

DEPTH TO GROUNDWATER INTERPRETED FROM CONE PENETROMETER TESTING

* SHIFTED FOR CLARITY PURPOSE

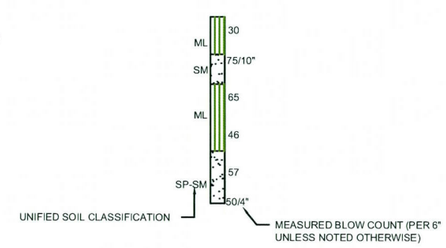
COARSE GRAINED SOILS, PREDOMINANTLY SANDS

FINE-GRAINED SOILS, PREDOMINANTLY SILTS

GRAVEL

SANDSTONE

INTERPRETED SUBSURFACE SOIL STRATIGRAPHY



NOTE: THIS DRAWING WHEN REDUCED TO 11"X17" SIZE IS 50% SMALLER THAN FULL SIZE VERSION

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Sections AA3-1-1' and AA3-10-10'
Interpreted Subsurface Soil Conditions

Anomaly Area 3

Date: 04-08	Former MCAS El Toro	Figure
Project No. 29307	EarthTech — A tyco International Ltd. Company	5-8

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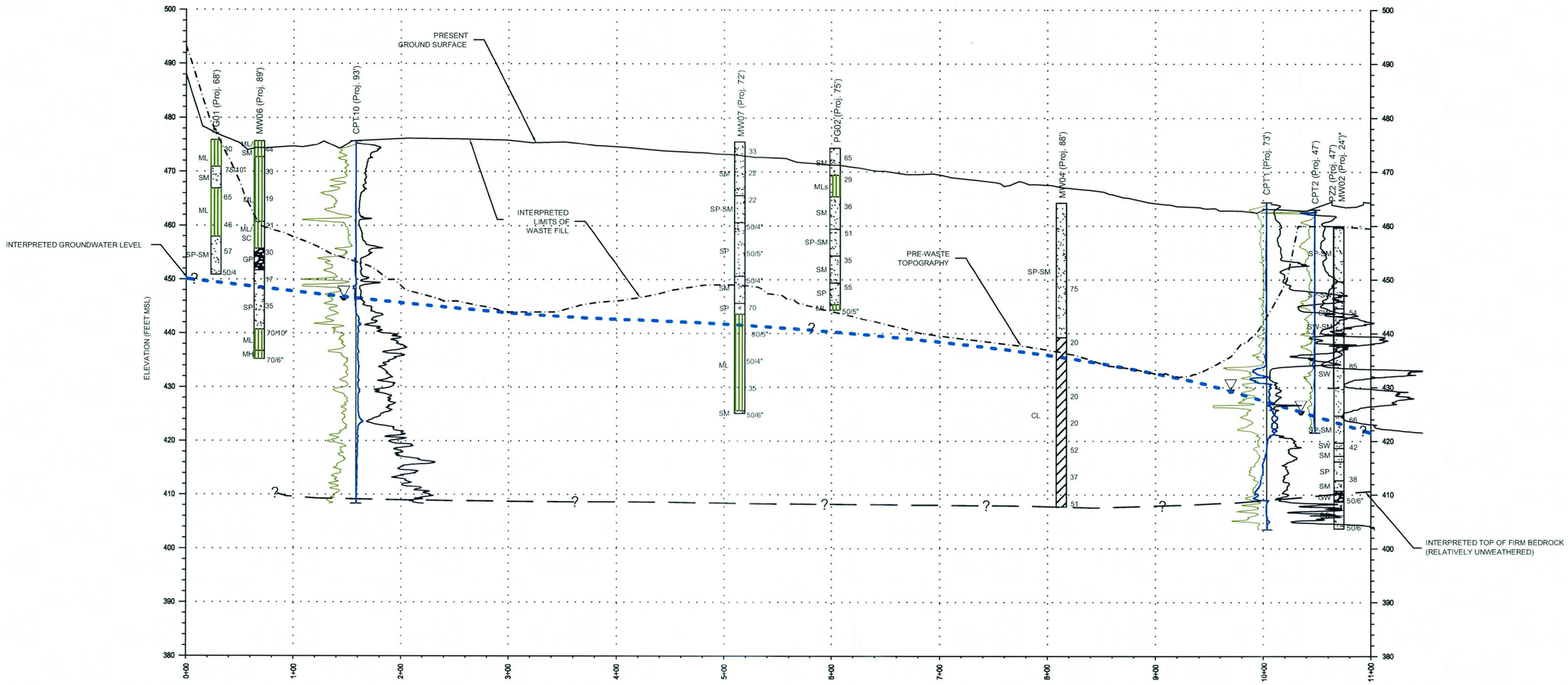
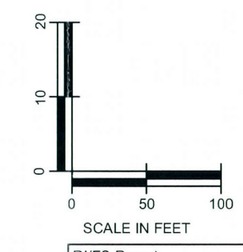
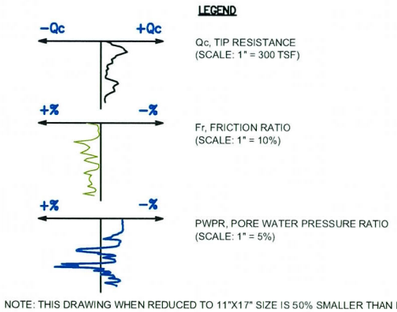






INTERPRETED GROUNDWATER LEVEL FROM GROUNDWATER MONITORING WELLS (FEBRUARY 2005)

DEPTH TO GROUNDWATER INTERPRETED FROM CONE PENETROMETER TESTING

* SHIFTED FOR CLARITY PURPOSE

COARSE GRAINED SOILS, PREDOMINANTLY SANDS

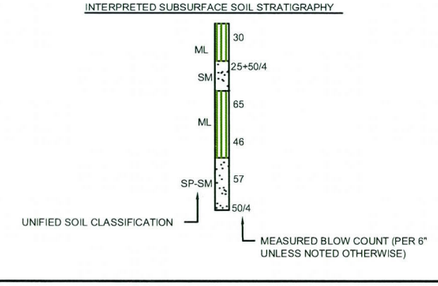
FINE-GRAINED SOILS, PREDOMINANTLY SILTS

FINE-GRAINED SOILS, PREDOMINANTLY CLAYS

GRAVEL

SANDSTONE

INTERPRETED SUBSURFACE SOIL STRATIGRAPHY



NOTE: THIS DRAWING WHEN REDUCED TO 11"X17" SIZE IS 50% SMALLER THAN FULL SIZE VERSION

RI/FS Report — Draft Final

Section AA3-12-12'
Interpreted Subsurface Soil Conditions

Anomaly Area 3

Date: 04-08	Former MCAS El Toro	Figure
Project No. 29307	EarthTech — A tyco International Ltd. Company	5-9

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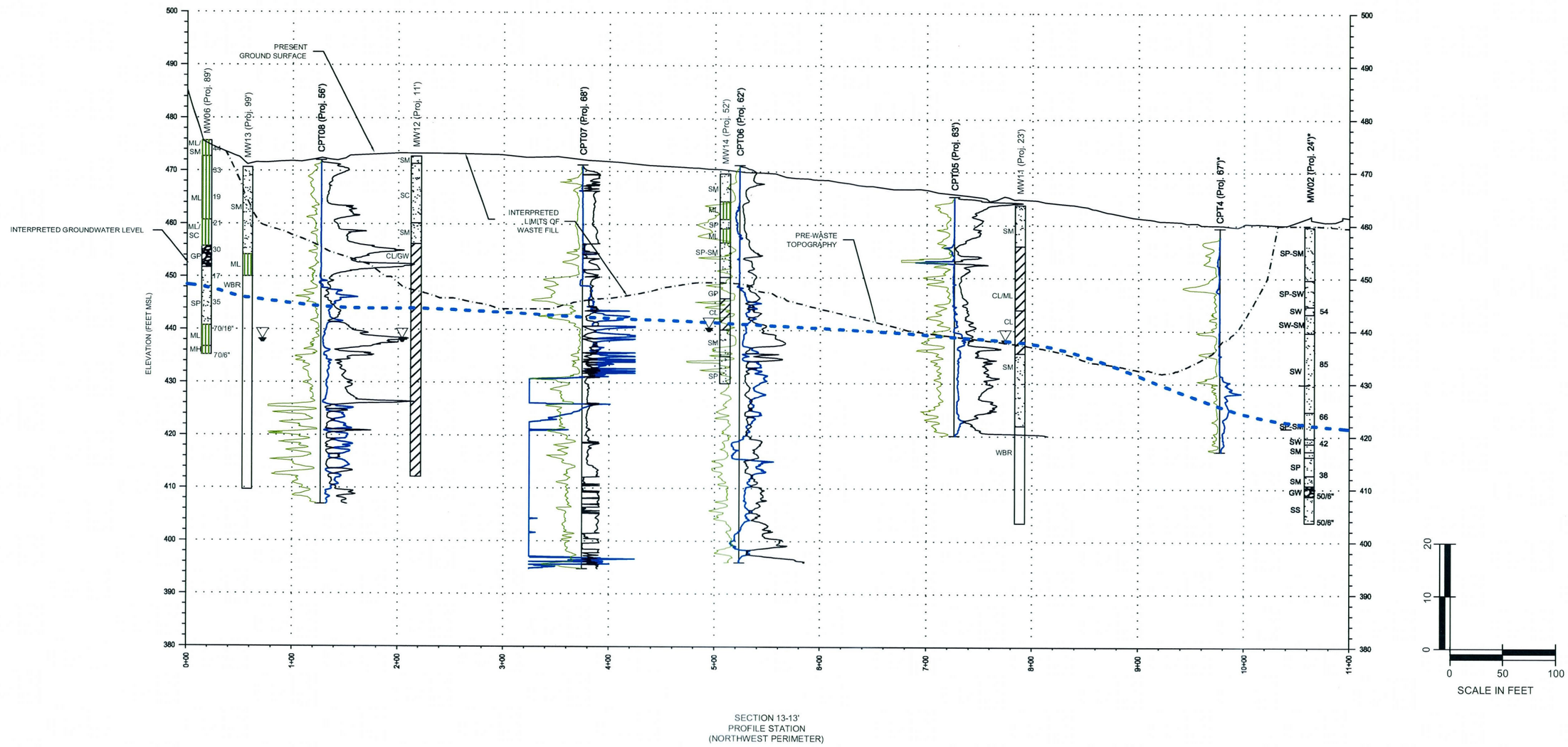

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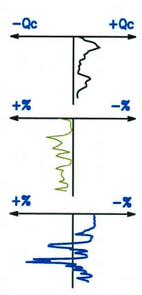


Qc, TIP RESISTANCE (SCALE: 1" = 300 TSF)

Fr, FRICTION RATIO (SCALE: 1" = 10%)

PWPR, PORE WATER PRESSURE RATIO (SCALE: 1" = 5%)

INTERPRETED GROUNDWATER LEVEL FROM GROUNDWATER MONITORING WELLS (FEBRUARY 2005)

DEPTH TO GROUNDWATER INTERPRETED FROM CONE PENETROMETER TESTING

SHIFTED FOR CLARITY PURPOSE

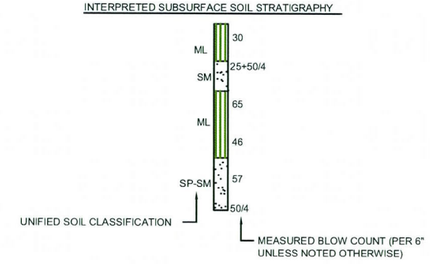
COARSE GRAINED SOILS, PREDOMINANTLY SANDS

FINE-GRAINED SOILS, PREDOMINANTLY SILTS

FINE-GRAINED SOILS, PREDOMINANTLY CLAYS

SANDSTONE

INTERPRETED SUBSURFACE SOIL STRATIGRAPHY



NOTE: THIS DRAWING WHEN REDUCED TO 11"X17" SIZE IS 50% SMALLER THAN FULL SIZE VERSION

RI/FS Report — Draft Final

Section AA3-13-13'
Interpreted Subsurface Soil Conditions

Anomaly Area 3

Date: 04-08 | Former MCAS El Toro | Figure 5-10

Project No. 29307 | EarthTech, A tyco International Ltd. Company

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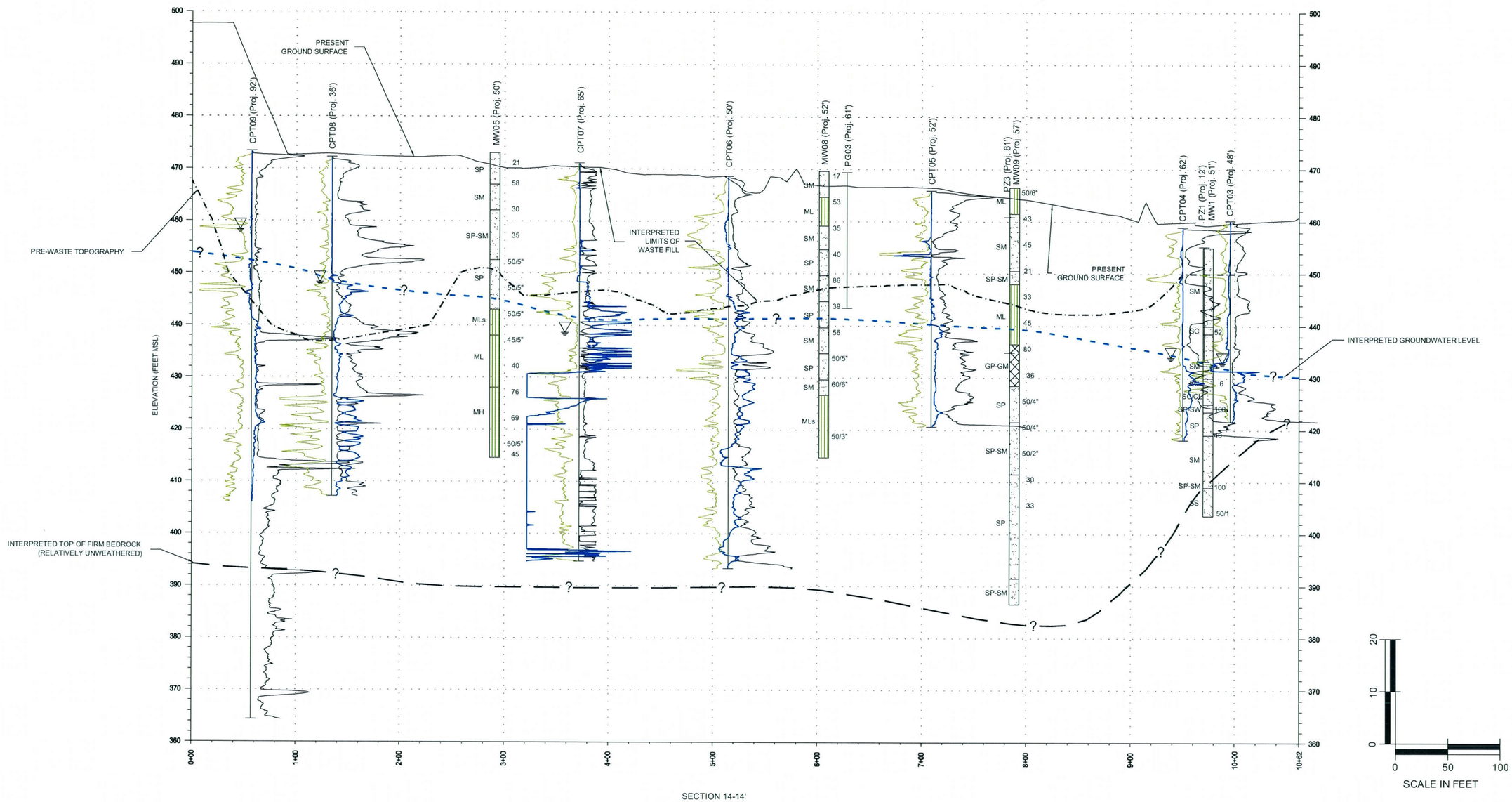
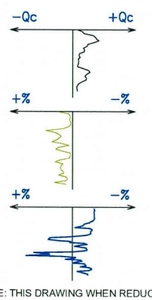


SECTION 14-14'
PROFILE STATION
(SOUTHEAST PERIMETER)

LEGEND



Qc, TIP RESISTANCE (SCALE: 1" = 300 TSF)

Fr, FRICTION RATIO (SCALE: 1" = 10%)

PWPR, PORE WATER PRESSURE RATIO (SCALE: 1" = 5%)

INTERPRETED GROUNDWATER LEVEL FROM GROUNDWATER MONITORING WELLS (FEBRUARY 2005)

DEPTH TO GROUNDWATER INTERPRETED FROM CONE PENETROMETER TESTING

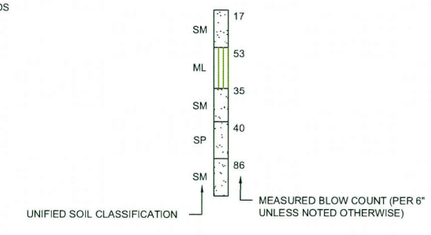
COARSE GRAINED SOILS, PREDOMINANTLY SANDS

FINE-GRAINED SOILS, PREDOMINANTLY SILTS

FINE-GRAINED SOILS, PREDOMINANTLY CLAYS

GRAVEL

INTERPRETED SUBSURFACE SOIL STRATIGRAPHY



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Section AA3-14-14' **Interpreted Subsurface Soil Conditions** Anomaly Area 3		
Date: 04-08	Former MCAS El Toro	Figure
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Table 5-4: Summary of Subsurface Soil Exploration Details – RSE Investigation

Date of Exploration (m/d/yr)	Exploration Number	Exploration Type	Ground Surface Elevation [1] (feet above msl)	Total Depth (feet)	Groundwater Depth [1, 2] (feet bgs)	Bedrock [1, 3] Depth (feet)	Groundwater Elevation [1, 2] (feet above msl)	Bedrock Elevation [1, 3] (feet above msl)	Reference
12/21/95	MW-01	GW MW	455	51.5	24	46	431	409	IT/OHM 2000
05/27/98	MW-02	GW MW	460	56.0	36	49	424	411	IT/OHM 2000
06/01/98	MW-03	GW MW	500*	86.5	60	35	441	465	IT/OHM 2000
06/01/98	MW-04	GW MW	464	56.5	29	25	435	439	IT/OHM 2000
06/01/98	MW-05	GW MW	473	58.5	30	NE	443	NE	Earth Tech 2002a
6/4-5/98	MW-06	GW MW	476	40.5	26	NE	450	NE	Earth Tech 2002a
12/05/01	MW-07	GW MW	476	50.5	36	32	440	444	Earth Tech 2002a
12/20/01	MW-08	GW MW	470	55.0	26	NE	443	NE	Earth Tech 2002a
12/05/01	MW-09	GW MW	467	80.0	27	NE	440	NE	Earth Tech 2002a
12/06/01	MW-10	GW MW	464	76.0	38	56	426	408	Earth Tech 2002a
05/27/98	PG-01	PG Well	476	25.0	NE	NE	NE	<451	Earth Tech 2002a
12/03/01	PG-02	PG Well	474	30.0	NE	NE	NE	<444	Earth Tech 2002a
12/03/01	PG-03	PG Well	469	26.0	NE	NE	NE	<443	Earth Tech 2002a
12/04/01	CPT-1	CPT	464	61.0	37	~ 56 (?)	427	~ 408 (?)	Earth Tech 2002a
12/04/01	CPT-2	CPT	463	42.0	35	NE	428	<421	Earth Tech 2002a
12/20/01	CPT-3	CPT	460	38.0	27	NE	433	<422	Earth Tech 2002a
12/20/01	CPT-4	CPT	459	41.0	25	NE	434	<418	Earth Tech 2002a
12/20/01	CPT-5	CPT	466	45.5	NM	NE	NM	<420	Earth Tech 2002a
12/20/01	CPT-6	CPT	469	75.0	> 18	NE	< 451	<394	Earth Tech 2002a
12/04/01	CPT-7A	CPT	471	77.0	33	NE	439	<394	Earth Tech 2002a
12/06/01	CPT-8A	CPT	472	65.0	24	NE	448	<407	Earth Tech 2002a
12/06/01	CPT-9	CPT	473	109.5	15	NE	458	<363	Earth Tech 2002a
12/06/01	CPT-10	CPT	476	68.0	30	NE	446	<408	Earth Tech 2002a
10/1999	PZ-01	PG Well	455	22.0	NR	NE	NR	NE	IT/OHM 2000

Table 5-4: Summary of Subsurface Soil Exploration Details – RSE Investigation

Date of Exploration (m/d/yr)	Exploration Number	Exploration Type	Ground Surface Elevation [1] (feet above msl)	Total Depth (feet)	Groundwater Depth [1, 2] (feet bgs)	Bedrock [1, 3] Depth (feet)	Groundwater Elevation [1, 2] (feet above msl)	Bedrock Elevation [1, 3] (feet above msl)	Reference
10/1999	PZ-02	PG Well	460	30.0	NR	NE	NR	NE	IT/OHM 2000
10/1999	PZ-03	PG Well	467	26.0	NR	NE	NR	NE	IT/OHM 2000

Notes:
[1] Depths and elevations were rounded off to the nearest foot.
[2] Interpreted groundwater depth and elevation based on CPT, should only be considered as rough approximations (estimated based on pore water pressure dissipation tests, or dipmeter measurements).
[3] Bedrock depth based on CPT sounding records, should be considered only as approximate interpretation, particularly in identifying soft weathered ("soil-like") bedrock, like those existing at AA 3.
bgs = below ground surface
CPT = cone penetrometer test
GW MW = groundwater monitoring well
msl = mean sea level
m/d/y = month/day/year
NE = not encountered
NR = not reported
N/A = not applicable
PG Well = perimeter gas well
RSE = removal site evaluation
* This elevation will be verified

Table 5-5: Summary of Interpreted Stratigraphy from CPT Soundings–RSE Investigation

Exploration Number	Ground Surface Elevation (feet above msl)	Depth to Top of Generalized Layer (feet)	Generalized Layer Thickness (feet)	Interpreted Stratigraphy and Soil Type
CPT-1	464	0	16	Medium dense sands and silty sands
	448	16	14	Dense to very dense sands and gravelly sands
	434	30	13	Stiff to very stiff fine-grained soil (sandy silts and clays)
	421	43	12	Medium dense to dense sands and silty sands
	409	55	6	Interbedded dense to very dense sands and stiff to hard silts
	403	61		Bottom of CPT, possible bedrock (?)
CPT-2	463	0	18	Medium dense sands and silty sands
	445	18	24	Sequence of interbedded layers (several feet in thickness) of dense to very dense sand and medium dense sand
	421	42		Bottom of CPT
CPT-3	460	0	18	Medium dense sands and silty sands
	442	18	8	Loose to medium dense sands, silty sands, and sandy silts
	434	26	7	Medium stiff to stiff fine-grained soil (clays and silts)
	427	33	5	Dense to very dense sands and gravelly sands
	422	38		Bottom of CPT
CPT-4	459	0	3	Dense to very dense sands and gravelly sands
	456	3	8	Interbedded medium dense sands and stiff to very stiff silts
	448	11	7	Dense sands
	441	18	8	Loose to medium dense sands, silty sands, and sandy silts
	433	26	8	Medium dense sands and silty sands
	425	34	6	Dense to very dense sands and gravelly sands
	419	40		Bottom of CPT
CPT-5	459	0	9	Dense to very dense sands and gravelly sands
	450	9	4	Very soft to medium stiff fine grained soil (clays and silts)
	446	13	15	Interbedded medium dense silty sand and stiff to very stiff sandy silt
	431	28	17	Loose to medium dense sands, silty sands, and sandy silts
	414	45	1	Very dense sand and gravelly sand
	413	46		Bottom of CPT, possible bedrock (?)
CPT-6	469	0	7	Medium dense to dense sands and silty sands
	462	7	8	Very stiff fine grained soil (clays and silts)

Table 5-5: Summary of Interpreted Stratigraphy from CPT Soundings–RSE Investigation

Exploration Number	Ground Surface Elevation (feet above msl)	Depth to Top of Generalized Layer (feet)	Generalized Layer Thickness (feet)	Interpreted Stratigraphy and Soil Type
	454	15	15	Very interbedded sequence of layers (generally less than 2 feet in thickness) of medium dense silty sand and stiff fine-grained soil (silts, clays)
	439	30	4	Medium dense sands and silty sands
	435	34	40	Very interbedded sequence of layers (generally less than 5 feet in thickness) of medium dense silty sand and stiff to very stiff fine-grained soil (silts, clays)
	395	74	1	Dense to very dense sands and gravelly sands
	394	75		Bottom of CPT, possible bedrock (?)
CPT-7A	471	0	16	Medium dense to dense sands and silty sands, very dense/gravelly at 4 feet to 5 feet
	455	16	14	Sequence of interbedded layers (several feet in thickness) of medium dense to dense sand and very stiff fine-grained soil (silts, clays)
	441	30	10	Medium dense to dense sands and silty sands
	431	40	17	Medium stiff to stiff fine-grained soil (clays and silts), with occasional thin sand layers/lenses
	414	57	17	Medium dense silty sands and sandy silts
	397	74	3	Dense to very dense sands and gravelly sands, possibly near top of bedrock.
	394	77		Bottom of CPT, possibly near bedrock (?)
CPT-8A	472	0	24	Sequence of interbedded layers (several feet in thickness) of medium dense to very dense sands and silty sands
	448	24	3	Soft to very stiff fine-grained soil (silts, clays)
	445	27	19	Sequence of interbedded layers (4 feet to 10 feet in thickness) of medium dense to very dense sands and silty sands
	426	46	19	Sequence of interbedded layers (generally less than 1 foot in thickness) of medium dense sand and medium stiff to stiff fine-grained soil (silts, clays)
	407	65		Bottom of CPT
CPT-9	473	0	3	Dense to very dense sands and gravelly sand
	470	3	6	Loose to medium dense sands, silty sands, and sandy silts
	464	9	14	Stiff to very stiff fine-grained soil (sandy silts and clays)
	450	23	14	Loose sands, silty sands, and sandy silts
	436	37	22	Stiff to very stiff fine-grained soil (sandy silts and clays)
	414	59	13	Medium dense sands and silty sands
	401	72	8	Stiff to very stiff fine-grained soil (sandy silts and clays)

Table 5-5: Summary of Interpreted Stratigraphy from CPT Soundings–RSE Investigation

Exploration Number	Ground Surface Elevation (feet above msl)	Depth to Top of Generalized Layer (feet)	Generalized Layer Thickness (feet)	Interpreted Stratigraphy and Soil Type
	393	80	15	Medium dense sands and silty sands
	378	95	15	Sequence of interbedded layers (generally less than 5 feet in thickness) of medium dense sand and stiff to very stiff fine-grained soil (silts, clays)
	363	110		Bottom of CPT
CPT-10	476	0	7	Medium dense sands and silty sands
	469	7	24	Sequence of interbedded layers (several feet in thickness) loose to medium dense silty sands and stiff to very stiff fine-grained soil (silts and clays)
	445	31	37	Medium dense to dense sands and silty sands
	408	68		Bottom of CPT, possible bedrock (?)

Notes:

Depths and elevations were rounded off to the nearest foot.

Soil type based on CPT sounding records should be considered only as approximate interpretation. Similarly, interpretation of bedrock depth may vary widely because of soft weathered ("soil-like") bedrock conditions, like those existing at AA 3.

CPT = cone penetrometer test

msl = mean sea level

RSE = removal site evaluation

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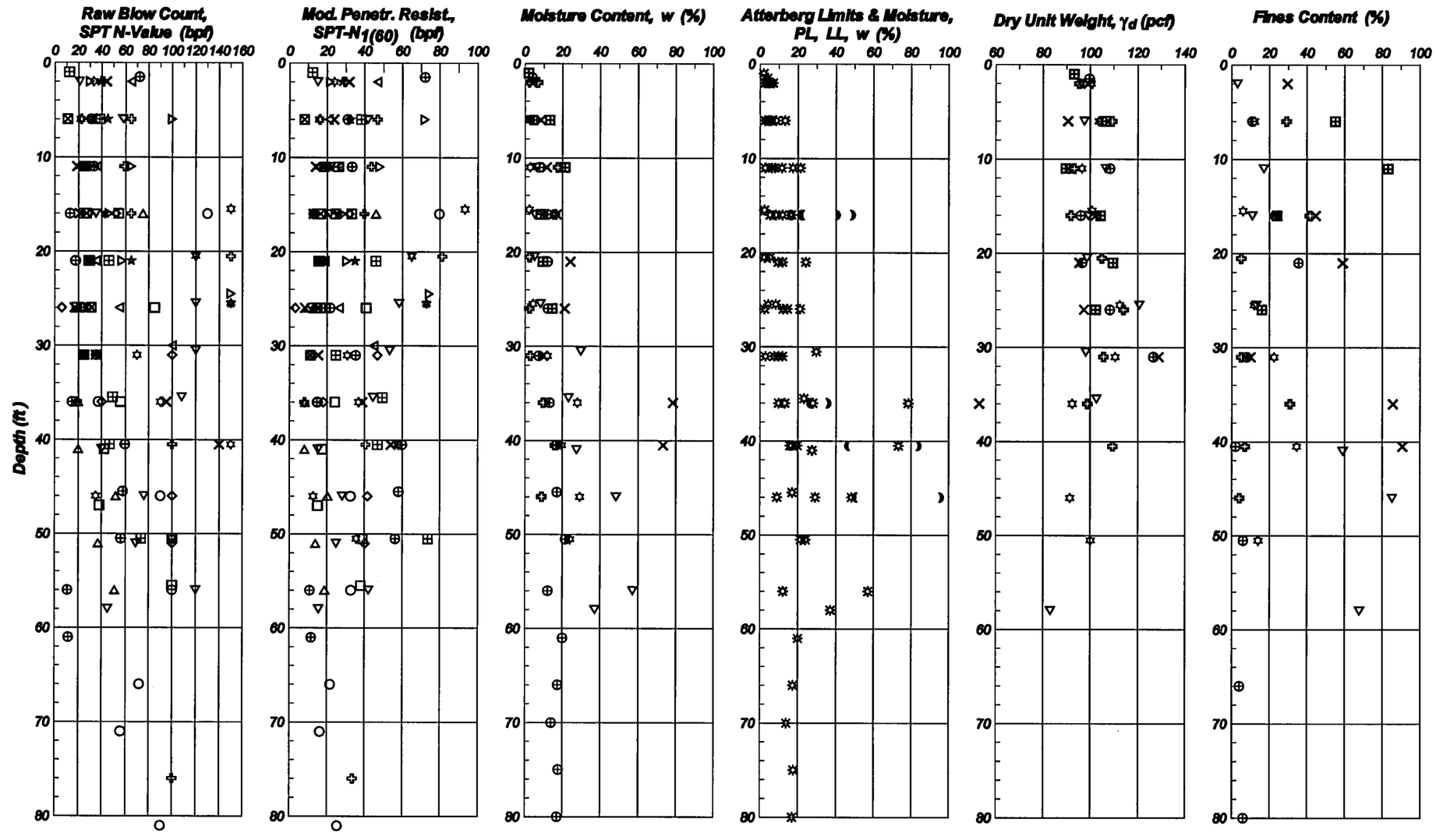

Boring:

- ◇ AA3-MW01
- □ AA3-MW02
- ○ AA3-MW03
- △ AA3-MW04
- ▽ AA3-MW05
- × AA3-MW06
- ✡ AA3-MW07
- ⊞ AA3-MW08
- ⊕ AA3-MW09
- ✚ AA3-MW10
- ▷ AA3-PG-01
- ◁ AA3-PG-02
- ★ AA3-PG-03
- ✳ AA3-PZ-01
- ⊠ AA3-PZ-02
- ✧ AA3-PZ-03

Legend
bpf: blows per foot

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Soil Property Characterization Data Versus Depth

Anomaly Area 3

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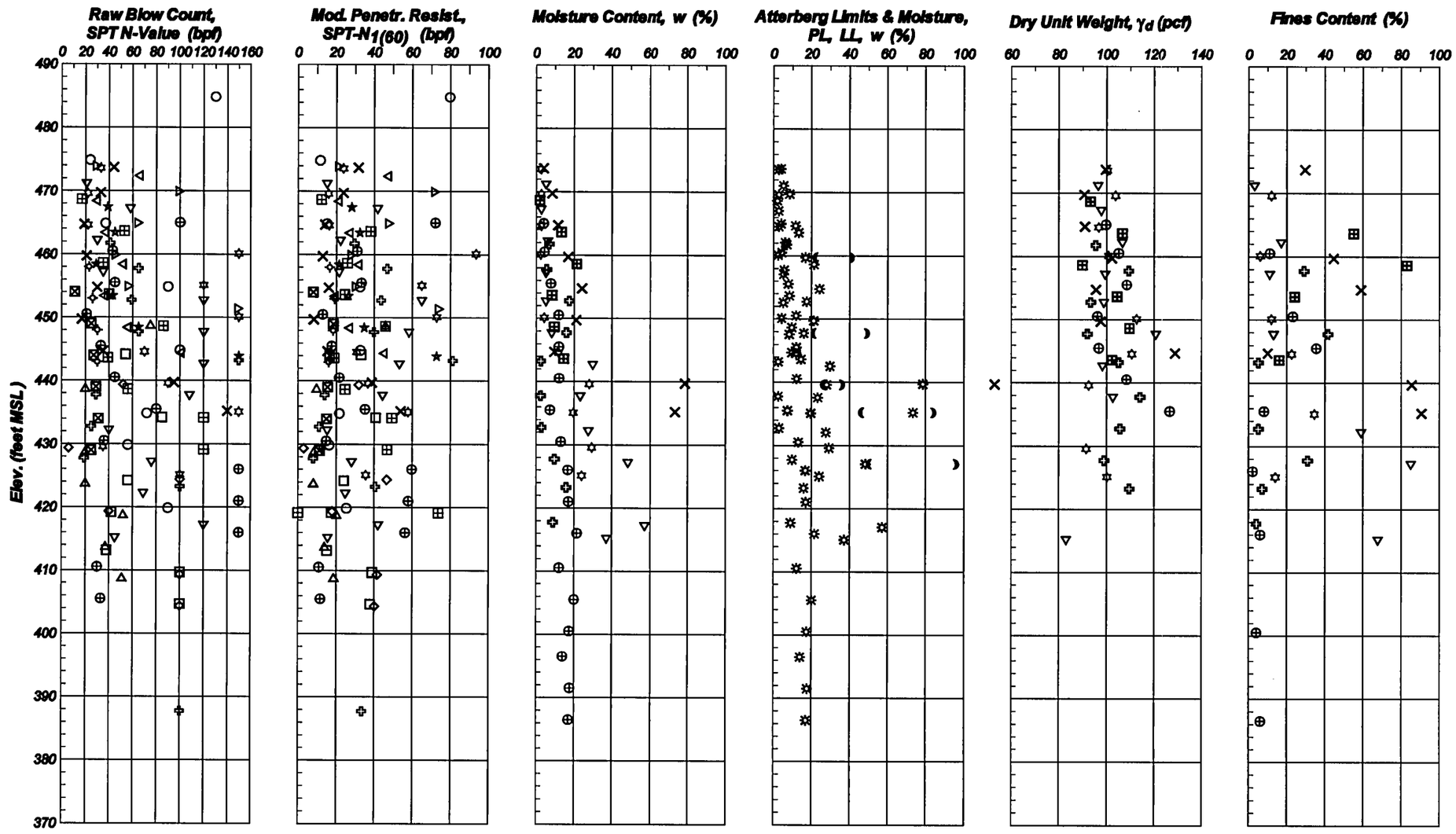

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bpf: blows per foot

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Soil Property Characterization Data Versus Elevation

Anomaly Area 3

Date: 04-08	Former MCAS El Toro	Figure
Project No. 29307	EarthTech — A tyco International Ltd. Company	5-13

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Groundwater is approximately 20 feet to 40 feet bgs (approximately 60 feet bgs at abandoned Well MW03), and ranges in elevation from approximately 425 feet to 450 feet msl from northeast to southwest, as shown on Figures 5-8, 5-9, 5-10, and 5-11.

5.4.4 Geotechnical Evaluation

The geotechnical analysis of the existing soil cover and the subsurface soil at the site was conducted in response to Project Decision Questions #2 and #3.

> **Decision Question #2:** Has the existing soil cover been adequately characterized (thickness and soil properties), or is further evaluation required?
>
> **Decision Question #3:** Are adequate data available to characterize if the existing soil cover is sufficient to either protect human health and the environment, or if not, to serve as a foundation layer for a soil cover system?

The RSE investigation collected sufficient geotechnical soil samples to adequately respond to the Decision Questions #2 and #3. The existing soil cover properties have been adequately characterized and these existing soil cover geotechnical data will be utilized in the next design stages in order to provide efficient and accurate cap designs. Based on the results of the investigation, sufficient information is available to evaluate if the existing soil cover can serve as a foundation layer.

5.5 HABITAT ASSESSMENT

A biological site reconnaissance (BSR) was conducted at AA 3 to provide biological input to the screening-level problem formulation for a ecological SRA, as required by the CERCLA and in accordance with the legal requirements set forth under Section 7 of the Endangered Species Act of 1973, (19 U.S.C. 1536(c), 50 CFR 402).

The focus of this BSR is AA 3, which encompasses an area of approximately nine acres and is located in the northwestern section of former MCAS El Toro facility near Pusan Way, adjacent to the Agua Chinon Wash (see Figure 1-1). The site is accessible by vehicle over various paved roads. A fence surrounds the area with a portion of the site located outside the fence. The study site is mostly flat in the center with some gently rolling hills around the periphery.

5.5.1 Methods and Limitations

A review of the California Natural Diversity Data Base (CNDDB 2001a and 2001b) for USGS El Toro, Canada Gobernadora, San Juan Capistrano, and Santiago Peak 7 1/2' topo quadrangles, the California Native Plant Society's (CNPS) Inventory of Rare and Endangered Vascular Plants of California (Tibor 2001), the CNPS Electronic Inventory (2001, for the same quadrangles), and the compendia of special status species published by the U.S. Fish and Wildlife Service (U.S. FWS) (1993a and 1996) and California Department of Fish and Game (CDFG 2002) was conducted. Reports specific to the former MCAS El Toro, including that by the FWS (1993b), were also reviewed.

5.5.2 Botanical Survey

On 9 October 2002, and 7 June 2003, the project botanist surveyed the site for special status plants, evaluated habitat suitability for other special status plants, and mapped and described vegetation. The entire area was walked, species present noted, and vegetation types mapped for the site and adjacent areas. Habitat types on the site were visited on foot and plant species observed were recorded in field

notes. Plants of uncertain identity were collected and subsequently identified from keys, descriptions, and illustrations in Abrams (1923, 1944, and 1951), Abrams and Ferris (1960), Hickman (1993) and Munz (1974). A list of all plant species observed is presented in Table 5-6. Fieldwork was completed in two different seasons, during which a variety of plants could be identified. Thus, occurrence probability for special status plants is based on both habitat conditions and presence or absence documented by field surveys. Mapping was done on a recent APHO and topographic map. Vegetation types follow the Orange County Habitat Classification System (OCHCS) nomenclature and plant names generally follow Hickman (ed.) 1993.

5.5.3 Wetlands and Waters of the United States

The project botanist conducted the potential wetlands and waters mapping on 9 October 2002. That mapping provided a basis for evaluating if these resources are potentially present and if so, where they are located. On 7 June 2003, the project botanist conducted a formal delineation.

Section 404 of the Federal Clean Water Act requires permitting of activities that would result in discharge of dredge or fill material into jurisdictional waters of the U.S. or adjacent wetlands. Federal policy directs no net loss of wetland habitats. Section 1603 of the California Fish and Game code requires a Streambed Alteration Agreement for projects that would alter a stream channel. Depending on its implementation, future remediation at the site could alter or place fill material in eroded drainage channels and, under other circumstances, could come under jurisdiction of one or both agencies. However, for Federal actions, the State 1603 process may not apply. This report identifies if jurisdictional waters of the U.S. occur on the site and determines their wetland status, based on the Army Corps of Engineers (USACE) Wetlands Delineation Manual (Department of the Army Environmental Laboratory 1987) for the purpose of permit application under the Federal Clean Water Act. The areas identified here as waters of the U.S. are also considered streambeds under State policy.

5.5.3.1 Jurisdictional Criteria

Section 404 of the Federal Clean Water Act applies to waters of the U.S. By definition, these include waterways, streams, and intermittent streams and their tributaries that could be used for interstate commerce. In non-tidal waters, the limits of jurisdiction are ordinary high water marks (OHWMs), such as stream banks. Where wetlands occur above high tide or high water marks, they are considered adjacent wetlands and are included within the Army Corps jurisdiction.

The term "interstate commerce" has been broadly interpreted to include use by migratory waterfowl or out-of-state tourists, and the USACE jurisdiction has often been extended to wetlands not adjacent to waters of the U.S. (isolated wetlands). Section 1603 of the State Fish and Game Code, if relevant in this case, is applied to stream channels, defined elsewhere in the Code as follows:

"A stream is a body of water that flows at least periodically...through a bed or channel having banks and supports fish or other aquatic life. This includes watercourses having a surface or subsurface flow that supports or has supported riparian vegetation."

The State definition does not specify a flow rate or inundation frequency, and provides no clear distinction between jurisdictional and non-jurisdictional lands. The field survey for this Report covered all low areas, swales, and drainage ways where water could pond or flow.

5.5.3.2 VALUATION CRITERIA

USACE evaluates wetlands by three criteria: hydrology, soil, and vegetation. Under the Federal delineation procedure, a site must normally satisfy all three criteria to be classified as a wetland. At its discretion, and if it were to be involved in this process, the CDFG may regard a site as a wetland based on any one of the three criterion.

The hydrology criterion evaluates the presence of water based on simple observation or on indirect evidence such as high water marks, drift lines or sediment deposits. The soil criterion is based on hydric soil characteristics, such as certain colors and mottling, which develop under wetland conditions. The vegetation criterion evaluates plant species growing on a site. Most plants cannot survive extended periods of root saturation, and are called "obligate upland" species (UPL).

Table 5-6: All Plant Species Found On and/or Adjacent to AA 3

Latin Name		Occurrence	
Vascular Plants	Common Name	On-site	Adjacent
CUPRESSACEAE	CYPRESS FAMILY		
Cupressus sp.	Unid. escaped ornamentals (2)		X
Juniperus californica	California juniper		
AIZOACEAE	ICEPLANT FAMILY		
* *Carpobrotus edulis (?)*	Hottentot fig		X
ANACARDIACEAE	CASHEW FAMILY		
Malosma laurina (Rhus laurina)	Laurel sumac		X
* *Schinus molle*	Peruvian pepper tree		X
* *Schinus terebinthifolius*	Brazilian pepper tree		X
Toxicodendron diversilobum	Poison oak		X
APIACEAE	CELERY FAMILY		
* *Foeniculum vulgare*	Fennel	X	
ASCLEPIADACEAE	MILKWEED FAMILY		
Sarcostemma cynanchoides	Climbing milkweed		X
ASTERACEAE	ASTER FAMILY		
Ambrosia acanthicarpa	Annual sandbur	X	
Ambrosia psilostachya	Western ragweed	X	
Artemisia californica	California sagebrush		X
Artemisia douglasiana	Douglas mugwort		X
Artemisia dracunculus	Tarragon	X	
Baccharis pilularis	Coyote bush		X
Baccharis salicifolia	Mulefat	X	X
Brickellia californica	Calif. brickellbush		X
* *Centaurea melitensis*	Tocalote	X	
* *Chamomilla suaveolens (Matricaria matricarioides)*	Pineapple weed	X	
* *Chrysanthemum coronarium*	Garland daisy	X	
* *Cnicus benedictus*	Blessed thistle	X	
Conyza canadensis	Horseweed	X	
* *Cynara cardunculus*	Artichoke thistle, cardoon	X	
Encelia californica	California encelia	X	
* *Filago gallica*	Narrow-leaved filago	X	

Table 5-6: All Plant Species Found On and/or Adjacent to AA 3

Latin Name Vascular Plants	Common Name	Occurrence	
		On-site	Adjacent
Gnaphalium sp.	Unid. annual	X	
Gnaphalium californicum.	California everlasting	X	
Helianthus annuus	Annual sunflower	X	
Hemizonia fasciculate *(Deinandra fasciculate)*	Fascicled tarplant	X	
Heterotheca grandiflora	Telegraph weed	X	
Isocoma menziesii *(Haplopappus venetus)*	Coast goldenbush	X	
Lepidospartum squamatum	Scalebroom		X
* *Matricaria globifera (?)*	Stink-net	X (Irono 43:528 1996)	
Pluchea sericea (?)	Arrow weed		X
* *Pulicaria paludosa*	Spanish sunflower		X
Xanthium strumarium	Cocklebur		X
BORAGINACEAE	BORAGE FAMILY		
Amsinckia menziesii	Rancher's fiddleneck	X	
BRASSICACEAE	MUSTARD FAMILY		
* *Brassica geniculata* *(Hirschfeldia incana)*	Short-pod mustard	X	
* *Brassica nigra*	Black mustard	X	
* *Raphanus sativus*	Wild radish	X	
CACTACEAE	CACTUS FAMILY		
Opuntia littoralis ssp. littoralis	Coast prickly pear	X	
Opuntia oricola (?)	Oracle cactus		X
Opuntia prolifera	Coastal cholla		X
CAPRIFOLIACEAE	HONEYSUCKLE FAMILY		
Sambucus mexicana	Mexican elderberry		X
CHENOPODIACEAE	GOOSEFOOT FAMILY		
* *Atriplex semibaccata*	Australian saltbush	X	
* *Atriplex suberecta*	Australian saltbush	X	
* *Chenopodium album (?)*	Common goosefoot	X	
* *Salsola tragus*	Russian thistle, tumbleweed	X	
CRASSULACEAE	STONECROP FAMILY		
Dudleya pulverulenta	Chalk dudleya		X
CUCURBITACEAE	CUCUMBER FAMILY		
Cucurbita foetidissima	Calabazilla		X
CUSCUTACEAE	DODDER FAMILY		
Cuscuta subinclusa (C. ceanothi)	Dodder (on Malosma, Nicotiana)		X
EUPHORBIACEAE	SPURGE FAMILY		
Croton californicus	California croton	X	
Eremocarpus setiger	Doveweed	X	
* *Ricinus communis*	Castor bean	X	
FABACEAE	PEA FAMILY		

Table 5-6: All Plant Species Found On and/or Adjacent to AA 3

Latin Name		Occurrence	
Vascular Plants	Common Name	On-site	Adjacent
* *Acacia sp.*	Unid. escaped ornamental	X	
Lotus purshianus (L. unifoliatus)	"Spanish" clover	X	
Medicago polymorpha	Bur-clover	X	
* Melilotus alba	White sweet-clover	X	
* Melilotus indica	Yellow sweet-clover	X	
GERANIACEAE	GERANIUM FAMILY		
* *Pelargonium*	Ornamental geranium		X
LAMIACEAE	MINT FAMILY		
* *Marrubium vulgare*	Horehound	X	
Salvia mellifera	Black sage		X
MALVACEAE	MALLOW FAMILY		
* *Malva parviflora*	Cheeseweed	X	
MYRTACEAE	EUCALYPTUS FAMILY		
* *Eucalyptus globulus (?)*	Red gum, red river gum		X
OLEACEAE	OLIVE FAMILY		
* *Fraxinus udhei*	Shamel ash (escaped ornamental)		X
PLATANACEAE	SYCAMORE FAMILY		
Platanus racemosa	California sycamore		X
POLYGONACEAE	BUCKWHEAT FAMILY		
Eriogonum fasciculatum	California buckwheat		X
* *Rumex crispus*	Curly dock		X
ROSACEAE	ROSE FAMILY		
Heteromeles arbutifolia	Toyon, Christmas berry		X
SALICACEAE	WILLOW FAMILY		
Salix goodingii	Black willow		X
SCROPHULARIACEAE	SNAPDRAGON FAMILY		
Keckiella antirrhinoides	Yellow bush-penstemon		X
SOLANACEAE	NIGHTSHADE FAMILY		
Datura wrightii (D. meteloides)	Jimsonweed	X	
* *Nicotiana glauca*	Tree tobacco	X	
Solanum douglasii	Nightshade	X	
TAMARICACEAE	TAMARISK FAMILY		
* *Tamarix ramosissima*	Mediterranean tamarisk		X
ULMACEAE	ELM FAMILY		
* *Ulmus parviflora*	Chinese elm		X
VITACEAE	GRAPE FAMILY		
Vitis girdiana	Wild grape	X	
ARECACEAE	PALM FAMILY		
* *Phoenix canariensis*	Canary Island palm		X
**Washingtonia robusta*	Fan palm	X	
* *Yucca aloifolia*	Spanish bayonet (ornamental)		X
POACEAE	GRASS FAMILY		
* *Avena barbata*	Wild oat	X	

Table 5-6: All Plant Species Found On and/or Adjacent to AA 3

Latin Name Vascular Plants	Common Name	Occurrence	
		On-site	Adjacent
* *Bromus diandrus*	Ripgut brome		X
* *Bromus hordeaceus (B. mollis)*	Soft chess	X	
* *Bromus madritensis ssp. rubens (B. rubens)*	Red brome	X	
* *Cynodon dactylon*	Bermuda grass		X
Elymus condensatus (Leymus condensatus)	Giant wild rye		X
* *Lamarckia aurea*	Goldentop grass	X	

Notes: * Alien species indicated by asterisk. This list includes only species observed on the site. Others may have been overlooked or unidentifiable due to season. Plants were identified using keys, descriptions, and illustrations in Abrams (1923-1951), Hickman (1993), and Munz (1974). Taxonomy and nomenclature generally follow Hickman.

Others grow almost exclusively in wetlands habitats, or on both wetlands and uplands. These are called "obligate wetlands" (WET) or "facultative wetlands" (FACW) species, respectively, in Wetland Plants in California (Appendix O to the Delineation Manual).

5.5.4 Wildlife Survey

On 9 October 2002, the project wildlife biologist and project manager conducted a preliminary on-site survey of the site and adjacent lands for special status animals that would be observable this time of year, evaluated habitat suitability for other special status animals, and mapped the location of any sensitive wildlife resources noted. On 23 October 2002 and 7 June 2003, the project wildlife biologist conducted a more formal general biological survey. On 23 October 2002, the weather conditions for temperature and wind ranged from 58 degree Fahrenheit (°F) to 75 °F and wind at 1 mph to 7 mph, respectively, with 100 percent overcast to clear sky conditions. On 7 June 2003, the weather conditions for temperature and wind ranged from 68 °F to 74 °F and 1 mph to 7 mph, respectively, with 10 percent to 100 percent overcast conditions. The entire parcel was traversed by foot, using meandering transects. Each habitat type was examined for signs (i.e., tracks and scat) and regular 5-minute stops were made to look and listen for birds and other wildlife. In off-site areas that contained gnatcatcher habitat, a recording of their calls was played periodically. The surveys were not intended to be at the focused or protocol level. However, all observed species, either listed or considered sensitive, were noted (Table 5-7). The basis for field identification and scientific nomenclature used in this Report is from the following references: amphibians and reptiles (Stebbins 1985), birds (American Ornithologists' Union 1983 and 1989), and mammals (Jones et al. 1982 and Murie 1954).

5.5.5 Results

5.5.5.1 LITERATURE/DATA SEARCH

All species identified by this literature review, as well as others known from the general region, were searched for during this assessment. Those not observed, but having potential to be on-site, are listed in Table 5-8 (plants) and Table 5-9 (wildlife). These tables list special status species known from comparable habitats within the region and summarize their natural history, agency status, and occurrence probability on-site. Figure 5-14 presents the results of the assessment.

5.5.5.2 FLORA

Eighty-five plant species were observed, with 40 of these (47 percent) being exotic or non-native species (see Table 5-6). Most of the species observed were typical for the southern California habitats and disturbed areas.

5.5.5.3 HABITAT

Most of the area covered by this habitat assessment (9.60 acres including AA 3) is "ruderal" vegetation (OCHCS 4.6) (see Figure 5-14).

Table 5-7: Wildlife Species Documented On and Adjacent to AA 3

Taxonomic Group (1)	Scientific Name (1)	Habitat (2)	Status (3,4)
	REPTILES		
Iguanidae – Iguanids			
Western fence lizard	*Sceloporus occidentalis*	CHP, RSS	S, W
Side-blotched lizard	*Uta stansburiana*	CHP, RSS	S, W
	AMPHIBIANS		
***Hylidae* Treefrogs and Relatives**			
Pacific tree frog	*Hyla regilla*	G, D	W
	BIRDS		
Cathartidae - American Vultures			
Turkey vulture	*Cathartes aura*	Flying	S, W
Accipitridae - Hawks, Old World Vultures, and Harriers			
Red-tailed hawk	*Buteo jamaicensis*	RSS, G	S, W
Red-shouldered hawk	*Buteo lineatus elagans*	RP, Flying	W
Cooper's hawk	*Accipiter cooperii*	RSS, Flying	W, †
Falconidae - Caracaras and Falcons			
American kestrel	*Falco sparverius*	RSS, G	W
Phasianidae - Quails, Pheasants, and Relatives			
California quail	*Callipepla californica*	CHP, RSS	S, W
Charadrriidae – Plovers and Relatives			
Killdeer	Charadrius vociferous	D	W
Columbidae - Pigeons and Doves			
Mourning dove	*Zenaida macroura*	D, RSS	S, B, W
Rock dove	*Columbia livia*	DEV	S, W
Trochilidae – Hummingbirds			
Anna's hummingbird	*Calypte anna*	CHP, RSS	S, W
Tyrannidae – Flycatchers			
Western kingbird	*Tyrannus verticaliss*	RSS, D, G	W
Tyrannidae - Tyrant Flycatchers			
Black phoebe	*Sayornis nigricans*	G, D	S, W
Say's phoebe	*Sayornis saya*	G	W
Cassin's kingbird	*Tyrannus vociferas*	D	S
Ash-throated flycatcher	*Myiarchus cinerascens*	D	
Swallows			
Cliff swallow	*Hirundo pyrrhonota*	Flying	S
Corvidae - Jays, Magpies, and Crows			

Table 5-7: Wildlife Species Documented On and Adjacent to AA 3

Taxonomic Group (1)	Scientific Name (1)	Habitat (2)	Status (3,4)
Scrub jay	*Aphelocoma coerulescens*	CHP, RSS, RP	S, W
American crow	*Corvus brachyrhynchos*	Flying	S
Common raven	*Corvus corax*	RSS, CHP	W
Aegithalidae – Bushtit			
Bushtit	*Psaltriparus minimus*	RSS, CHP, RP	S, W
Trogliditidae – Wrens			
Bewick's wren	*Thryomanes bewickii*	RSS	S, W
Cactus wren	*Campylorhynchus brunneicapillus*	CSS	S, W, B, †
Muscicapidae - Old World Warblers, Gnatcatchers, Kinglets, Thrushes, Bluebirds, and Wrentit			
Coastal California gnatcatcher	*Polioptila californica californica*	RSS	S, W, †
Wrentit	*Chamaea fasciata*	RSS, CHP	S, W
Mimidae - Mockingbirds and Thrashers			
Northern mockingbird	*Mimus polyglottos*	RSS, D	S, W
California thrasher	*Toxostoma redivivum*	RSS, CHP	S, W
Silky-Flycatchers			
Phainopepla	*Phainopepla nitens*	D	S
Starlings			
European starling	*Sturnus vulgaris*	D	S
Emberizidae - Warblers, Sparrows, and Relatives			
Yellow-rumped Warbler	*Dendroica coronata*	RP	W
Wilson's warbler	*Wilsonia pusilla*	RP	V
California towhee	*Pipilo crissalis*	RSS, CHP	S, W
Spotted towhee	*Pipilo maculates*	RSS, RP, CHP	S, W
White-crowned sparrow	*Zonotrichia leucophrys*	RSS	V
Song Sparrow	*Melospiza melodia*	RSS	
Fringillidae – Finches			
House finch	*Carpodacus mexicanus*	RSS, D	S, W
Blackbirds and Orioles			
Hooded Oriole	*Icterus cucullatus*	RP	S
Finches			
Lesser goldfinch	*Carduelis psaltria*	RP	S
MAMMALS			
Canidae - Foxes, Wolves, and Relatives			
Coyote	*Canis latrans*	CHP, RSS	W
Sciuridae – Squirrels			
California ground squirrel	*Spermophilus beecheyi*	CHP, RSS	S, W
Geomyidae - Pocket Gophers			
Botta's pocket gopher	*Thomomys bottae*	CHP, RSS	W
Leporidae - Rabbits and Hares			
Desert cottontail	*Sylvilagus auduboni*	RSS, G	S, W
Cricetae – Native Mice, Rats, and Voles			
San Diego desert woodrat	*Neotoma lepida intermedia*	CHP, RP	B, †
Kangaroo rat (species unknown)	*(Unknown)*	G	S

Table 5-7: Wildlife Species Documented On and Adjacent to AA 3

Taxonomic Group (1)	Scientific Name (1)	Habitat (2)	Status (3,4)

Notes:
1. Nomenclature from American Ornithologists' Union (1983); Collins (1990); Jones, et al. (1982).
2. Habitat acronyms: CHP, chaparral; W, woodland; RSS, sage scrub; G, non-native grassland; RP, riparian; D, disturbed; DEV, developed.
3. Status acronyms: B – breeding on-site ; V – visitor, migrant, or transient; W – winter observation; S – summer observation.
4. † = Sensitive species.

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Table 5-8: Special Status Plants Potentially Present at AA 3

Special Status Plants	Habitat and Distribution	Flower season	Status Designation	Occurrence Probability
Brodiaea filifolia Thread-leaved brodiaea	Vernal pools and alkali sink in inland valleys; also on upland mesic clay soil nearer coast; hot spring soil at Arrowhead Hot Springs; scattered locations in foothills and valleys (Los Angeles County to San Bernardino, S to San Diego County), below 2,000 feet elevation.	May–June	Federal: **THR** California: S2.1 **END** CNPS: List 1B R-E-D: 3-3-3	Absent (field survey; no suitable soil or mesic habitat; habitat not suitable due to land uses)
Calochortus plummerae Plummer's mariposa lily	Chaparral, pine forest, below about 5,500 feet elevation; widespread but uncommon throughout Southern California mountains, foothills, and valleys.	May–July	Federal: none California: S3.2 CNPS: List 1B R-E-D: 2-2-3	Absent (field survey; habitat unsuitable due to land uses)
Calochortus weedii var. *intermedius* Weed's mariposa lily	Chaparral, coastal sage scrub, valley grassland, sandy or clay soil, below about 6,200 feet elevation; coastal southern and central California counties.	June–August	Federal: none California: S2.2 CNPS: List 1B R-E-D: 2-2-3	Absent (field survey; habitat unsuitable due to land uses)
Chorizanthe parryi var. *fernandina* San Fernando Valley spineflower	Shrub lands; historically from San Fernando Valley, adjacent foothills, and coastal Orange County; only known occurrence in eastern Ventura County and adjacent Los Angeles County.	April–June	Federal: candidate California: **END** S1.1 CNPS: List 1B R-E-D: 3-3-3	Absent (field survey; habitat unsuitable due to land uses; presumed extinct locally)
Comarostaphylos diversifolia ssp. *diversifolia* Summer holly	Chaparral below about 1,800 feet elevation; Orange County, west San Diego County, and northwest Baja California.	April–June	Federal: none Calif.: S2.2 CNPS: List 1B R-E-D: 2-2-2	Absent (field survey)
Dudleya cymosa ssp. *ovatifolia* Santa Monica Mountains Dudleya	Shaded, rocky slopes below about 1,600 feet elevation; most records are from Santa Monica Mountains, but also recorded from Modjeska Canyon.	March–May	Federal: THR California: S2.2 CNPS: List 1B R-E-D: 3-2-3	Absent (field survey, no suitable habitat)
Dudleya multicaulis Many-stemmed dudleya	Heavy soil, often clay, grassland or shrub land below about 2,600 feet elevation; Los Angeles to San Diego Counties, inland to San Gabriel Mountain foothills and west Riverside County.	May–June	Federal: none California: S2.1 CNPS: List 1B R-E-D: 1-2-3	Absent (field survey; habitat unsuitable due to land uses)

Table 5-8: Special Status Plants Potentially Present at AA 3

Special Status Plants	Habitat and Distribution	Flower season	Status Designation	Occurrence Probability
Dudleya stolonifera Laguna Beach dudleya	North facing cliffs and rocky outcrop; endemic to San Joaquin Hills area.	May–July	Federal: **THR** California: **THR** S1.1 CNPS: List 1B R-E-D: 3-3-3	Absent (field survey, no suitable habitat)
Hemizonia parryi ssp. *australis* (*Centromadia parryi australis; Hemizonia australis*) Southern tarplant	Valley grasslands, vernal pools, margins of coastal wetlands; sea level to about 1,400 feet elevation; Santa Barbara County southern to northern Baja California.	June–September	Federal: none California: S2.1 CNPS: List 1B R-E-D: 3-3-2	Absent (field survey; habitat unsuitable due to land uses)
Monardella hypoleuca ssp. *lonata* Felt-leaved monardella	Chaparral, about 1,000-1,400 feet elevation; mountains of Orange County (from Santiago Park area and south) and San Diego County to northern Baja California.	June–July	Federal: none California: S2.2 CNPS: List 1B R-E-D: 2-2-2	Absent (field survey, no suitable habitat)

Notes:

General references: CNDDB 2003, CNPS 2003, Hickman (ed) 1993, Munz 1974, Roberts 1998, Tibor 2001, U.S. FWS 1999

Federal designations: (federal Endangered Species Act, U.S. FWS). Note that some agencies, but not U.S. FWS, continue to use "SOC" as a Federal status designation. Until 1996, U.S. FWS maintained a list of "category 2 candidates," described as species of concern, but for which insufficient data were available to support listing. This list is no longer maintained and U.S.FWS has no "SOC" category.

END: **Federally listed, endangered**
THR: **Federally listed, threatened**
Candidate: Sufficient data are available to support federal listing, but not listed at this time
Proposed: Formally proposed for federal status shown

State designations: (California Endangered Species Act, CDFG)

END: **State listed, endangered**
THR: **State listed, threatened**
RARE: **State listed as rare** (Listed "rare" animals have been re-designated as threatened, but rare plants have retained the rare designation)
CSC: Species of special concern

CDFG Natural Diversity Data Base Designations: Applied to special status plants and sensitive plant communities; where correct category is uncertain, CDFG uses two categories or question marks.

S1: Fewer than 6 occurrences or fewer than 1,000 individuals or less than 2,000 acres
- S1.1: Very threatened
- S1.2: Threatened
- S1.3: No current threats known

S2: 6 to 20 occurrences or 1,000 to 3,000 individuals or 2000 to 10,000 acres (decimal suffixes same as above)
S3: 21 to 100 occurrences or 3,000 to 10,000 individuals or 10,000 to 50,000 acres (decimal suffixes same as above)
S4: Apparently secure in California; this rank is clearly lower than S3 but factors exist to cause some concern, i.e., there is some threat or somewhat narrow habitat. No threat rank
S5: Demonstrably secure or ineradicable in California. No threat rank.

California Native Plant Society (CNPS) designations

Note: CNPS (Tibor, ed., 2001 p. 54-55) asserts that plants on Lists 1A, 1B, and 2 meet definitions as threatened or endangered and "are eligible" for state listing

List 1A:	Plants presumed extinct in California
List 1B:	Plants rare and endangered in California and throughout their range
List 2:	Plants rare, threatened, or endangered in California, but more common elsewhere in their range
List 3:	Plants about which we need more information; a review list
List 4:	Plants of limited distribution; a watch list

CNPS R-E-D Code:

Rarity

1: Rare, but sufficient numbers and distribution that the potential for extinction is presently low
2: Occurrence confined to several populations or one extended population
3: Occurrence limited to one or a few highly restricted populations, or present in such small numbers that it is seldom reported

Endangerment

1: Not endangered
2: Endangered in a portion of its range
3: Endangered throughout its range

Distribution

1: More or less widespread outside California
2: Rare outside California
3: Endemic to California (i.e., does not occur outside California)

Definitions of occurrence probability:

Occurs :	Observed on the site by qualified biologists
High:	Observed in similar habitat in region by qualified biologists, or habitat on the site is a type often utilized by the species and the site is within the known range of the species
Moderate:	Reported sightings in surrounding region, or site is within the known range of the species and habitat on the site is a type occasionally used by the species
Low:	Site is within the known range of the species but habitat on the site is rarely used by the species
Absent:	A focused study failed to detect the species, or, no suitable habitat is present
Unknown:	No focused surveys have been performed in the region, and the species' distribution and habitat are poorly known

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Table 5-9: Sensitive Animals Potentially Present but Not Observed at AA 3

Common Name	Listing Status (1)	Potential To Occur On-Site
Invertebrates		
Quino Checkerspot	**FE**	Low; primary food resource not observed on-site. Regionally extinct.
San Diego fairy shrimp	**FE**	Low; no appropriate habitat on-site.
Riverside fairy shrimp	**FE**	Low; no appropriate habitat on-site.
Reptiles and Amphibians		
San Diego horned lizard	SOC; CSC	Low; no appropriate habitat on-site.
Orange-throated whiptail	SOC; CSC	Low; no appropriate habitat on-site.
Silvery legless lizard	SOC; CSC	Low; no appropriate habitat on-site.
San Bernardino ringneck snake	SOC	Low; no appropriate habitat on-site.
Coast patch-nosed snake	SOC; CSC	Low; no appropriate habitat on-site.
Two-striped garter snake	CSC	Medium; limited appropriate habitat on-site.
Northern red diamond rattlesnake	SOC; CSC	Low; no appropriate habitat on-site.
Western spadefoot	SOC; CSC	Low; no appropriate habitat on-site.
Arroyo southwestern toad	**FE;** CSC	Low; limited suitable habitat.
Birds		
Least Bell's vireo	**FE; CE**	Low; no appropriate habitat on-site.
Yellow Breasted chat	CSC	Low; no appropriate habitat on-site.
Bell's sage sparrow	SOC; CSC	Low; no appropriate habitat on-site.
Loggerhead shrike	SOC; CSC	Medium in suitable habitat; observed nearby.
California horned lark	CSC	Low; no appropriate habitat on-site.
Tri-colored blackbird	SOC; CSC	High; suitable habitat.
Yellow warbler	CSC	Low; no appropriate habitat on-site.
White-tailed kite	CSC; FP	High; observed nearby.
Northern harrier	CSC	High; observed nearby.
Sharp-shinned hawk	CSC	High in winter; observed nearby.
Ferruginous hawk	SOC	High in winter; recently observed over adjacent parcel.
Merlin	CSC	Medium in winter; suitable habitat and prey.

Table 5-9: Sensitive Animals Potentially Present but Not Observed at AA 3

Common Name	Listing Status (1)	Potential To Occur On-Site
Prairie falcon	CSC	Low; no appropriate habitat on-site.
Swainson's hawk	CT	Low; uncommon migrant.
Golden eagle	Eagle Act; CSC/FP	Low; no appropriate habitat on-site.
American peregrine falcon	Federally delisted; **CE**	Low; no suitable prey or habitat.
Short-eared owl	CSC	Low; limited habitat but prey available.
Burrowing owls	CSC; state internal memorandum.	Low; no appropriate habitat on-site.
Mammals		
San Diego pocket mouse	CSC	Low; limited habitat on-site.
Southern grasshopper mouse	CSC	Low; very rare in region.
Los Angeles pocket mouse	CSC	Low; limited suitable habitat.
Stevens' Kangaroo Rat	**FE; CE**	Low; limited habitat and food on-site. Not known from area.
Mountain lion	FP	Low; limited habitat and prey on-site.
Pallid bat	CSC	Low; limited habitat.
Townsend's big-eared bat	SOC; CSC	Low; limited habitat.
California mastiff bat	SOC; CSC	Low; limited habitat.
American badger	CSC	Low; limited habitat and prey on-site.

Notes:
FE Federally Endangered
SOC Federal Species of Concern/Sensitive
CE California Endangered
CSC California Species of Special Concern
FP California Fully Protected

MAPPING BY LINCER AND ASSOCIATES (2002)

LEGEND

- MINOR SURFACE ELEVATION: 2-FOOT INTERVALS
- 460 MAJOR SURFACE ELEVATION: 10-FOOT INTERVALS
- MCAS EL TORO BOUNDARY
- EXISTING STREAM OR WASH
- ESTIMATED EXTENT OF WASTE PLACEMENT BEFORE RSE INVESTIGATION (EARTH TECH 2001)
- MSS/NNG — MIXED SAGE SCRUB/NON-NATIVE GRASSLAND
- MFS — MULE FAT SCRUB
- RUD/DEV — RUDERAL/DEVELOPED
- SCS — SOUTHERN CACTUS SCRUB
- COASTAL CALIFORNIA GNATCATCHER
- CACTUS WREN (PAIR)
- CACTUS WREN NEST
- NEOTOMA NEST

NORTH

60 0 60 120 FEET

SCALE: 1"=120'

RI/FS Report — Draft Final

Habitat and Sensitive Natural Resources

Anomaly Area 3

Date: 04-08	Former MCAS El Toro	Figure
Project No. 29307	EarthTech — A tyco International Ltd. Company	5-14

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There is an intermittent stream channel parallel to, and inside, the northeastern site border and outside the southeastern boundary, the latter of which supports Mulefat Scrub (OCHCS 7.3) with scattered large black willows (Figure 5-14). These willow trees are in a few patches and do not cover enough of the area to match OCHCS descriptions of Southern Willow Scrub or Southern Black Willow forest. Open patches of Mulefat scrub extend onto the project site itself and in an eroded channel along the southeastern boundary (Figure 5-14). The area of Mulefat Scrub within AA 3 is 0.08-acre.

A form of coastal sage scrub (CSS) occurs on a hillside off-site to the northwest, and degraded CSS, mixed with non-native grassland, occurs on a fill slope to the east, crossing the northeastern corner of the site and extending off-site to the south and southeast. The CSS off-site to the north matches OCHCS description of Southern Cactus Scrub (OCHCS 2.4). Degraded CSS matches the mixed sage scrub grassland (OCHCS 2.8.5). There is no CSS habitat located within the landfill boundary.

5.5.5.4 Wetlands and Waters of the U.S.

Hydrology. The field survey for this Report covered all low areas, swales, and drainage ways where water could pond or flow. One part of the site, the head cut drainage way at the southeastern boundary, potentially meets Federal criteria as waters of the U.S. and California criteria as a jurisdictional streambed (see Figure 5-14). The OHWM, indicated by sediment deposits and small banks cut by running water, are about 5 feet apart over a distance of about 70 feet, a total of 350 square feet (less than 0.01-acre) of potentially Federally jurisdictional waters of the U.S..

None of AA 3 meets all three Federal criteria as a wetland. The head cut drainage way meets the hydrology and vegetation wetland criteria. The soil criterion could not be evaluated due to the origin and texture of soil on the site. If involved in this Federal action, the CDFG, at its discretion, may consider the head cut drainage way a wetland, based on indicators of the hydrology criterion alone.

Soils. Soil on the anomaly area is fill material, and soil is composed of fine sand in the drainage way showing OHWMs (above). Sandy soil generally does not show hydric indicators even where it is native on a site. Because of the sandy soil texture and because the soil is not native to the site, an attempt to find indicators of hydric soil was not made.

Vegetation. Plants growing in the low-lying areas on the AA 3 surface are generally weedy native and non-native upland species, including red brome grass (*Bromus madritensis ssp. rubens*), tocalote (*Centaurea melitensis*), sweetclover (*Melilotus sp.*), and Spanish clover (*Lotus purshianus*). None of these species is ranked as facultative plant (FAC), FAC Wetlands (FACW), or obligate wetland plants (OBL); therefore, these depressions do not meet the criterion for hydrophytic vegetation. Garland daisy (*Chrysanthemum coronarium*) is overwhelmingly dominant along the swale near the northeastern boundary. This species also is not ranked as FAC, FACW, or OBL; therefore, the swale does not meet the criterion for hydrophytic vegetation.

The riparian habitat located along Agua Chinon Wash, adjacent to AA3, includes areas of mulefat scrub and scattered black willows. Mulefat has a wetland indicator status of "facultative wetland" meaning that it is usually associated with a wetland (67 percent to 99 percent probability). Black willow is an obligate wetland species and is almost always associated with wetlands. A small area (approximately 3,400 square feet) of Mulefat habitat extends onto the site from the wash along an erosion channel located at the southeast boundary (Figure 5-14 and Section 5.5.6).

5.5.5.5 WILDLIFE

A total of 2 reptiles, 1 amphibian, 37 avian, and 6 mammalian species were documented on the site. A complete listing of those species documented is presented in Table 5-7.

5.5.6 Sensitive Resources

5.5.6.1 FLORA

Based on the field survey and on the habitats of listed threatened and endangered plants known from the region, it can be concluded that no listed plant species occur on the project site itself (see Table 5-8).

5.5.6.2 HABITAT

CSS is considered a sensitive habitat by several resource agencies because it supports a number of State and Federally listed endangered, threatened, and rare vascular plants as well as several bird and reptile species that are federally listed or are candidate species for Federal listing. Of particular importance is the coastal California gnatcatcher (*Polioptila californica californica*). These species are in decline because of the loss of their habitat. Loss estimates for sage scrub habitat in California range from 36 percent to 85 percent, but since these estimates were made in 1979 to 1981, additional losses have occurred (O'Leary 1990). Most of this habitat is located off-site. Only a small amount of the CSS, in the form of Mixed Sage Scrub Grassland (0.18-acre), is within the limits of AA 3 and none appears to be within the estimated extent of the debris placement area (see Figure 5-14). As long as this area can be avoided, it should not be a jurisdictional issue.

Wetland resources are also considered sensitive because of their scarcity in semi-arid southern California, their value to wildlife, and recent loss of this habitat from urbanization, agriculture, and flood control projects. The Mulefat Scrub wetlands are considered sensitive wetland habitats. Mulefat Scrub is only considered sensitive where it occurs in a wetland landscape position (i.e., along drainages and not on level pads). There is a very limited area of this habitat on-site, which limits its significance. This area should be avoided, or impacts minimized during any future investigation or remediation work.

5.5.6.3 WETLANDS AND WATERS OF THE U.S.

One part of the site, the head cut drainage way (erosion channel) at the southeastern boundary, potentially meets Federal criteria as waters of the U.S. and California criteria as a jurisdictional streambed (see Figure 5-14). The OHWM, indicated by sediment deposits and small banks cut by running water, are about 5 feet apart over a distance of about 70 feet, a total of 350 square feet (less than 0.01-acre) of potentially Federally jurisdictional waters of the U.S. This site, and no other part of the AA3, meets criteria as waters of the U.S. If involved in this Federal action, the CDFG would probably claim jurisdiction over all mapped Mulefat Scrub associated with the head cut channel.

None of AA 3 meets all three Federal criteria as a wetland. The head cut drainage way meets the hydrology, but not the vegetation criterion. The soil criterion could not be evaluated due to the origin and texture of soil on the site. If involved in this Federal action, the CDFG, at its discretion, may consider the head cut drainage way a wetland, based on indicators of the hydrology criterion alone.

5.5.6.4 WILDLIFE

Special status species include those listed by State and Federal agencies (CDFG 1994; U.S.FWS 1989, 1990, 1992, 1993a, and 1993b) as endangered, threatened, rare, or of special concern. They also include species listed by Everett (1979). No listed or sensitive species was observed on the study

site. One listed and one sensitive bird species and a sensitive mammal were documented adjacent to the site. These are discussed in the following sections and locations are depicted on Figure 5-14. A female Cooper's hawk was noted flying over an adjacent area, but was not nesting on or near the study site. The likelihood of other listed or sensitive species being present is detailed in Table 5-9.

5.5.6.4.1 Coastal California Gnatcatcher (Polioptila californica californica)

Listing: Federally Threatened and California State Species of Special Concern. On 7 February 2000, the U.S.FWS proposed critical habitat for the gnatcatcher (65 FR 5946). A final rule was published 24 October 2000 (Fed. Reg. Vol. 65, No. 206).

Distribution: Historically, gnatcatchers could be found from southern Ventura County southward through Los Angeles, Orange, Riverside, San Bernardino, and San Diego counties, and into Baja California, Mexico, to approximately 30 degrees North latitude near El Rosario (Atwood 1990). They were considered locally common in the mid-1940s, but this subspecies had declined substantially in the U.S. by the 1960s (Atwood 1980). Although observed declines in numbers and distribution of the gnatcatcher resulted from numerous factors, habitat destruction, fragmentation, and adverse modification are the principal reasons for listing of the gnatcatcher as a Federally threatened species in 1993 (58 FR-16742).

Habitat: The gnatcatcher occurs in several distinctive sub-associations of the CSS plant community. CSS is composed of relatively low-growing, dry-season deciduous and succulent plants. Characteristic plants of the community include California sagebrush (*Artemisia californica*), various species of sage (*Salvia spp.*), California buckwheat (*Eriogonum fasciculatum*), lemonadeberry (*Rhus integrifolia*), California encelia (*Encelia californica*), and *Opuntia spp.* (Atwood 1990). CSS is patchily distributed throughout the range of the gnatcatcher, and the gnatcatcher is not uniformly distributed within the structurally and floristically variable CSS. Rather, the subspecies tends to occur most frequently within California sagebrush-dominated stands of CSS on mesas and lower slopes of the coast ranges (Atwood 1990). Comparative data on population densities between vegetation sub-association types within sage scrub are lacking. However, within the Riversidean Association of CSS, data indicate that gnatcatcher fitness is positively correlated with relatively mature vegetation structure (Braden 1997). Any and all shrub species within the CSS are usable habitat for gnatcatchers. Furthermore, density of vegetation does not predict suitability of habitat (Braden 1997), but influences the territory size of the bird (Atwood 1992). Territory size increases as vegetation density decreases, probably due to food resource availability. Therefore, gnatcatchers will use sparsely vegetated CSS for shelter and forage for insects as long as perennial shrubs are available.

Status on-site: Three gnatcatchers were documented in the Southern Cactus Scrub, immediately to the northwest of the site during the BSR (see Figure 5-14). They consisted of one adult (sex unknown) and two separate individuals of unknown age and sex. All birds were observed in CSS and were, likely, members of the same family group. The breeding season of the gnatcatcher extends from 15 February through 30 August, with the peak of nesting activity occurring from mid-March through mid-May. Although it is too early in the season to determine breeding status and specific location, it is likely that at least one pair will breed in this habitat adjacent to the study site. Appropriate habitat to support the coastal California gnatcatcher does not exist within the site boundary.

5.5.6.4.2 Cactus Wren (Campylorhynchus brunneicapillus)

Status: California State Species of Special Concern

Distribution: Southern Orange County (San Juan Creek) south through San Diego County into northwestern Baja California, Mexico.

Habitat(s): Restricted to clumps of prickly-pear (*Opuntia littoralis and O. oricola*) or cholla (*O.prolifera*) growing in CSS or along washes.

Status on-site: Two individuals, probably representing a pair, were documented in the Southern Cactus Scrub, immediately to the northwest of the site during the BSR. In addition, a cactus wren nest was found in that same habitat (see Figure 5-14). Although it is too early in the season to determine breeding status and specific location, it is likely that this pair will breed in this habitat adjacent to the study site. Appropriate habitat to support the cactus wren does not exist within the site boundary.

5.5.6.4.3 San Diego Desert Woodrat (Neotoma lepida intermedia)

Status: Federally Sensitive/California state Species of Special Concern

Distribution: Coastal slope of southern California from San Luis Obispo County south into coastal northwestern Baja California, Mexico.

Habitat(s): Open Chaparral and CSS, often building large, stick nests in rock outcrops or around clumps of cactus, yucca, or other woody vegetation.

Status on-site: One large stick nest was noted on the ground, among cactus scrub, on the property directly northwest of the study site. Appropriate habitat to support the San Diego woodrat does not exist within the site boundary.

5.5.7 Summary

1. No listed or otherwise sensitive plant species were documented on the site.
2. Three Federally listed plant species, which have the potential for being on-site, were not found and/or the site did not have appropriate habitat. One listed species is presumed to be extinct locally.
3. Seven other plant species, of lesser sensitivity, which have the potential to be found on-site, were determined to be absent, based on the survey and the lack of suitable habitat (see Table 5-8).
4. No listed wildlife species were found on the site.
5. One listed animal species, the coastal California gnatcatcher, and two sensitive species, the Cactus Wren and the San Diego Wood Rat, were documented next to the site.
6. The potential for three other listed wildlife species (Quino Checkerspot Butterfly, San Diego Fairy Shrimp, and Riverside Fairy Shrimp) is low to non-existent because of lack of appropriate habitat on or next to the site.
7. The potential for animal species, of lesser sensitivity, which have the potential to be found on-site, is as follows: low potential for 26 species due to lack of suitable habitat, rarity, and/or food; medium potential for three species in suitable habitat or at a different time of year; and high for five species that were not noted at the time of the survey (see Table 5-9).

6. NATURE AND EXTENT OF CONTAMINATION

The sample collection methodology, number, depth of samples collected, and laboratory analyses performed on the samples are presented in Section 4. To assess the nature and extent of contamination at the site, the analytical results of various media-specific sampling were evaluated and interpreted in terms of concentration and spatial distribution. The media-specific evaluation of the nature and extent of contamination, including results of all previous investigations, are presented in this section. Information presented in this section is from the following sources:

1. Results of previous investigations – Technical Information Package (OHM/IT 2000)
2. Results of the RSE field investigation

The physical characteristics including surface features, site geology, and hydrogeology presented in Section 5, provide the context for discussing the nature and extent of debris at the site. As presented previously, the site was historically used as a source of borrow material. Records indicate that some of the borrow pits and trenches were backfilled with construction debris and later covered with 5 feet or more of fill soil (IT/OHM 2000). During the RSE investigation, it was confirmed that there is an average of 4.5 feet of soil cover with isolated areas having 2 feet of soil cover over the construction debris. Interviews with former Station personnel indicate that construction debris generated during the construction of the IDW management area at IRP Site 3 was placed at AA 3. A review of topographical maps and the development of cross sections were conducted as part of the RSE Work Plan to estimate the lateral extent and depth of the debris placement area.

This exercise presumed that the entire difference (vertical depth) in ground surface elevation between the pre- and post-waste placement topographs was backfilled with construction debris. The estimated boundary limits was refined and confirmed as part of the RSE field exploratory trenching.

Since the spatial chemical character of the debris that was placed at the site was not adequately characterized, samples were collected during the RSE investigation from the following media:

Air – To evaluate emissions from within the debris placement boundary

Soil (during soil gas survey) – For human health and ERA purposes

Soil gas from within the debris placement limits (soil gas survey) and along the perimeter of the debris (gas wells) – To characterize debris and evaluate landfill gas emissions

Groundwater – To evaluate potential impact to groundwater due to leachate from the debris

Sediment – To evaluate potential impact to the sediments of the Agua Chinon Wash due to the debris that was placed at AA 3

Surface water – To evaluate potential impact to the surface waters of the Agua Chinon Wash due to the debris that was placed at AA 3

6.1 PHYSICAL EXTENT OF DEBRIS PLACEMENT AREA

The Decision Rule #1 of the RSE investigation indicated that if the debris placement boundary had not been adequately delineated previously, then additional trenching would be performed to define the debris placement boundaries.

The trenching activity was performed in March 2000 to confirm the results of the geophysical investigation and was not primarily conducted to delineate the extent of debris, even though a few trenches delineated the lateral boundaries. The physical characterization of the debris was performed to a depth of approximately 22 feet bgs during the previous investigation. The debris profile from these 18 trenches is presented in Table 3-3. The debris encountered included concrete, rubble, rebar, metallic debris, wood, plastic and asbestos pipes. Only one trench (H4–central portion of the site at a depth of 7 feet bgs) out of 18 trenches had domestic refuse, such as milk containers. Domestic refuse was not encountered in any other trench. The waste profile of the March 2000 trenches is predominantly construction-related debris.

As part of the RSE investigation, 12 trenches were excavated at the tentative waste placement boundary that was established by using the pre- and post-waste placement topographs (see Section 3.6). The estimated depth of exploration and physical characterization was limited to the maximum reach of the backhoe (approximately 12 feet bgs). For exploration methodology and details, refer to Section 4.3. Figure 4-1 presents the RSE investigation trench locations. Table 6-1 summarizes the trench details, including the dimensions and debris profile. The type of debris encountered is similar to the March 2000 trenching debris profile and includes wire, brick chips, asphalt, rebar, concrete rubble, gravel, metal pipes, spent sand bags, and hardened gravel-concrete slurry. No domestic refuse was encountered in any of the 12 RSE investigation trenches.

Cross sectional maps developed using historical topographs were updated using data collected during trenching activities and are presented in Figures 6-1, 6-2, and 6-3. The depth of debris encountered in the trenches during both the March 2000 and October 2002 trenching activities is also presented graphically on these cross sections, along with the existing soil cover depth. Figure 5-7 presents the site plan showing the locations of these cross sections. The estimated debris placement boundary was revised and presented on Figure 6-4. RSE investigation trenching has confirmed that the initial demarcation of debris placement was fairly accurate, with the exception of one area near the southeast corner of the site where the boundary was revised inward.

6.2 AIR SAMPLING RESULTS

Air sampling was proposed for the site to assess the potential emissions from the surface of the debris and the potential impact of the waste emissions on the surrounding air quality.

The air sampling methodology for the RSE investigation is presented in Section 4.5. Two types of air sampling were performed at AA 3. Sixteen ambient and integrated samples were collected during the RSE investigation; seven ambient air samples (including one duplicate) and nine integrated air samples (including one duplicate). The complete data sets for ambient and integrated air sampling are presented in Appendix B.

6.2.1 Ambient Air Sampling

Ambient air samples were collected at three locations, designated A-1 through A-3 (see Figure 4-2). Based on the wind directions recorded during the day, Location A-1 was designated as the upwind location, while location A-3 was designated as the upwind location during the night. The wind rose diagram for the month of October 2002 is presented in Figure 4-2. Two sets of ambient air samples were collected from each location (12-hour sample collection each time, for a total of 24 hours).

Table 6-2 and Figure 6-5 present the summary of detected analytes. Data published by the CARB for statewide landfill testing include median and maximum concentrations for 10 VOCs (1,1,1-trichloroethane, perchloroethylene, methylene chloride, benzene, trichloroethylene, carbon

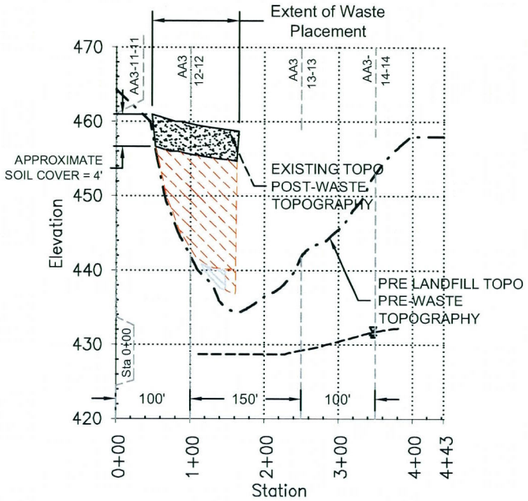
Table 6-1: Details of October 2002 Trench Exploration – RSE Investigation

Trench Number	Date of Trenching	Description	First Horizontal Contact with Debris from End A (feet)	First Vertical Contact with Debris (feet bgs)	Materials Found
TR01-A-A'	10/22/2002	Total Depth – 12 feet bgs Total Length – 150 feet	25 feet toward center of site from End A	2 feet bgs	Traces of wire, brick chips and asphalt from 2 feet to 4 feet bgs; No debris encountered from 4 feet to 12 feet bgs. No odors recorded.
TR02-A-A'	10/21/2002	Total Depth – 10 feet bgs Total Length – 150 feet	No debris encountered up to 150 feet toward the center of site from End A	No debris encountered up to the maximum reach of the backhoe (10 feet bgs)	— No odors recorded.
TR03-A-A'	10/21/2002	Total Depth – 7 feet bgs Total Length – 45 feet	15 feet toward center of site from End A	4 feet bgs	Concrete rubble with some granodiorite boulders up to 2.5 feet bgs, rebar, and metal pipes. No odors recorded.
TR04-A-A'	10/21/2002	Total Depth – 10 feet bgs Total Length – 45 feet	30 feet toward center of site from End A	3 feet bgs	Scattered debris, concrete, and asphalt from 3 feet to 6 feet bgs; major concrete rubble with some metal, pipes, and asphalt from 6 feet to 10 feet bgs. No odors recorded.
TR05-A-A'	10/18/2002	Total Depth – 9 feet bgs Total Length – 75 feet	Minor scattered debris until 50 feet toward center of site from End A	5 feet bgs	Scattered debris (wire, asphalt, and plastic) from 0-foot to 5 feet bgs; major construction debris, mostly concrete rubble, asphalt, and concrete gravel slurry from 5 feet to 9 feet bgs. No odors recorded.
TR06-A-A'	10/08/2002	Total Depth – 8 feet bgs Total Length – 60 feet	Minor scattered debris until 55 feet toward center of site from End A	2 feet bgs	Scattered construction debris with concrete asphalt, and PVC tubing from 0-foot to 6 feet bgs; Major debris, mostly concrete rubble, rebar, steel pipes, and asphalt from 6 feet to 8 feet bgs. No odors recorded.

Table 6-1: Details of October 2002 Trench Exploration – RSE Investigation

Trench Number	Date of Trenching	Description	First Horizontal Contact with Debris from End A (feet)	First Vertical Contact with Debris (feet bgs)	Materials Found
TR07-A-A'	10/18/2002	Total Depth – 11 feet bgs Total Length – 60 feet	5 feet toward center of site from End A	2 feet bgs	Gravel and cement slurry; traces of asphalt debris; from 5 feet to 9 feet bgs construction debris, mostly concrete, fence poles, wire, and plastic. No odors recorded.
TR08-A-A'	10/17/2002	Total Depth – 10 feet bgs Total Length – 60 feet	45 feet toward center of site from End A	3 feet bgs	Traces of concrete and brick chips; major concrete debris with some asphalt and spent sand bags from 6 feet to 10 feet bgs. No odors recorded.
TR09-A-A'	10/17/2002	Total Depth – 8 feet bgs Total Length – 45 feet	30 feet toward center of site from End A	3 feet bgs	Concrete and gravel slurry; major concrete debris from 6 feet to 8 feet bgs. No odors recorded.
TR10-A-A'	10/17/2002	Total Depth – 13 feet bgs Total Length – 70 feet	5 feet toward center of site from End A	5 feet bgs	Scattered cobbles, traces of concrete debris, spent sand bags; major concrete debris with asphalt and some wood from 7 feet to 10 feet bgs. No odors recorded.
TR11-A-A'	10/22/2002	Total Depth – 8 feet bgs Total Length – 75 feet	5 feet toward center of site from End A	1-foot bgs	Construction debris mostly asphalt, concrete, rebar, bricks, wire and gravel-concrete slurry from 4 feet to 8 feet bgs. No odors recorded.
TR12-A-A'	10/22/2002	Total Depth – 12 feet bgs Total Length – 150 feet	50 feet toward the center of the site from End A	2 feet bgs	Traces of asphalt, brick debris, and concrete from 2 feet to 6 feet bgs. No odors recorded.

Notes:
bgs = below ground surface
PVC = polyvinyl chloride
RSE = removal site evaluation



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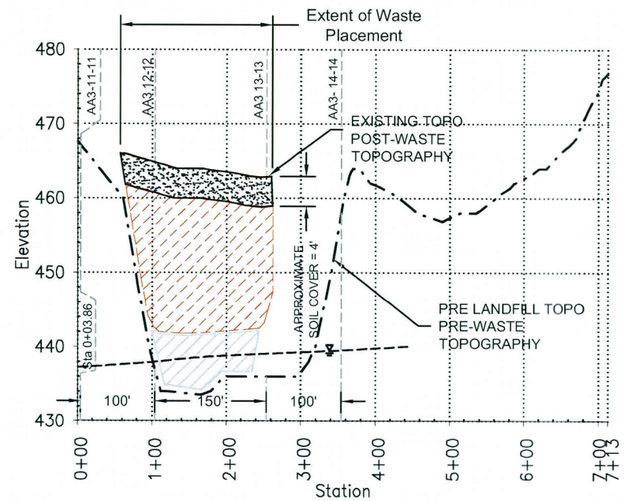

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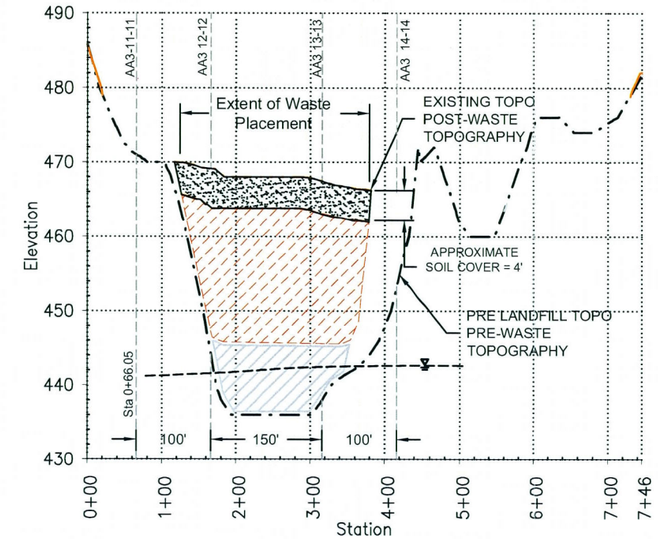

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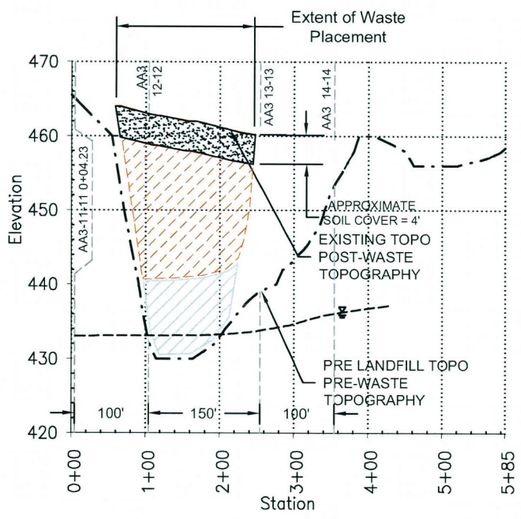

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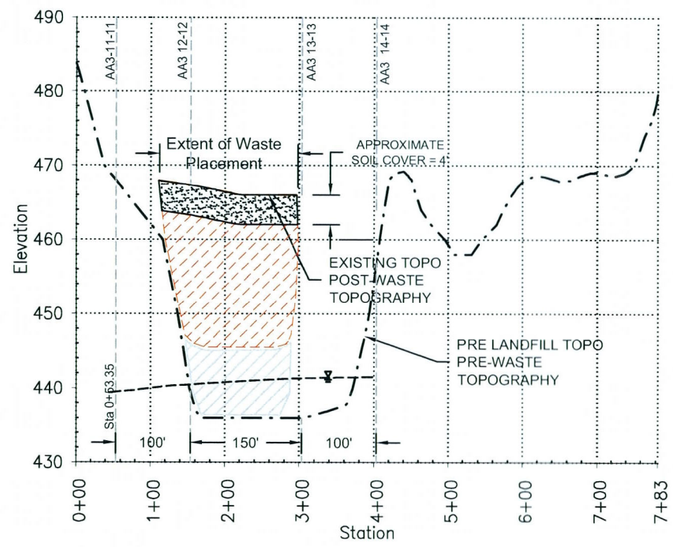

SECTION AA3--4-4'

SCALE: 1"=200' Horizontal
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LEGEND

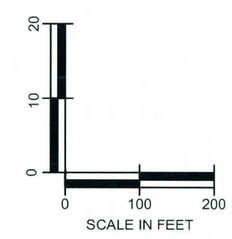
- PRE-WASTE PLACEMENT TOPOGRAPHY
- POST-WASTE PLACEMENT TOPOGRAPHY
- APPROXIMATE GROUNDWATER ELEVATION (APRIL 2005)
- APPROXIMATE THICKNESS OF SOIL COVER
- APPROXIMATE LIMIT OF WASTE
- WASTE PLACEMENT INFERRED
- AA3-14-14 INTERSECTING CROSS SECTION

NOTES:

1. POST-WASTE PLACEMENT TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHOD FROM AERIAL PHOTOGRAPHY DATED NOVEMBER 8, 1990 BY AIRBORNE SYSTEMS, INC.
2. PRE-WASTE PLACEMENT TOPOGRAPHY CIRCA 1972.

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL.

APPROXIMATE LIMIT OF WASTE BASED ON MARCH 2000 AND OCTOBER 2002 TRENCH EXPLORATIONS. MAXIMUM DEPTH OF EXPLORATION AS 22 FEET DEEP (MARCH 2000) OR MAXIMUM DEPTH OF EXPLORATION APPROXIMATELY 12 FEET (OCTOBER 2002).



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Anomaly Area 3		
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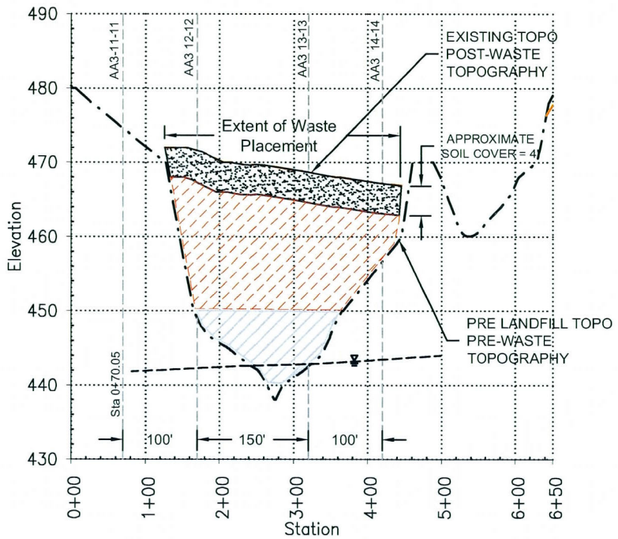

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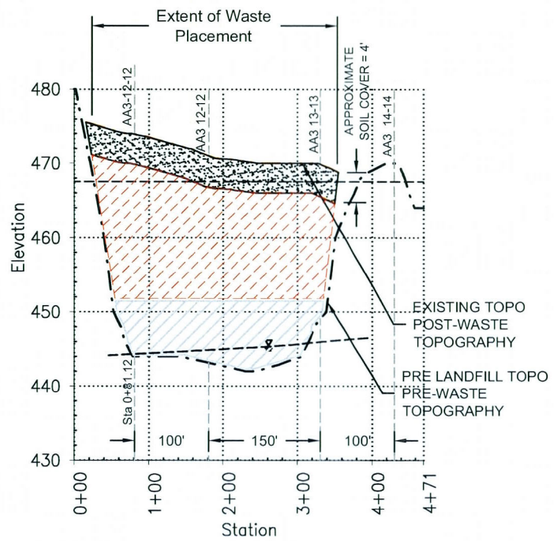

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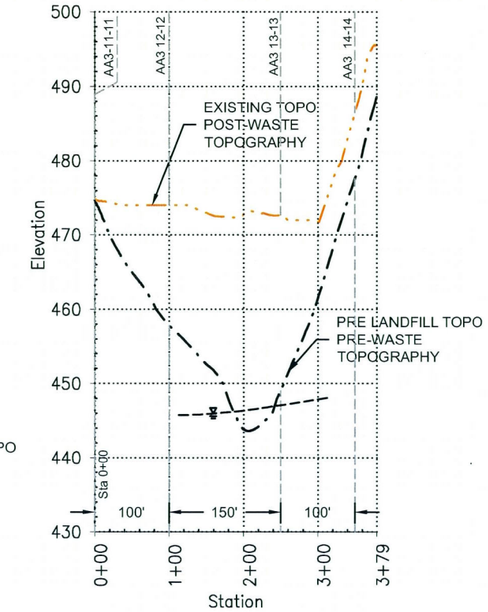

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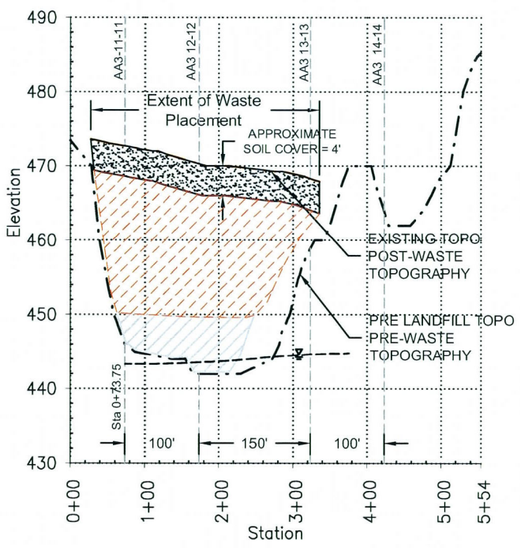

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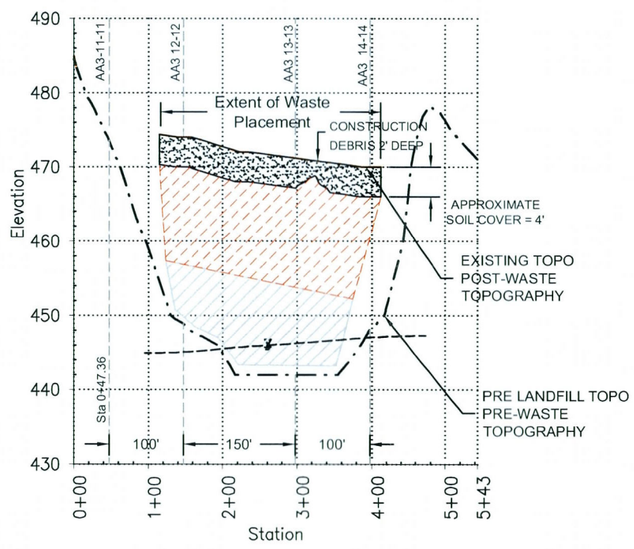

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LEGEND

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- POST-WASTE PLACEMENT TOPOGRAPHY
- APPROXIMATE GROUNDWATER ELEVATION (APRIL 2005)
- APPROXIMATE THICKNESS OF SOIL COVER
- APPROXIMATE LIMIT OF WASTE
- WASTE PLACEMENT INFERRED
- AA3-14-14 INTERSECTING CROSS SECTION

NOTES:

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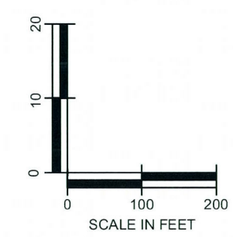

RI/FS Report — Draft Final

Revised Cross Sections -- II

Anomaly Area 3

Date: 04-08	Former MCAS El Toro	Figure
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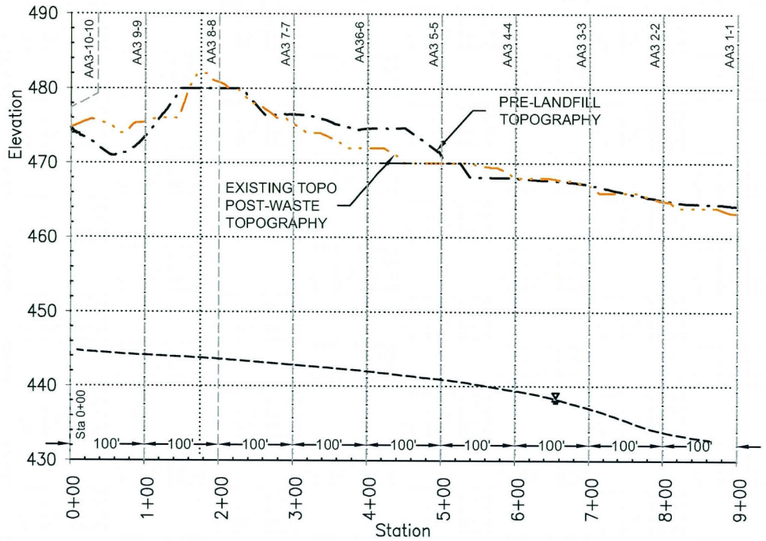

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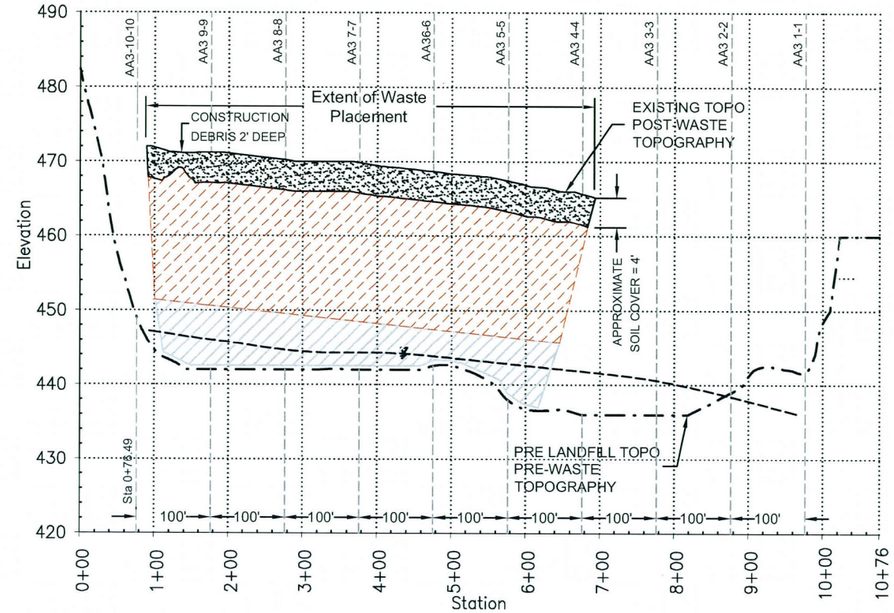

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- POST-WASTE PLACEMENT TOPOGRAPHY
- APPROXIMATE GROUNDWATER ELEVATION (APRIL 2005)
- APPROXIMATE THICKNESS OF SOIL COVER
- APPROXIMATE LIMIT OF WASTE
- WASTE PLACEMENT INFERRED
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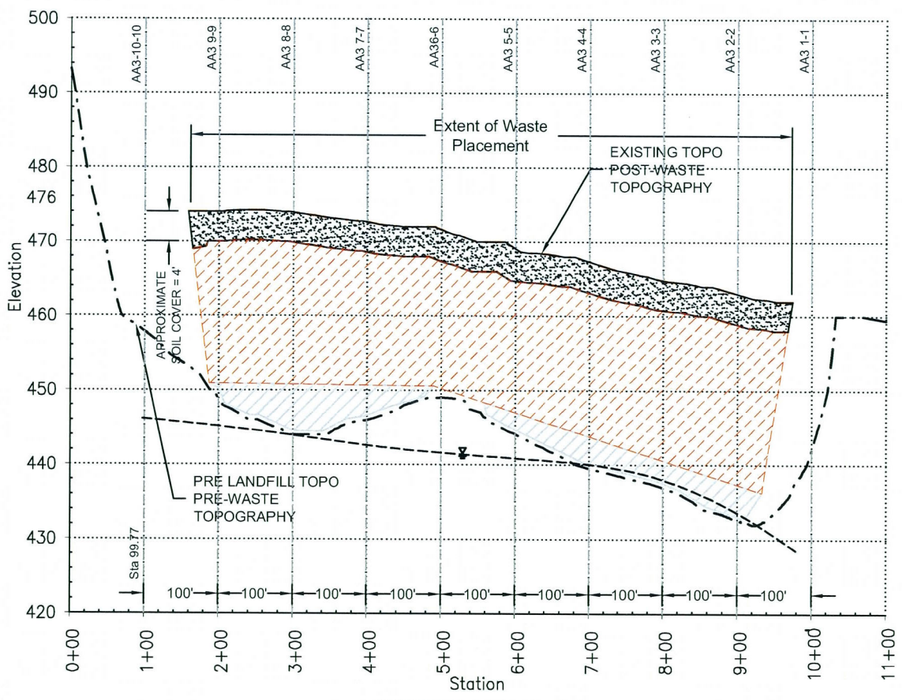
ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL.

APPROXIMATE LIMIT OF WASTE BASED ON MARCH 2000 AND OCTOBER 2002 TRENCH EXPLORATIONS. MAXIMUM DEPTH OF EXPLORATION AS 22 FEET DEEP (MARCH 2000) OR MAXIMUM DEPTH OF EXPLORATION APPROXIMATELY 12 FEET (OCTOBER 2002).



SECTION AA3—12-12'

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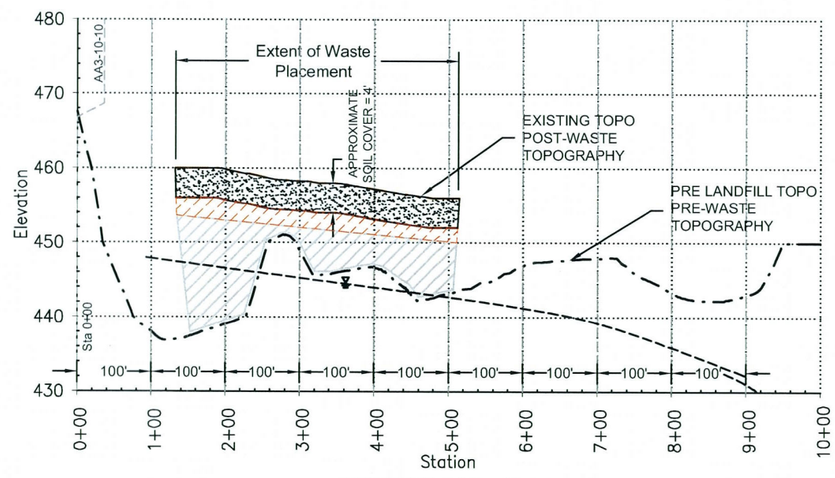
1"=20' Vertical



SECTION AA3—14-14'

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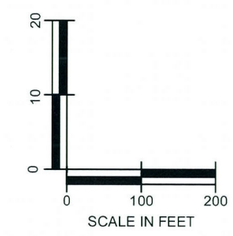

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Revised Cross Sections -- III

Anomaly Area 3

Date: 04-08	Former MCAS El Toro	Figure
Project No. 29307	EarthTech — A tyco International Ltd. Company	6-3

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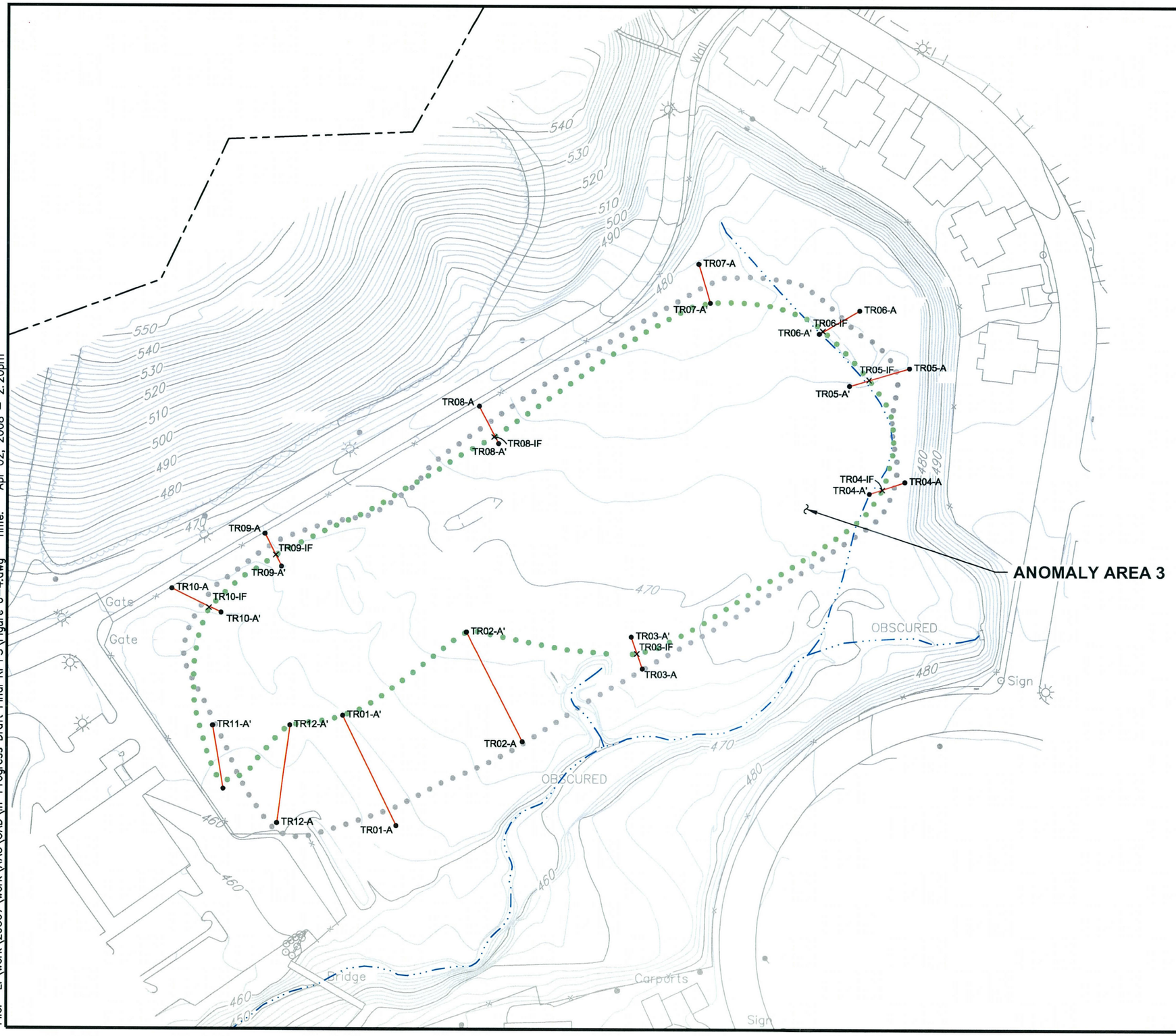

LEGEND

- MINOR SURFACE ELEVATION: 2-FOOT INTERVALS
- 460 MAJOR SURFACE ELEVATION: 10-FOOT INTERVALS
- MCAS EL TORO BOUNDARY
- EXISTING STREAM OR WASH
- PREVIOUSLY ESTIMATED EXTENT OF WASTE PLACEMENT BEFORE RSE INVESTIGATION (EARTH TECH 2001)
- REVISED EXTENT OF WASTE PLACEMENT BASED ON TRENCHING (MARCH 2000 AND OCTOBER 2002)
- TR08-A TR08-A' NEW TRENCH LOCATION AND DESIGNATION
- TR08-IF INTERFACE OF DEBRIS AND FILL SOIL

NOTES

1. TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHOD FROM AERIAL PHOTOGRAPHY DATED DECEMBER 2001 BY SAN-LO AERIAL SURVEYS.
2. COORDINATES ARE IN CALIFORNIA STATE PLANE COORDINATE SYSTEM, NAD 83, ZONE 6.
3. ELEVATIONS IN FEET; BENCHMARK BASED ON NORTH AMERICAN VERTICAL DATUM 1988.

NORTH

60 0 60 120 FEET

SCALE: 1"=120'

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Revised Extent of Waste Placement

Anomaly Area 3

Date: 04-08	Former MCAS El Toro	Figure
Project No. 29307	EarthTech — A tyco International Ltd. Company	6-4

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Table 6-2: Summary of Detected Analytes - Ambient Air Sampling - RSE Investigation

Parameter	CARB Study Median[a] (ppb_v)	CARB Study Maximum[a] (ppb_v)	Sample ID:	LK001	LK002	LK003	LK004	LK014	LK015	LK016
			Location ID:	AA3-A01	AA3-A02	AA3-A03	AA3-A03	AA3-A01	AA3-A02	AA3-A03
			Sample Type:	Regular	Regular	Regular	Duplicate	Regular	Regular	Regular
			Sample Date:	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002
VOCs (EPA Method TO-14)			Units							
2-Butanone (MEK)	NR	NR	ppb_v	3.4 U	3.4 U	3.4 U	6.5	3.4 U	3.6 U	3.6 U
Acetone	NR	NR	ppb_v	5.8	12	5.7	9.6	7.5	6.2	7.8
Ethanol	NR	NR	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	5.5	4	5.4
Methylene Chloride	1U	1,300	ppb_v	**1.3**	**1.4**	**1.1**	**0.9**	**0.98**	**1**	**1**
Toluene	NR	NR	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.9	0.93	0.9 U
Fixed Gases (ASTM D-1946)										
Carbon Dioxide	NR	NR	%	0.045	0.047	0.046	0.047	0.044	0.042	0.043
Methane	NR	NR	%	0.00021	0.0002	0.00022	0.00022	0.0002	0.0002	0.0003
Nitrogen	NR	NR	%	78	78	78	78	80	80	80
Oxygen	NR	NR	%	22	22	22	22	20	20	20

NOTES:

ppb_v = parts per billion by volume
% = percent
VOC = volatile organic compound
CARB - California Air Resources Board
ASTM = American Society of Testing and Materials
NR = not reported in referenced document.
AA3 = Anomaly Area 3
RSE = removal site evaluation
EPA = Environmental Protection Agency
U = indicates the analyte was not detected at or above the stated limit.
VOC analytes (part of EPA Method TO-14 list) not shown in this table are below their respective reporting limits.
[a] Data (median and maximum concentrations) published by CARB for statewide landfill testing for ten VOCs (CARB 1990).
Values in **bold** indicate that the concentrations of that particular analyte have exceeded the median concentrations of the CARB study.

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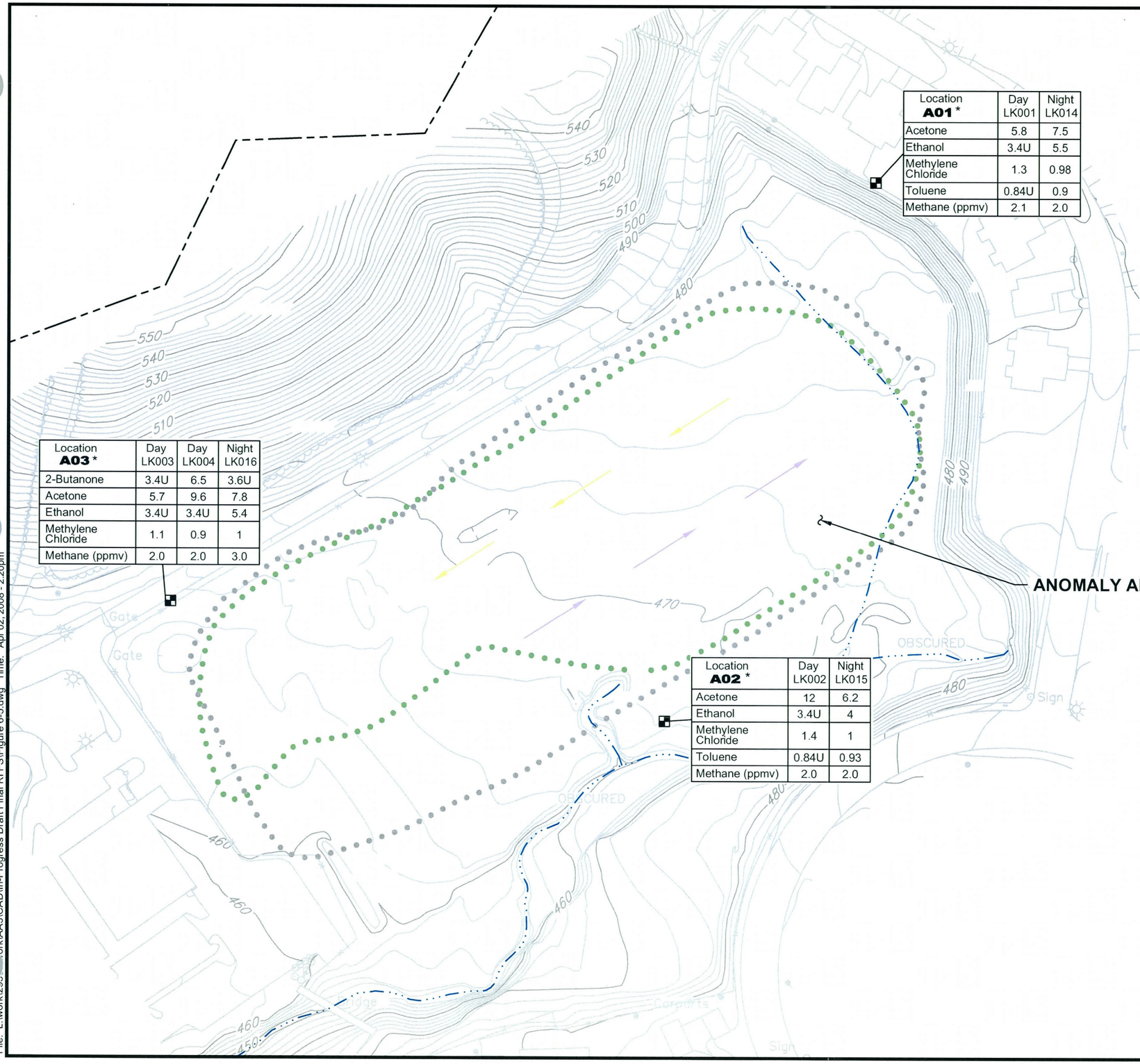

Location A01 *	Day LK001	Night LK014
Acetone	5.8	7.5
Ethanol	3.4U	5.5
Methylene Chloride	1.3	0.98
Toluene	0.84U	0.9
Methane (ppmv)	2.1	2.0

Location A03 *	Day LK003	Day LK004	Night LK016
2-Butanone	3.4U	6.5	3.6U
Acetone	5.7	9.6	7.8
Ethanol	3.4U	3.4U	5.4
Methylene Chloride	1.1	0.9	1
Methane (ppmv)	2.0	2.0	3.0

Location A02 *	Day LK002	Night LK015
Acetone	12	6.2
Ethanol	3.4U	4
Methylene Chloride	1.4	1
Toluene	0.84U	0.93
Methane (ppmv)	2.0	2.0

LEGEND

- MINOR SURFACE ELEVATION: 2-FOOT INTERVALS
- 460 MAJOR SURFACE ELEVATION: 10-FOOT INTERVALS
- MCAS EL TORO BOUNDARY
- EXISTING STREAM OR WASH
- PREVIOUSLY ESTIMATED EXTENT OF WASTE PLACEMENT BEFORE RSE INVESTIGATION (EARTH TECH 2001)
- REVISED EXTENT OF WASTE PLACEMENT BASED ON TRENCHING ACTIVITY (MARCH 2000 AND OCTOBER 2002)
- A3 AMBIENT AIR SAMPLING LOCATIONS
- U NOT DETECTED AT THRESHOLD INDICATED
- * CONCENTRATIONS IN TABLES ARE PARTS PER BILLION VOLUME (ppbv), UNLESS OTHERWISE NOTED
- PREDOMINANT DAYTIME WIND DIRECTION DURING FOR THE SAMPLING PERIOD
- PREDOMINANT NIGHTTIME WIND DIRECTION DURING FOR THE SAMPLING PERIOD

NOTES

1. TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHOD FROM AERIAL PHOTOGRAPHY DATED DECEMBER 2001 BY SAN-LO AERIAL SURVEYS.
2. COORDINATES ARE IN CALIFORNIA STATE PLANE COORDINATE SYSTEM, NAD 83, ZONE 6.
3. ELEVATIONS IN FEET; BENCHMARK BASED ON NORTH AMERICAN VERTICAL DATUM 1988.

NORTH

60 0 60 120 FEET

SCALE: 1"=120'

RI/FS Report — Draft Final

Ambient Air Sampling Results - RSE Investigation

Anomaly Area 3

Date: 04-08 | Former MCAS El Toro | Figure 6-5

Project No. 29307 | EarthTech — A tyco International Ltd. Company

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tetrachloride, chloroform, ethylene dichloride, vinyl chloride, ethylene dibromide) required by California law (CARB 1990). These data are based on results of landfill testing from 288 landfills at which ambient air sampling was performed. Detected ambient air sample results from this RSE investigation were compared to the CARB median and maximum concentrations for ambient air sampling (see Table 6-2). Table 6-3 presents the statistics of detected analytes and the number of samples exceeding the CARB Study median and maximum concentrations.

Table 6-3: Statistics of Detected Analytes – Ambient Air Sampling – RSE Investigation

Analyte	Number of Samples Analyzed [a]	Number of Detections	Minimum and Maximum Detected Concentrations (ppbv)	Frequency of Detection (%)	Detections Above Median Concentrations of CARB Study	Detections Above Maximum Concentrations of CARB Study
UPWIND						
2-Butanone	2	0	—	0	— [b]	— [b]
Acetone	2	2	5.8 and 7.8	100	— [b]	— [b]
Ethanol	2	1	5.4	50	— [b]	— [b]
Methylene chloride	2	2	1.0 and 1.3	100	2	0
Toluene	2	0	—	0	— [b]	— [b]
Methane	2	2	2100 and 3000	100	— [b]	— [b]
DOWNWIND						
2-Butanone	5	1	6.5	20	— [b]	— [b]
Acetone	5	5	5.7 and 12	100	— [b]	— [b]
Ethanol	5	2	4 and 5.5	40	— [b]	— [b]
Methylene chloride	5	5	0.9–1.4	100	5	0
Toluene	5	2	0.9–0.93	40	— [b]	— [b]
Methane	5	5	2000–3000	100	— [b]	— [b]

Notes:
[a] Number of samples analyzed for the specified analyte, including duplicates, if any.
[b] Not established in the CARB Study (CARB 1990), therefore, no comparison was made.
% = percent
CARB = California Air Resources Board
ppb_v = parts per billion by volume
RSE = removal site evaluation

Composting activities that are conducted northwest of the AA 3 may also influence the ambient air results at the site. The results indicate that there is no significant difference between the upwind and downwind sample results since low levels of the same constituents (acetone, ethanol, methylene chloride, and methane) were detected at approximately the same concentrations at both upwind and downwind locations (see Table 6-2). Low concentrations of 2-butanone and toluene were detected only in downwind samples. Methylene chloride was detected in all the upwind and downwind locations at concentrations exceeding only the CARB Study median concentrations. Since methylene chloride was detected at 40 percent of the landfills tested and had the highest maximum level concentrations, the CARB Study attributed these concentrations to possible contamination from extraneous sources or interference from common laboratory contaminants. The median and maximum concentrations for the other ambient air detected analytes (e.g., methane) were not established in the CARB Study. Methane was detected at concentrations ranging from 2 ppm_v to 3 ppm_v.

6.2.2 Integrated Surface Air Sampling Results

Integrated surface sampling was performed in accordance with the SCAQMD guidance for waste sampling (SCAQMD 1989). Integrated surface air samples (IN-1 through IN-8), were collected from Grids #1 through #8 to assess the potential emissions of VOCs and methane from the surface of the landfill (see Figure 4-2).

All integrated air samples collected were sent to a fixed laboratory for VOC and fixed gas analysis, even though the Work Plan indicated that only samples that exceeded the field reading of 50 ppm_v would be sent to the laboratory for analysis. None of the samples that was field screened exceeded the SCAQMD limit of 50 ppm_v for total organic carbon. Methane was detected at concentrations ranging from 2 ppm_v to 3 ppm_v, similar to ambient air concentrations (see Section 6.2.1). Table 6-4 and Figure 6-6 present the summarized results of detected analytes for integrated air sampling. Table 6-5 presents the statistics on the detected analytes of integrated air sampling, along with the comparison to the CARB Study integrated air sampling results.

Detected analytes included low levels of 2-propanol, acetone, benzene, ethanol, m,p-xylenes, methylene chloride, and toluene. Data published by the CARB for Statewide landfill testing include median and maximum concentrations for methane and 10 VOCs (1,1,1-trichloroethane, perchloroethylene, methylene chloride, benzene, trichloroethylene, carbon tetrachloride, chloroform, ethylene dichloride, vinyl chloride, and ethylene dibromide) required by California law (CARB 1990). These data are based on results of landfill testing from 251 landfills at which integrated air sampling was performed. Integrated samples from these landfills were analyzed for methane and 10 specified VOC contaminants. Detected sample results from this investigation were compared to the CARB median and maximum concentrations for integrated sampling (see Table 6-4). Benzene, methylene chloride, and methane exceeded the median concentrations in 100 percent, 78 percent, and 63 percent of the integrated air samples analyzed, respectively; no detected chemicals exceeded the CARB maximum concentrations. Table 6-4 also presents a comparison of the detected analytes of the integrated air samples to the PRGs. Only benzene (100 percent of the samples analyzed) and methylene chloride (77 percent of the samples analyzed) concentrations exceeded their respective PRGs.

6.2.3 Summary of Air Sampling Results

The results presented in Table 6-3 for ambient air samples indicate that both the upwind and downwind locations had 100 percent detections of the same analytes (methylene chloride, acetone, and methane). Only downwind samples had low levels of 2-butanone (6.5 parts per billion by volume [ppb_v]), ethanol (4 and 5.5 ppb_v), and toluene (0.9 and 0.93 ppb_v). Methylene chloride, acetone and 2-butanone are common laboratory contaminants. Integrated air sampling results presented in Table 6-5 indicate that with the exception of low levels of 2-propanol (6 ppb_v), benzene (3.7 ppb_v to 43 ppb_v), and m,p-xylene (1.5 ppb_v to 2.7 ppb_v), the same detected constituents of integrated air samples were also detected in ambient air samples, including methane. In addition, as described below in Section 6.3, no VOCs were detected in any of the soil gas samples collected from within the debris placement boundary. These results show that the integrated air samples were not influenced by debris placed at the site and the results are relatively consistent with the ambient air samples.

6.3 SOIL GAS SAMPLING RESULTS

Figure 4-1 illustrates the soil gas sampling locations arranged in a grid pattern at the centers of 33 100-foot by 100-foot grids. Shallow and subsurface soil gas sampling was conducted across AA 3 to characterize soil vapors within the debris placement area, to determine whether soil hot spots are

Table 6-4: Summary of Detected Analytes - Integrated Air Sampling - RSE Investigation

Parameter	CARB Study Median[a] (ppb_v)	CARB Study Maximum[a] (ppb_v)	PRGs	Sample ID:	LK005	LK006	LK007	LK008	LK009	LK010	LK011	LK012	LK013
				Location ID:	AA3-ING01	AA3-ING02	AA3-ING03	AA3-ING04	AA3-ING05	AA3-ING06	AA3-ING07	AA3-ING08	AA3-ING08
				Sample Type:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate
				Sample Date:	10/8/2002	10/8/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002
VOCs (EPA Method TO-14)				Units									
2-Propanol	NR	NR	--	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	6
Acetone	NR	NR	1360.53	ppb_v	16	13	5.3	6.4	8.8	13	10	9.4	10
Benzene	2U	120	0.08	ppb_v	**6**	**6.4**	**3.7**	**7**	**15**	**43**	**42**	**33**	**25**
Ethanol	NR	NR	--	ppb_v	5.1	6.6	3.8 U	6.6	4.5	7.1	6.2	5.4	12
m,p-Xylene	NR	NR	23.98	ppb_v	2.7	1.5	0.96 U	1.2 U	1.8	2.4	1.7	1.6	1.9
Methylene Chloride	1U	3,200	1.16	ppb_v	**1.1**	**1.3**	**1.2**	1.2 U	**1**	**1.4**	**1.2**	**1.4**	1.1 U
Toluene	NR	NR	104.83	ppb_v	3.6	1.8	0.96 U	1.2 U	2.2	2.7	2.2	1.7	2.5
Fixed Gases (ASTM D-1946)													
Carbon Dioxide	NR	NR	--	%	0.047	0.046	0.044	0.045	0.048	0.045	0.044	NA	0.042
Methane	--	--	--	%	0.0003	0.00022 U	0.00025	0.00024 U	0.0002 U	0.00021 U	0.00022	NA	0.00024
	2.6	130,000		ppb_v	**3000**	2200 U	**2500**	2400 U	**2000**	2100 U	**2200**	NA	**2400**
Nitrogen	NR	NR	--	%	78	78	79	79	79	78	78	NA	80
Oxygen	NR	NR	--	%	22	22	21	21	21	22	22	NA	20

NOTES:

ppb_v = parts per billion by volume
% = percent
VOC = volatile organic compound
CARB = California Air Resources Board
ASTM = American Society of Testing and Materials
ID = identifiation
U = indicates the analyte was not detected at or above the stated limit.
NR = not reported in referenced document.
AA3 = Anomaly Area 3
RSE = removal site evaluation
- = Not applicable
EPA = Environmental Protection Agency
PRG = preliminary remediation goal
NA = Due to laboratory error, the canister containing sample LK012 was inadvertently evacuated prior to final analysis.
VOC analytes (part of EPA Method TO-14 list) not shown in this table are below their respective reporting limits.
[a] Data (median and maximum concentrations) published by CARB for statewide landfill testing for ten VOCs and methane (CARB 1990).
Values in **bold** indicate that the respective analytes have exceeded the CARB study median concentrations for Integrated air sampling.

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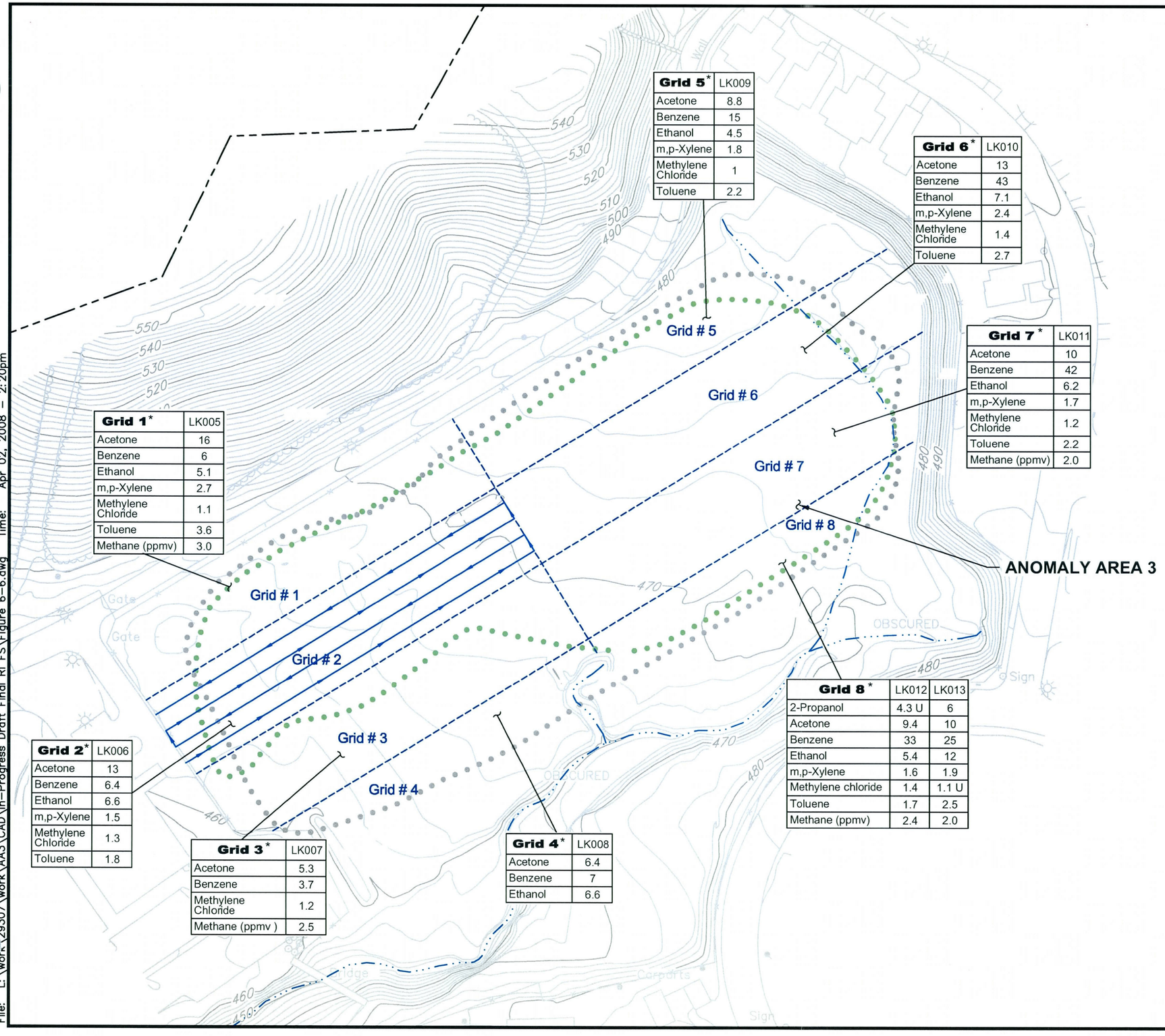

Grid 1*	LK005
Acetone	16
Benzene	6
Ethanol	5.1
m,p-Xylene	2.7
Methylene Chloride	1.1
Toluene	3.6
Methane (ppmv)	3.0

Grid 2*	LK006
Acetone	13
Benzene	6.4
Ethanol	6.6
m,p-Xylene	1.5
Methylene Chloride	1.3
Toluene	1.8

Grid 3*	LK007
Acetone	5.3
Benzene	3.7
Methylene Chloride	1.2
Methane (ppmv)	2.5

Grid 4*	LK008
Acetone	6.4
Benzene	7
Ethanol	6.6

Grid 5*	LK009
Acetone	8.8
Benzene	15
Ethanol	4.5
m,p-Xylene	1.8
Methylene Chloride	1
Toluene	2.2

Grid 6*	LK010
Acetone	13
Benzene	43
Ethanol	7.1
m,p-Xylene	2.4
Methylene Chloride	1.4
Toluene	2.7

Grid 7*	LK011
Acetone	10
Benzene	42
Ethanol	6.2
m,p-Xylene	1.7
Methylene Chloride	1.2
Toluene	2.2
Methane (ppmv)	2.0

Grid 8*	LK012	LK013
2-Propanol	4.3 U	6
Acetone	9.4	10
Benzene	33	25
Ethanol	5.4	12
m,p-Xylene	1.6	1.9
Methylene chloride	1.4	1.1 U
Toluene	1.7	2.5
Methane (ppmv)	2.4	2.0

LEGEND

- MINOR SURFACE ELEVATION: 2-FOOT INTERVALS
- 460 — MAJOR SURFACE ELEVATION: 10-FOOT INTERVALS
- MCAS EL TORO BOUNDARY
- EXISTING STREAM OR WASH
- PREVIOUSLY ESTIMATED EXTENT OF WASTE PLACEMENT BEFORE RSE INVESTIGATION (EARTH TECH 2001)
- REVISED EXTENT OF WASTE PLACEMENT BASED ON TRENCHING ACTIVITY (MARCH 2000 AND OCTOBER 2002)
- GRID BOUNDARY
- WALK PATTERN FOR INTEGRATED SAMPLING
- U — NOT DETECTED AT THE THRESHOLD INDICATED
- * — CONCENTRATIONS IN TABLES ARE PARTS PER BILLION BY VOLUME (ppbv), UNLESS OTHERWISE NOTED
- ppmv — CONCENTRATION IN PARTS PER MILLION BY VOLUME

NOTES

1. TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHOD FROM AERIAL PHOTOGRAPHY DATED DECEMBER 2001 BY SAN-LO AERIAL SURVEYS.
2. COORDINATES ARE IN CALIFORNIA STATE PLANE COORDINATE SYSTEM, NAD 83, ZONE 6.
3. ELEVATIONS IN FEET; BENCHMARK BASED ON NORTH AMERICAN VERTICAL DATUM 1988.

NORTH

60 0 60 120 FEET

SCALE: 1"=120'

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Integrated Air Sampling Results - RSE Investigation

Anomaly Area 3

Date: 04-08 | Former MCAS El Toro | Figure 6-6

Project No. 29307

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Table 6-5: Statistics of Detected Analytes – Integrated Air Sampling – RSE Investigation

Analyte	Number of Samples Analyzed [a]	Number of Detections	Minimum and Maximum Detected Concentrations (ppbv)	Frequency of Detection (%)	Detections Above Median Concentrations of CARB Study	Detections Above Maximum Concentrations of CARB Study
2-Propanol	9	1	6	11	-[b]	-[b]
Acetone	9	9	5.3 – 16	100	-[b]	-[b]
Benzene	9	9	3.7 – 43	100	-[b]	-[b]
Ethanol	9	8	4.5 – 12	89	-[b]	-[b]
m,p-xylenes	9	7	1.5 – 2.7	78	-[b]	-[b]
Methylene chloride	9	7	1.0 – 1.4	78	7	0
Toluene	9	7	1.7 – 3.6	78	-[b]	-[b]
Methane	8	5	200 – 300	63	4	0

[a] Number of samples analyzed for the specified analyte, including duplicates, if any.
[b] Not established in the CARB Study (CARB 1990); therefore, no comparison was made.
% = percent
CARB = California Air Resources Board
ppb_v = parts per billion by volume
RSE = removal site evaluation

present, and to check if a landfill gas collection system is necessary for the site. Results from this survey were used in evaluating the nature and extent of contamination in soil gas media, if any, as it related to the DQO Decisions #5 and #6.

Chemical characterization of the debris within the waste placement boundary using soil gas collection and analysis was not performed during previous investigations. In order to adequately answer the RSE decision questions, a soil gas survey was conducted at AA 3. Soil gas sampling proceeded at 10-foot intervals starting at 5 feet bgs and continued until the soil gas sample collected at the preceding depth had no VOC detection (based on mobile laboratory results).

However, soil gas samples were collected from 15 feet bgs at all locations irrespective of detection at the 5 feet depth. The soil vapor samples collected at a depth of 5 feet were designated as shallow soil vapor samples and samples collected deeper than 5 feet were designated as subsurface soil gas samples. With the exception of one location (HA11) where a 25-foot-deep vapor sample was collected due to the presence of elevated methane at 15 feet, sampling at all other locations terminated at 15 feet bgs. Details of the soil gas survey, including the soil gas survey report, are presented in Appendix B.

Since none of the 76 soil gas samples (centers of 100-foot by 100-foot grids) exceeded the hot spot VOC threshold concentration of 300 µg/L total VOCs, no additional sampling locations at the center of a 50-foot by 50-foot grid were required.

6.3.1 Shallow Soil Gas Sampling Results

Thirty-three samples were collected at depths of 5 feet at the site and analyzed in the field by a mobile analytical laboratory for VOCs (EPA Method 8260). As per the RSE Work Plan, approximately 10 percent of the soil gas samples were to be sent to the laboratory for fixed gas analysis based on the field screening results. Since none of the shallow soil gas results showed indications of methane, none of the samples was sent to the laboratory.

Appendix B presents the complete data sets for the shallow soil gas samples. Table 6-6 presents the field screening results for shallow soil gas samples. None of the 51 target VOCs and methane (field monitoring data) was detected in any of the shallow soil gas samples. Therefore, it can be concluded that at shallow depths of 5 feet bgs, no hot spots of landfill gases were found that would be indicative of "principal threat waste" as defined by EPA (1991c).

Table 6-6: Summary of Field Screening Results – Shallow Soil Gas (5 feet bgs) Survey – RSE Investigation

Location ID	Sample ID	Sample Date	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Lower Explosive Limit (%)	Flame Ionization Detector Reading (ppm)
HA01	LK018	10/9/2002	0.0	2.6	18.2	0.0	1.2
HA02	LK021	10/9/2002	0.0	3.4	17.1	0.0	5.5
HA03	LK024	10/9/2002	0.0	4.5	16.1	0.0	0.0
HA04	LK027	10/9/2002	0.0	0.0	20.9	0.0	0.0
HA05	LK030	10/9/2002	0.0	0.6	19.7	0.0	0.0
HA06	LK033	10/9/2002	0.0	2.0	18.5	0.0	0.7
HA07	LK036	10/10/2002	0.0	1.3	18.9	0.0	1.8
HA08	LK039	10/10/2002	0.0	1.4	18.4	0.0	0.0
HA09	LK042	10/10/2002	0.0	0.0	20.3	0.0	0.0
HA10	LK048	10/10/2002	0.0	0.9	19.4	0.0	0.0
HA11	LK048	10/10/2002	0.0	1.0	19.4	0.0	0.0
HA12	LK051	10/11/2002	0.0	3.2	16.7	0.0	0.0
HA13	LK054	10/10/2002	0.0	0.9	19.3	0.0	0.0
HA14	LK057	10/11/2002	0.0	0.0	20.6	0.0	0.0
HA15	LK060	10/11/2002	0.0	1.0	19.3	0.0	4.2
HA16	LK063	10/11/2002	0.0	0.4	19.0	0.0	0.0
HA17	LK066	10/11/2002	0.0	0.5	20.1	0.0	0.0
HA18	LK069	10/11/2002	0.0	16.3	2.9	0.0	0.0
HA19	LK072	10/11/2002	0.0	0.8	19.4	0.0	0.0
HA20	LK075	10/14/2002	0.0	2.4	17.3	0.0	1.4
HA21	LK078	10/14/2002	0.0	3.2	13.7	0.0	0.0
HA22	LK081	10/14/2002	0.0	1.9	18.4	0.0	NA
HA23	LK084	10/14/2002	0.0	2.4	18.0	0.0	NA
HA24	LK087	10/14/2002	0.0	0.3	18.6	0.0	0.0
HA25	LK090	10/14/2002	0.0	0.1	20.3	0.0	0.0
HA26	LK093	10/14/2002	0.0	6.8	13.8	0.0	0.9
HA27	LK096	10/14/2002	0.0	8.5	10.9	0.0	0.0
HA28	LK099	10/15/2002	0.0	5.9	13.4	0.0	0.0
HA29	LK102	10/15/2002	0.0	6.3	14.3	0.0	0.0
HA30	LK105	10/15/2002	0.0	5.4	14.8	0.0	0.0
HA31	LK108	10/15/2002	0.0	1.6	15.9	0.0	0.0
HA32	LK111	10/15/2002	0.0	7.9	13.4	0.0	0.5
HA33	LK114	10/15/2002	0.0	4.5	15.7	0.0	0.0

NOTES:
% = percent

bgs = below ground surface
ID = identification
ppm = parts per million
RSE = removal site evaluation

6.3.2 Subsurface Soil Gas Sampling Results

Forty-two samples collected at a depth of 15 feet (including nine duplicate samples) plus one 25-foot soil gas sample) were analyzed in the field by a mobile analytical laboratory for VOCs (EPA Method 8260). Per the requirements of the BCT, nine samples, including one duplicate sample were sent to the fixed laboratory for methane analysis using ASTM D-1946, in addition to field screening for fixed gases. The samples selected for laboratory fixed gas analysis were based on the results of the field screening. Table 6-7 presents the field screening results for subsurface soil gas samples and Figure 6-7 presents the spatial distribution of methane in subsurface soil gas (field screening results). Field screening results showed non-detect methane concentrations at twenty five of thirty three sampling locations, with detected concentrations (in twelve samples) ranging from 6,000 ppm_v (HA26 and HA29) to 230,000 ppm_v (HA18). The eight locations with detectable methane concentrations were confined to the central portion of the site; with only three central locations (HA16, HA18, and HA21) exceeding the Title 27 CCR stipulated LEL of 50,000 ppm_v for methane (Figure 6-7). These results indicate that subsurface methane is confined to the central portion of the site and is not migrating.

Appendix B presents the complete data sets for subsurface soil gas samples. Since none of the samples analyzed for 51 VOC analytes had detected concentrations, Table 6-8 presents only the summarized results of the laboratory fixed gas analysis.

The subsurface methane concentrations (laboratory results) ranged from 8.3 ppm_v at location HA32 to 130,000 ppm_v at location HA21. The field screening results at these locations are 0 ppm_v and 133,000 ppm_v, respectively. Locations HA14, HA18, and HA21 had methane field screening results exceeding the Title 27 CCR stipulated LEL for methane (5 percent or 50,000 ppm_v for soil vapor). It should be noted that all of the 51 VOC analytes analyzed as part of the EPA Method 8260 analysis for these samples had non-detect concentrations.

Carbon monoxide was detected in one of the nine samples analyzed at a concentration of 20 ppm_v (HA07). No gas hot spots (exceeding total VOC threshold concentration of 300 μg/L) were found that would be indicative of "principal threat waste" defined by EPA (1991c).

6.3.3 Perimeter Soil Gas Sampling

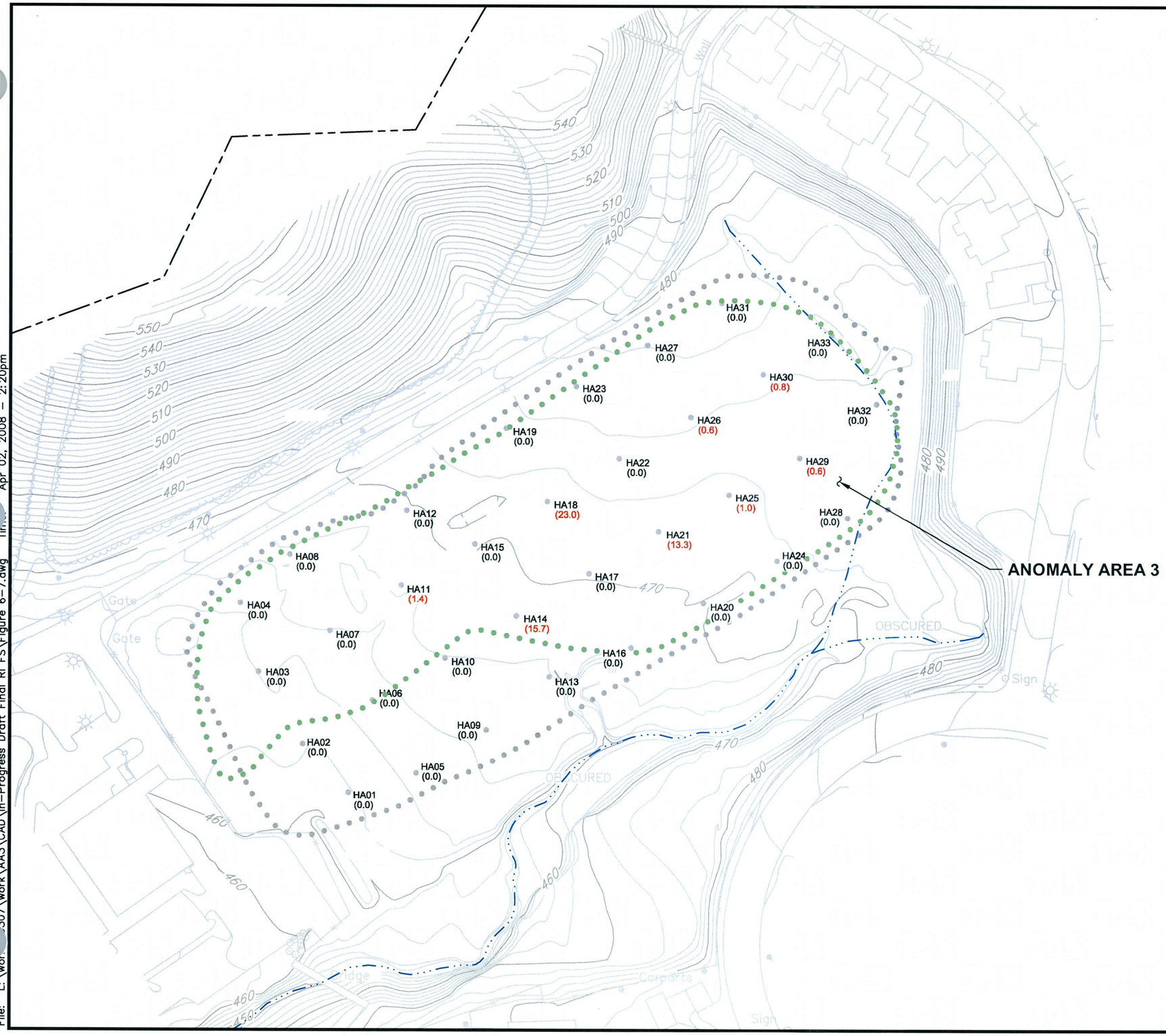
Perimeter soil vapor sampling was conducted to verify whether soil vapor is migrating to and beyond the boundaries of the debris. This perimeter vapor sampling results along with the results of the subsurface soil gas survey within the limits of debris placement area assists in resolving the RSE DQO Project Decision #6.

The existing vapor wells are single wells screened from 15 feet to 20 feet bgs (PZ3), 17 feet to 22 feet bgs (PZ1), and 25 feet to 30 feet bgs (PZ2). Based on the estimated vertical extent of the debris placement area, and for the purposes of discussion, the soil gas results from these existing wells were evaluated as deep zone soil gas results. Newly installed wells (PG01 through PG03) are triple nested wells screened to coincide with the shallow zone (5 feet to 7 feet bgs), intermediate zone (14 feet to 16 feet bgs), and the zone at or near the greatest depth of the debris (20 feet to 22 feet bgs) at each location. These screened intervals assist in evaluating whether there are soil gas emissions from these zones.

Table 6-7: Summary of Field Screening Results – Subsurface Soil Gas (15 feet bgs) Survey – RSE Investigation

Location Identification	Sample Identification	Sample Date	Methane (percent)	Carbon Dioxide (percent)	Oxygen (percent)	Lower Explosive Limit (percent)	Flame Ionization Detector Reading (ppm)
HA01	LK019	10/9/2002	0.0	6.3	14.7	0.0	1.4
HA02	LK022	10/9/2002	0.0	0.3	20.1	0.0	18.2
HA03	LK025	10/9/2002	0.0	11.8	9.7	0.0	20
HA04	LK028	10/9/2002	0.0	6.6	13.6	0.0	3
HA05	LK031	10/9/2002	0.0	0.9	19.5	0.0	0.0
HA06	LK034	10/9/2002	0.0	4.9	17.0	0.0	0.0
HA07	LK037	10/10/2002	0.0	17.0	2.0	0.0	1.0
HA08	LK040	10/10/2002	0.0	4.3	14.9	0.0	3.1
HA09	LK043	10/10/2002	0.0	1.9	18.5	0.0	0.0
HA10	LK046	10/10/2002	0.0	30.7	2.8	0.0	1,700
HA11	LK049	10/10/2002	1.4	27.1	1.8	28	>2,000
HA11	LK129	10/10/2002	0.1	1.8	18.7	0.0	350.0
HA12	LK052	10/11/2002	0.0	9.1	5.7	0.0	0.0
HA12	LK121	10/11/2002	0.0	9.1	5.7	0.0	0.0
HA13	LK055	10/10/2002	0.0	9.5	10.9	0.0	0.0
HA13	LK120	10/10/2002	0.0	9.5	10.9	0.0	0.0
HA14	LK058	10/11/2002	15.7	32.0	0.6	316	>2,000
HA15	LK061	10/11/2002	0.0	0.0	20.6	0.0	20
HA16	LK064	10/11/2002	0.0	7.7	12.5	0.0	2.0
HA17	LK067	10/11/2002	0.0	0.0	20.7	0.0	120
HA18	LK070	10/11/2002	23.0	37.8	0.3	460	>2,000
HA18	LK122	10/11/2002	23.0	39.8	0.3	460	>2,000
HA19	LK073	10/11/2002	0.0	7.5	12.0	0.0	6.9
HA20	LK076	10/14/2002	0.0	3.9	15.3	0.0	13
HA21	LK079	10/14/2002	13.3	14.2	0.7	268	>2,000
HA22	LK082	10/14/2002	0.0	8.3	0.4	0.0	NA
HA23	LK085	10/14/2002	0.0	9.9	5.6	0.0	NA
HA23	LK123	10/14/2002	0.0	9.9	5.6	0.0	NA
HA24	LK088	10/14/2002	0.0	6.4	11.5	0.0	0.0
HA25	LK091	10/14/2002	1.0	9.4	0.3	20	980
HA25	LK125	10/14/2002	1.0	4.4	0.3	20	980
HA26	LK094	10/14/2002	0.6	1.9	0.3	12	800
HA26	LK138	10/14/2002	0.6	1.9	0.3	12	800
HA27	LK097	10/14/2002	0.0	4.9	11.1	0.0	1,460
HA27	LK124	10/14/2002	0.0	4.9	11.1	0.0	1,460
HA28	LK100	10/15/2002	0.0	0.0	19.1	0.0	250
HA29	LK029	10/15/2002	0.6	11.6	0.4	12	680
HA30	LK106	10/15/2002	0.8	5.9	1.9	16	>2,000
HA31	LK109	10/15/2002	0.0	11.1	5.3	0.0	0.0
HA31	LK126	10/15/2002	0.0	11.1	5.3	0.0	0.0
HA32	LK112	10/15/2002	0.0	19.9	1.8	0.0	0.0
HA33	LK115	10/15/2002	0.0	8.6	11.3	0.0	7
HA33	LK127	10/15/2002	0.0	8.6	11.3	0.0	7

Notes:
bgs = below ground surface ppm = parts per million >= greater than NA = not analyzed



LEGEND

- MINOR SURFACE ELEVATION: 2-FOOT INTERVALS
- 460 MAJOR SURFACE ELEVATION: 10-FOOT INTERVALS
- MCAS EL TORO BOUNDARY
- EXISTING STREAM OR WASH
- PREVIOUSLY ESTIMATED EXTENT OF WASTE PLACEMENT BEFORE RSE INVESTIGATION (EARTH TECH 2001)
- REVISED EXTENT OF WASTE PLACEMENT BASED ON TRENCHING ACTIVITY (MARCH 2000 AND OCTOBER 2002)
- HA31 (1.4) RSE SOIL/SOIL VAPOR SAMPLING LOCATIONS FIELD SCREENING METHANE READING (PERCENT)

NOTES

1. TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHOD FROM AERIAL PHOTOGRAPHY DATED DECEMBER 2001 BY SAN-LO AERIAL SURVEYS.
2. COORDINATES ARE IN CALIFORNIA STATE PLANE COORDINATE SYSTEM, NAD 83, ZONE 6.
3. ELEVATIONS IN FEET; BENCHMARK BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
4. ALL SOIL VAPOR SAMPLES WERE COLLECTED AT A DEPTH OF 15 FEET BELOW GROUND SURFACE. A 25-FOOT SAMPLE WAS COLLECTED AT THE HA25 LOCATION, AND THE FIELD METHANE READING WAS THE SAME AS THE 15-FOOT SAMPLE

NORTH

60 0 60 120 FEET

SCALE: 1"=120'

RI/FS Report — Draft Final

Subsurface Soil Gas Field Screening Results (Methane Only) - RSE Investigation

Anomaly Area 3

Date: 04-08	Former MCAS El Toro	Figure
Project No. 29307	EarthTech — A tyco International Ltd. Company	6-7

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Table 6-8: Summary of Detected Analytes - Subsurface Soil Gas (15 feet bgs) Survey - RSE Investigation

	Sample ID:	LK037	LK049	LK079	LK091	LK094	LK138	LK103	LK106	LK112
	Location ID:	AA3-HA07	AA3-HA11	AA3-HA21	AA3-HA25	AA3-HA26	AA3-HA26	AA3-HA29	AA3-HA30	AA3-HA32
	Sample Type:	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular	Regular	Regular
	Sample Date:	10/10/2002	10/10/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/15/2002	10/15/2002	10/15/2002
Parameter[b]	Sample Depth:	15 feet	15 feet	15 feet	15 feet	15 feet	15 feet	15 feet	15 feet	15 feet
Fixed Gases (ASTM D-1946)[a]	Units									
Carbon Dioxide	%	17	25	13	4.8	1.7	2.9	10	5.5	16
Carbon Monoxide	%	0.002	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Methane	%	0.0068	1.8	**13**	1.7	0.56	1.2	1	1.3	0.00083
Nitrogen	%	82	70	63	82	77	85	86	89	78
Oxygen	%	2.3	3.6	1.7	1.5	12	1.4	1.6	3.2	3.9

NOTES:

U = indicates the analyte was not detected at or above the stated limit.
LEL = lower explosive limit
% = percent
VOC = volatile organic compound
AA3 = Anomaly Area 3
RSE = Removal Site Evaluation
ASTM = American Society of Testing and Materials
bgs = below ground surface

[a] Based on the field screening results of the gas monitor, 10 percent of soil gas samples (9 samples) were analyzed for fixed gases.
[b] All subsurface soil gas samples were analyzed for VOCs in a mobile laboratory. However, all were below their respective
Methane concentration in **bold** indicates that it has exceeded the LEL threshold limit of 5 percent.

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6.3.3.1 ROUND 1

The December 2002 soil gas sampling event represents the first of four quarterly sampling events as proposed in the Work Plan. Samples were screened for VOC concentrations with a FID and fixed gas monitor, and these field measurements are presented in Table 6-9. Appendix B presents the complete data sets for Round 1 perimeter soil gas samples. Table 6-10 presents the summarized detected results for the Round 1 perimeter soil gas samples collected as part of this RSE investigation. Figure 6-8 shows the spatial extent of perimeter soil gas analyte detections.

Table 6-9: Summary of Field Screening Results – Round 1 (December 2002) Perimeter Soil Gas Sampling – Round 1 RSE Investigation

Well ID	Sample ID	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Lower Explosive Limit (%)	Flame Ionization Detector Reading (ppm)
PZ1	LK266	0.0	2.5	17.4	0.0	0.0
PZ1	LK277	0.0	2.5	17.4	0.0	0.0
PZ2	LK265	0.0	2.7	17.5	0.0	0.0
PZ3	LK268	0.0	3.8	16.2	0.0	0.0
PG01S	LK269	0.0	1.0	19.2	0.0	0.0
PG01M	LK270	0.0	1.7	18.6	0.0	0.0
PG01D	LK271	0.0	1.6	18.1	0.0	0.0
PG02S	LK272	0.0	0.6	18.9	0.0	0.0
PG02M	LK273	0.0	1.1	18.3	0.0	0.0
PG02D	LK274	0.0	2.0	17.5	0.0	0.0
PG03S	LK275	0.0	0.3	19.3	0.0	5.0
PG03M	LK277	0.0	1.3	18.6	0.0	35.2
PG03D	LK276	0.0	1.3	18.6	0.0	35.2
PG03D	LK278	0.0	2.3	18.1	0.0	0.0

Notes:
% = percent
ID = identification
ppm = parts per million
RSE = removal site evaluation

Most of the detected analytes were below 1 µg/L, with the exception of tetrahydrofuran, 2-butanone, and acetone. All the maximum concentrations for the analytes cited above were from Samples LK276 and LK277 (duplicate) collected from the intermediate zone (screened from 14 feet to 16 feet bgs) at Well PG03. The tetrahydrofuran and 2-butanone concentrations seem to be contributions from well construction materials used to install the vapor wells. Section 6.3.2 presents the subsurface soil gas sampling (soil gas survey) results from within the debris placement area. None of the subsurface soil gas samples collected as part of the soil gas survey at 15 feet bgs, particularly HA09 and HA13, located less than 50 feet from Vapor Well PG03, had detectable concentrations of VOCs or methane. This suggests that the concentrations of these analytes in the intermediate zone at PG03 were not due to contributions from the AA 3 subsurface. All samples collected from the shallow zone (screened from 5 feet to 7 feet bgs) had less than 1 µg/L of detected VOC concentrations, with the exception of LK275, which had tetrahydrofuran concentrations of 26.98 µg/L. Similarly, all samples collected from the deep zone (screened from 20 feet to 22 feet bgs) had less than 1 µg/L of detected VOC concentrations, with the exception of LK274, which had tetrahydrofuran concentrations of 12.89 µg/L. With the exception of tetrahydrofuran, 2-butanone, and acetone, there were no other detections of any of the other compounds greater than 1 µg/L in samples collected from the shallow, intermediate, and deep zones along the site perimeter. It should be noted that, as

described above in Section 6.3.1, no VOCs were detected in any of the shallow soil gas samples collected from within the debris placement boundary. These results indicate that the debris placed at the site is not impacting perimeter soil gas in the shallow zone.

Methane was not detected in any of the 14 samples collected from these wells and analyzed in the laboratory. Title 27 CCR stipulates that methane concentrations migrating from the landfill should not exceed the LEL in air at the site property boundary (LEL for methane – 5 percent by volume or 50,000 ppm_v for soil vapor).

Two rounds (4 November 1999 and 24 July 2000) of perimeter soil gas samples were collected from PZ1 through PZ3 as part of the previous investigations. The summary of results from the previous investigations is presented in Table 3-2 of this Report. Analyses were not performed for analytes such as ethanol, 2-propanol, hexane, and tetrahydrofuran in the previous investigations. However, all the detected concentrations from the previous investigations were less than 1 µg/L, and are consistent with the results of the RSE investigation.

6.3.3.2 Round 2

The second round of perimeter soil gas sampling was conducted on 20 and 21 March 2003. Fifteen soil gas samples (including three duplicate samples) were collected from twelve perimeter soil gas wells. The samples were screened for VOC concentrations with a FID and fixed gas monitor. These field measurements are presented in Table 6-11. These soil gas samples were also sent to a fixed laboratory for VOC and fixed gas analysis. Appendix B presents the complete data set for the Round 2 perimeter soil gas samples. Table 6-12 presents the summarized detected results for the Round 2 perimeter soil gas samples. Consistent with Round 1, methane was not detected in any of the Round 2 samples analyzed in the field and was detected in only one of the fourteen soil gas samples that were analyzed in the laboratory at a very low concentration of 1.9 ppm_v. The relatively higher concentrations of VOCs detected in Round 1 were reduced significantly during the Round 2 sampling. The maximum concentration of tetrahydrofuran detected in Well PG03 (intermediate depth) was reduced from 74 µg/L (Round 1) to 3.896 µg/L (duplicate – 4.796 µg/L) (Round 2). Table 6-13 presents the statistics of detected analytes in the Round 1 and Round 2 perimeter soil gas samples.

6.3.3.3 Rounds 3 through Round 8

The Round 3 soil gas monitoring was conducted on 29 July 2003. The Round 4 soil gas monitoring was conducted on 25 November 2003. On 8 April 2004, during the site visit of the BCT members, including the CIWMB representatives, Round 5 soil gas monitoring was conducted. During the Round 5 monitoring event, gas readings were also recorded from the manhole that is present near AA 3. Round 6 soil gas monitoring was conducted on 8 July 2004; Round 7 soil gas monitoring was conducted on 12 October 2004; and, Round 8 soil gas monitoring was conducted on 23 February 2005.

None of the perimeter soil gas samples from Round 3 through Round 8 was sent to a fixed laboratory since none of the soil gas samples exceeded the 25 ppm_v FID field instrument reading. This requirement was stated in Section A-2.2.3.2 of the RSE Work Plan. The RSE SAP states that after two rounds of sampling, only those samples with FID readings above 25 ppm_v will be sent to a fixed laboratory. Field screening measurements of Round 3 soil gas samples (using a FID and fixed gas monitor) are presented in Tables 6-14 through 6-19. Consistent with the previous two rounds, methane was not detected in any of the Round 3 through Round 8 samples.

Table 6-10: Summary of Detected Analytes - Round 1 Perimeter Soil Gas Sampling - RSE Investigation

	Sample ID:	LK269	LK272	LK275	LK270	LK273	LK276	LK277	LK266	LK267	LK265	LK268	LK271	LK274	LK278
	Location ID:	AA3-PG01S	AA3-PG02S	AA3-PG03S	AA3-PG01M	AA3-PG02M	AA3-PG03M	AA3-PG03M	AA3-PZ01	AA3-PZ01	AA3-PZ02	AA3-PZ03	AA3-PG01D	AA3-PG02D	AA3-PG03D
	Sample Type:	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular	Duplicate	Regular	Regular	Regular	Regular	Regular
Parameter	Sampling Date:	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002
VOCs (EPA Method TO-14)	Units	Shallow Zone (5 feet to 7 feet bgs)			Intermediate Zone (14 feet to 16 feet bgs)				Deep Zone (greater than 16 feet bgs)						
1,2,4-Trimethylbenzene	µg/L	0.004	0.005 U	0.165 U	0.006	0.020 U	0.500 U	0.385 U	0.002 J	0.009	0.005	0.010	0.005	0.085 U	0.003
1,3,5-Trimethylbenzene	µg/L	0.002 U	0.005 U	0.165 U	0.005 U	0.020 U	0.500 U	0.385 U	0.002 U	0.003 U	0.200 U	0.003	0.200 U	0.085 U	0.200 U
2-Butanone (Methyl Ethyl Ketone)	µg/L	0.008	0.084	0.569	0.033	0.102	19.183	17.684	0.060	0.042	0.051	0.069	0.026	0.201 U	0.006 U
2-Propanol	µg/L	0.042	0.040	0.325 U	0.032	0.040	0.999 U	0.774 U	0.032	0.027	0.032	0.021	0.030	0.167 U	0.047
Acetone	µg/L	0.009	0.022	0.314 U	0.036	0.060	5.553	5.070	0.016	0.012	0.014	0.021	0.021	0.162 U	0.013
Benzene	µg/L	0.002 U	0.003 U	0.107 U	0.003 J	0.013 U	0.325 U	0.250 U	0.004	0.003	0.004	0.007	0.002 U	0.055 U	0.004
Carbon Disulfide	µg/L	0.006 U	0.013 U	0.411 U	0.013 U	0.051 U	1.266 U	0.981 U	0.009	0.009 U	0.007	0.006 U	0.007	0.212 U	0.020
Chloromethane	µg/L	0.001 U	0.002 U	0.069 U	0.006	0.008 U	0.210 U	0.162 U	0.001 U	0.010 U	0.001 U	0.003	0.002	0.036 U	0.001 U
Ethanol	µg/L	0.006	0.008 U	0.249 U	0.023	0.031 U	0.766 U	0.594 U	0.004	0.005 U	0.004 U	0.008	0.005	0.128 U	0.007
Ethyl Benzene	µg/L	0.002 U	0.004 U	0.146 U	0.004 U	0.018 U	0.441 U	0.340 U	0.002 U	0.003 U	0.002 U	0.004	0.002	0.075 U	0.002 U
Freon 12	µg/L	0.003	0.005 U	0.166 U	0.005 U	0.020 U	0.503 U	0.387 U	0.016	0.015	0.131	0.004	0.003	0.085 U	0.003
Heptane	µg/L	0.008 U	0.017 U	0.542 U	0.017 U	0.067 U	1.666 U	1.291 U	0.008 U	0.011 U	0.008 U	0.018	0.008 U	0.279 U	0.008 U
Hexane	µg/L	0.007 U	0.014 U	0.466 U	0.014 U	0.057 U	1.433 U	1.110 U	0.007 U	0.010 U	0.007 U	0.007 U	0.007 U	0.240 U	0.012
m,p-Xylene	µg/L	0.007	0.006	0.146 U	0.011	0.018 U	0.441 U	0.340 U	0.003	0.005	0.006	0.018	0.010	0.075 U	0.005
Methylene Chloride	µg/L	0.010	0.010	0.117 U	0.008	0.014 U	0.353 U	0.272 U	0.008	0.010	0.009	0.099	0.011	0.060 U	0.011
o-Xylene	µg/L	0.002 U	0.004 U	0.146 U	0.004 U	0.018 U	0.441 U	0.340 U	0.002 U	0.003 U	0.002	0.007	0.003	0.075 U	0.002 U
Tetrachloroethene	µg/L	0.003 U	0.007 U	0.228 U	0.007 U	0.028 U	0.689 U	0.531 U	0.003 U	0.005 U	0.006	0.003 U	0.003 U	0.117 U	0.003 U
Tetrahydrofuran	µg/L	0.093	0.989	26.976	0.569	3.896	74.933	65.941	0.216	0.141	0.210	0.243	0.300	12.888	0.007
Toluene	µg/L	0.008	0.007	0.126 U	0.011	0.015 U	0.383 U	0.295 U	0.007	0.007	0.008	0.172	0.012	0.065 U	0.010
	Total VOCs (µg/L)[a]	**0.190**	**1.15**	**27.55**	**0.74**	**4.10**	**99.67**	**88.70**	**0.38**	**0.27**	**0.49**	**0.71**	**0.44**	**12.89**	**0.14**
Fixed Gases (ASTM D-1946)[b]															
Carbon Dioxide	%	1.8	1.3	1.1	2.3	1.9	2.2	2.2	0.31	3.9	4	4.6	0.44	2.8	3
Nitrogen	%	77	78	78	77	79	80	78	77	76	77	77	79	78	78
Oxygen	%	19	19	19	18	19	19	18	17	17	18	16	20	17	18

NOTES:

µg/L = micrograms per liter
% = percent
VOC = volatile organic compound
ASTM = American Society of Testing and Materials
bgs = below ground surface

AA3 = Anomaly Area 3
RSE = Removal Site Evaluation
U = indicates the analyte was not detected at or above the stated limit.
EPA = Environmental Protection Agency
ID = identification

[a] The hot spot threshold concentration for the RSE investigation soil gas samples was defined as 300 µg/L of total VOCs.

All perimeter soil gas samples were analyzed for methane; however, all were below reporting limits and are not presented in this summary table.

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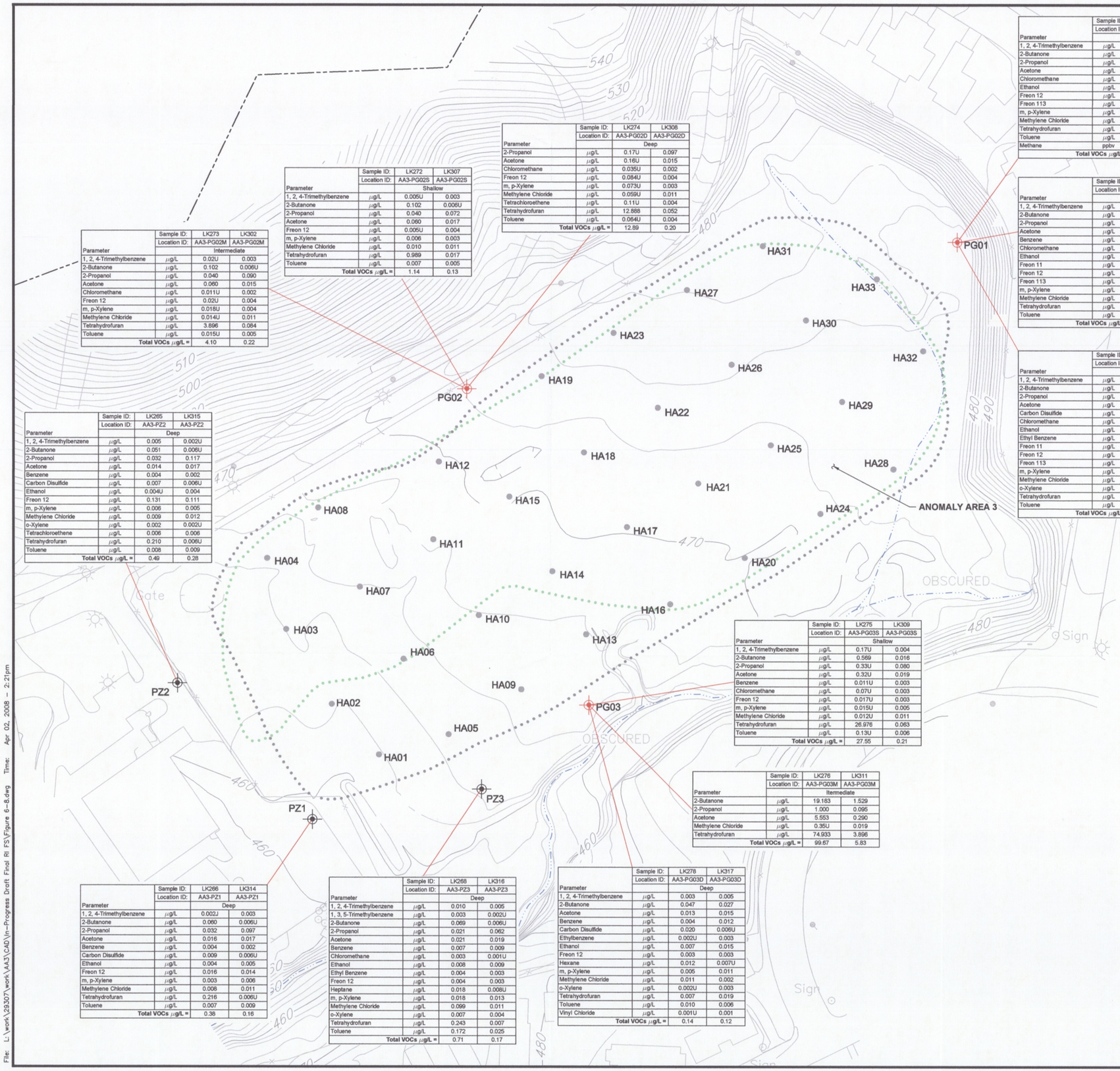

Parameter	Sample ID: / Location ID:	LK273 / AA3-PG02M	LK302 / AA3-PG02M
		Intermediate	
1, 2, 4-Trimethylbenzene	µg/L	0.02U	0.003
2-Butanone	µg/L	0.102	0.006U
2-Propanol	µg/L	0.040	0.090
Acetone	µg/L	0.060	0.015
Chloromethane	µg/L	0.011U	0.002
Freon 12	µg/L	0.02U	0.004
m, p-Xylene	µg/L	0.018U	0.004
Methylene Chloride	µg/L	0.014U	0.011
Tetrahydrofuran	µg/L	3.896	0.084
Toluene	µg/L	0.015U	0.005
Total VOCs µg/L =		4.10	0.22

Parameter	Sample ID: / Location ID:	LK272 / AA3-PG02S	LK307 / AA3-PG02S
		Shallow	
1, 2, 4-Trimethylbenzene	µg/L	0.005U	0.003
2-Butanone	µg/L	0.102	0.006U
2-Propanol	µg/L	0.040	0.072
Acetone	µg/L	0.060	0.017
Freon 12	µg/L	0.005U	0.004
m, p-Xylene	µg/L	0.006	0.003
Methylene Chloride	µg/L	0.010	0.011
Tetrahydrofuran	µg/L	0.989	0.017
Toluene	µg/L	0.007	0.005
Total VOCs µg/L =		1.14	0.13

Parameter	Sample ID: / Location ID:	LK274 / AA3-PG02D	LK308 / AA3-PG02D
		Deep	
2-Propanol	µg/L	0.17U	0.097
Acetone	µg/L	0.16U	0.015
Chloromethane	µg/L	0.035U	0.002
Freon 12	µg/L	0.084U	0.004
m, p-Xylene	µg/L	0.073U	0.003
Methylene Chloride	µg/L	0.059U	0.011
Tetrachloroethene	µg/L	0.11U	0.004
Tetrahydrofuran	µg/L	12.888	0.052
Toluene	µg/L	0.064U	0.004
Total VOCs µg/L =		12.89	0.20

Parameter	Sample ID: / Location ID:	LK265 / AA3-PZ2	LK315 / AA3-PZ2
		Deep	
1, 2, 4-Trimethylbenzene	µg/L	0.005	0.002U
2-Butanone	µg/L	0.051	0.006U
2-Propanol	µg/L	0.032	0.117
Acetone	µg/L	0.014	0.017
Benzene	µg/L	0.004	0.002
Carbon Disulfide	µg/L	0.007	0.006U
Ethanol	µg/L	0.004U	0.004
Freon 12	µg/L	0.131	0.111
m, p-Xylene	µg/L	0.006	0.005
Methylene Chloride	µg/L	0.009	0.012
o-Xylene	µg/L	0.002	0.002U
Tetrachloroethene	µg/L	0.006	0.006
Tetrahydrofuran	µg/L	0.210	0.006U
Toluene	µg/L	0.008	0.009
Total VOCs µg/L =		0.49	0.28

Parameter	Sample ID: / Location ID:	LK269 / AA3-PG01S	LK304 / AA3-PG01S
		Shallow	
1, 2, 4-Trimethylbenzene	µg/L	0.004	0.002U
2-Butanone	µg/L	0.008	0.006U
2-Propanol	µg/L	0.042	0.087
Acetone	µg/L	0.009	0.020
Chloromethane	µg/L	0.001U	0.002
Ethanol	µg/L	0.006	0.004
Freon 12	µg/L	0.003	0.003
Freon 113	µg/L	0.004U	0.009
m, p-Xylene	µg/L	0.007	0.003
Methylene Chloride	µg/L	0.010	0.014
Tetrahydrofuran	µg/L	0.093	0.012
Toluene	µg/L	0.006	0.005
Methane	ppbv	2.1U	1.9
Total VOCs µg/L =		0.19	0.16

Parameter	Sample ID: / Location ID:	LK270 / AA3-PG01M	LK305 / AA3-PG01M
		Intermediate	
1, 2, 4-Trimethylbenzene	µg/L	0.006	0.004
2-Butanone	µg/L	0.033	0.006U
2-Propanol	µg/L	0.032	0.057
Acetone	µg/L	0.036	0.016
Benzene	µg/L	0.003	0.002U
Chloromethane	µg/L	0.006	0.001U
Ethanol	µg/L	0.023	0.004U
Freon 11	µg/L	0.0057U	0.003
Freon 12	µg/L	0.005U	0.005
Freon 113	µg/L	0.0078U	0.027
m, p-Xylene	µg/L	0.011	0.004
Methylene Chloride	µg/L	0.008	0.011
Tetrahydrofuran	µg/L	0.569	0.022
Toluene	µg/L	0.011	0.002
Total VOCs µg/L =		0.74	0.15

Parameter	Sample ID: / Location ID:	LK271 / AA3-PG01D	LK303 / AA3-PG01D
		Deep	
1, 2, 4-Trimethylbenzene	µg/L	0.005	0.003
2-Butanone	µg/L	0.026	0.054
2-Propanol	µg/L	0.030	0.055
Acetone	µg/L	0.021	0.021
Carbon Disulfide	µg/L	0.007	0.006U
Chloromethane	µg/L	0.002	0.002
Ethanol	µg/L	0.005	0.004U
Ethyl Benzene	µg/L	0.002	0.002U
Freon 11	µg/L	0.003U	0.004
Freon 12	µg/L	0.003	0.006
Freon 113	µg/L	0.004U	0.028
m, p-Xylene	µg/L	0.010	0.003
Methylene Chloride	µg/L	0.011	0.007
o-Xylene	µg/L	0.003	0.002U
Tetrahydrofuran	µg/L	0.300	0.123
Toluene	µg/L	0.012	0.004
Total VOCs µg/L =		0.44	0.31

Parameter	Sample ID: / Location ID:	LK275 / AA3-PG03S	LK309 / AA3-PG03S
		Shallow	
1, 2, 4-Trimethylbenzene	µg/L	0.17U	0.004
2-Butanone	µg/L	0.569	0.016
2-Propanol	µg/L	0.33U	0.080
Acetone	µg/L	0.32U	0.019
Benzene	µg/L	0.011U	0.003
Chloromethane	µg/L	0.07U	0.003
Freon 12	µg/L	0.017U	0.003
m, p-Xylene	µg/L	0.015U	0.005
Methylene Chloride	µg/L	0.012U	0.011
Tetrahydrofuran	µg/L	26.976	0.063
Toluene	µg/L	0.13U	0.006
Total VOCs µg/L =		27.55	0.21

Parameter	Sample ID: / Location ID:	LK276 / AA3-PG03M	LK311 / AA3-PG03M
		Itermediate	
2-Butanone	µg/L	19.183	1.529
2-Propanol	µg/L	1.000	0.095
Acetone	µg/L	5.553	0.290
Methylene Chloride	µg/L	0.35U	0.019
Tetrahydrofuran	µg/L	74.933	3.896
Total VOCs µg/L =		99.67	5.83

Parameter	Sample ID: / Location ID:	LK266 / AA3-PZ1	LK314 / AA3-PZ1
		Deep	
1, 2, 4-Trimethylbenzene	µg/L	0.002J	0.003
2-Butanone	µg/L	0.060	0.006U
2-Propanol	µg/L	0.032	0.097
Acetone	µg/L	0.016	0.017
Benzene	µg/L	0.004	0.002
Carbon Disulfide	µg/L	0.009	0.006U
Ethanol	µg/L	0.004	0.005
Freon 12	µg/L	0.016	0.014
m, p-Xylene	µg/L	0.003	0.006
Methylene Chloride	µg/L	0.008	0.011
Tetrahydrofuran	µg/L	0.216	0.006U
Toluene	µg/L	0.007	0.009
Total VOCs µg/L =		0.38	0.16

Parameter	Sample ID: / Location ID:	LK268 / AA3-PZ3	LK316 / AA3-PZ3
		Deep	
1, 2, 4-Trimethylbenzene	µg/L	0.010	0.005
1, 3, 5-Trimethylbenzene	µg/L	0.003	0.002U
2-Butanone	µg/L	0.069	0.006U
2-Propanol	µg/L	0.021	0.062
Acetone	µg/L	0.021	0.019
Benzene	µg/L	0.007	0.009
Chloromethane	µg/L	0.003	0.001U
Ethanol	µg/L	0.008	0.009
Ethyl Benzene	µg/L	0.004	0.003
Freon 12	µg/L	0.004	0.003
Heptane	µg/L	0.018	0.006U
m, p-Xylene	µg/L	0.018	0.013
Methylene Chloride	µg/L	0.099	0.011
o-Xylene	µg/L	0.007	0.004
Tetrahydrofuran	µg/L	0.243	0.007
Toluene	µg/L	0.172	0.025
Total VOCs µg/L =		0.71	0.17

Parameter	Sample ID: / Location ID:	LK278 / AA3-PG03D	LK317 / AA3-PG03D
		Deep	
1, 2, 4-Trimethylbenzene	µg/L	0.003	0.005
2-Butanone	µg/L	0.047	0.027
Acetone	µg/L	0.013	0.015
Benzene	µg/L	0.004	0.012
Carbon Disulfide	µg/L	0.020	0.006U
Ethylbenzene	µg/L	0.002U	0.003
Ethanol	µg/L	0.007	0.015
Freon 12	µg/L	0.003	0.003
Hexane	µg/L	0.012	0.007U
m, p-Xylene	µg/L	0.005	0.011
Methylene Chloride	µg/L	0.011	0.002
o-Xylene	µg/L	0.002U	0.003
Tetrahydrofuran	µg/L	0.007	0.019
Toluene	µg/L	0.010	0.006
Vinyl Chloride	µg/L	0.001U	0.001
Total VOCs µg/L =		0.14	0.12

LEGEND

- MINOR SURFACE ELEVATION: 2-FOOT INTERVALS
- 460 — MAJOR SURFACE ELEVATION: 10-FOOT INTERVALS
- MCAS EL TORO BOUNDARY
- EXISTING STREAM OR WASH
- ESTIMATED EXTENT OF WASTE PLACEMENT FOR RSE INVESTIGATION
- REVISED ESTIMATED EXTENT OF WASTE PLACEMENT BASED ON TRENCHING ACTIVITY (MARCH 2000 AND OCTOBER 2002)
- HA31 — RSE SOIL/SOIL VAPOR SAMPLING LOCATIONS FIELD SCREENING METHANE READING (PERCENT)
- PG01 — RSE PERIMETER GAS MONITORING WELL LOCATION
- PZ3 — EXISTING VADOSE ZONE WELL
- U — NOT DETECTED AT THE THRESHOLD INDICATED

NOTES

1. TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHOD FROM AERIAL PHOTOGRAPHY DATED DECEMBER 2001 BY SAN-LO AERIAL SURVEYS.
2. COORDINATES ARE IN CALIFORNIA STATE PLANE COORDINATE SYSTEM, NAD 83, ZONE 6.
3. ELEVATIONS IN FEET; BENCHMARK BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
4. FIELD SCREENING READINGS OF METHANE WERE ZERO AT ALL LOCATIONS.

NORTH

60 0 60 120 FEET

SCALE: 1" = 60'

RI/FS Report — Draft Final

Detected Perimeter Soil Gas Sampling Results - Rounds 1 and 2 RSE Investigation

Anomaly Area 3

Date: 04-08 | Former MCAS El Toro | Figure 6-8

Project No. 29307 | EarthTech — A tyco International Ltd. Company

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Table 6-11: Summary of Field Screening Results – Round 2 (March 2003) Perimeter Soil Gas Sampling – RSE Investigation

Well ID	Sample ID	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Lower Explosive Limit (%)	Flame Ionization Detector Reading (ppm)
PZ1	LK314	0.0	3.6	17.0	0.0	0.0
PZ2	LK315	0.0	3.6	17.6	0.0	0.0
PZ3	LK316	0.0	4.2	16.6	0.0	0.0
PG01S	LK304	0.0	1.4	17.5	0.0	1.1
PG01M	LK305	0.0	6.8	10.2	0.0	1.2
PG01D	LK303	0.0	4.6	12.8	0.0	0.0
PG02S	LK306	0.0	2.5	17.6	0.0	0.4
PG02M	LK307	0.0	2.6	17.3	0.0	3.0
PG02D	LK308	0.0	3.1	17.0	0.0	1.8
PG03S	LK309	0.0	2.4	18.1	0.0	4.4
PG03S	LK310	0.0	2.4	18.1	0.0	4.4
PG03M	LK311	0.0	2.5	17.7	0.0	6.6
PG03M	LK312	0.0	2.5	17.7	0.0	6.6
PG03D	LK313	0.0	3.0	17.6	0.0	3.8
PG03D	LK317	—	—	—	—	—

Notes:
% = percent
ID = identification
ppm = parts per million
RSE = removal site evaluation

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Table 6-12: Summary of Detected Analytes - Round 2 Perimeter Soil Gas Sampling - RSE Investigation

PARAMETER		Sample ID:	LK304	LK306	LK309	LK310	LK305	LK307	LK311	LK312	LK314	LK315	LK316	LK303	LK308	LK317
		Location ID:	AA3-PG01S	AA3-PG02S	AA3-PG03S	AA3-PG03S	AA3-PG01M	AA3-PG02M	AA3-PG03M	AA3-PG03M	AA3-PZ01	AA3-PZ02	AA3-PZ03	AA3-PG01D	AA3-PG02D	AA3-PG03D
		Sample Type:	Regular	Regular	Regular	Duplicate	Regular	Regular	Regular	Duplicate	Regular	Regular	Regular	Regular	Regular	Duplicate
		Sampling Date:	3/20/2003	3/20/2003	3/20/2003	3/20/2003	3/20/2003	3/20/2003	3/20/2003	3/20/2003	3/21/2003	3/21/2003	3/21/2003	3/20/2003	3/20/2003	3/20/2003
VOCs	Units	Method	Shallow Zone (5 feet to 7 feet bgs)				Intermediate Zone (14 feet to 16 feet bgs)				Deep Zone (greater than 16 feet bgs)					
1,2,4-Trimethylbenzene	µg/L	TO-14A	0.002 U	0.003	0.004	0.002 U	0.004	0.003	0.025 U	0.020 U	0.003	0.002 U	0.005	0.003	0.002 U	0.005
2-Butanone (Methyl Ethyl Ketone)	µg/L	TO-14A	0.006 U	0.006 U	0.016	0.006 U	0.006 U	0.006 U	1.529	1.798	0.006 U	0.006 U	0.006 U	0.054	0.006 U	0.006 U
2-Propanol	µg/L	TO-14A	0.087	0.072	0.080	0.075	0.057	0.090	0.095	0.097	0.097	0.117	0.062	0.055	0.097	0.027
Acetone	µg/L	TO-14A	0.020	0.017	0.019	0.012	0.016	0.015	0.290	0.290	0.017	0.017	0.019	0.021	0.015	0.015
Benzene	µg/L	TO-14A	0.002 U	0.002 U	0.003	0.002 U	0.002 U	0.002 U	0.016 U	0.013 U	0.002	0.002	0.009	0.002 U	0.002 U	0.012
Chloromethane	µg/L	TO-14A	0.002	0.001 U	0.003	0.003	0.001 U	0.002	0.010 U	0.008 U	0.001 U	0.001 U	0.001 U	0.002	0.002	0.001 U
Ethanol	µg/L	TO-14A	0.004	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.038 U	0.031 U	0.005	0.004	0.009	0.004 U	0.004 U	0.015
Ethyl Benzene	µg/L	TO-14A	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.022 U	0.018 U	0.002 U	0.002 U	0.003	0.002 U	0.002 U	0.003
Freon 11	µg/L	TO-14A	0.003 U	0.003 U	0.003 U	0.003 U	0.003	0.003 U	0.029 U	0.023 U	0.003 U	0.003 U	0.003 U	0.004	0.003 U	0.003 U
Freon 113	µg/L	TO-14A	0.009	0.004 U	0.004 U	0.004 U	0.027	0.004 U	0.039 U	0.031 U	0.004 U	0.004 U	0.004 U	0.028	0.004 U	0.004 U
Freon 12	µg/L	TO-14A	0.003	0.004	0.003	0.003	0.005	0.004	0.025 U	0.020 U	0.014	0.111	0.003	0.006	0.004	0.003
m,p-Xylene	µg/L	TO-14A	0.003	0.003	0.005	0.003	0.004	0.004	0.022 U	0.018 U	0.006	0.005	0.013	0.003	0.003	0.011
Methylene Chloride	µg/L	TO-14A	0.014	0.011	0.011	0.007	0.011	0.011	0.019	0.014 U	0.011	0.012	0.011	0.007	0.011	0.002
o-Xylene	µg/L	TO-14A	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.022 U	0.018 U	0.002 U	0.002 U	0.004	0.002 U	0.002 U	0.003
Tetrachloroethene	µg/L	TO-14A	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.034 U	0.028 U	0.003 U	0.006	0.003 U	0.003 U	0.004	0.003 U
Tetrahydrofuran	µg/L	TO-14A	0.012	0.017	0.063	0.011	0.022	0.084	3.896	4.796	0.006 U	0.006 U	0.007	0.123	0.057	0.006 U
Toluene	µg/L	TO-14A	0.005	0.005	0.006	0.005	0.005	0.005	0.019 U	0.015 U	0.009	0.009	0.025	0.004	0.004	0.019
Trichloroethene	µg/L	TO-14A	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.027 U	0.022 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.006
Vinyl Chloride	µg/L	TO-14A	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.013 U	0.010 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001
		Total VOCs (µg/L)[a]	**0.16**	**0.13**	**0.21**	**0.12**	**0.15**	**0.22**	**5.83**	**6.98**	**0.16**	**0.28**	**0.17**	**0.31**	**0.20**	**0.12**
Fixed Gases																
Carbon Dioxide	%	ASTM D-1946	2	2	1.9	1.9	10	2.1	2.1	2	3	3.1	3.2	12	2.6	2.4
Methane	%	ASTM D-1946	0.00019	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U
	ppmv		1.9	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Nitrogen	%	ASTM D-1946	77	75	76	74	77	76	75	75	74	74	75	77	75	75
Oxygen	%	ASTM D-1946	18	18	19	19	8	18	18	18	18	18	18	6.2	18	19

NOTES:

µg/L = micrograms per liter
% = percent
VOC = volatile organic compound
ASTM = American Society of Testing and Materials
bgs = below ground surface
LEL = lower explosive limit

AA3 = Anomaly Area 3
RSE = removal site evaluation
U = indicates the analyte was not detected at or above the stated limit.
J = indicates an estimated value.
ppm_v = parts per million by volume

[a] The hot spot threshold concentration for the RSE investigation soil gas samples was defined as 300 µg/L of total VOCs.
The LEL threshold value for methane is 5 % or 50,000 ppmv

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Table 6-13: Statistics of Detected Analytes – Rounds 1 and 2 Perimeter Soil Gas Sampling – RSE Investigation

	Shallow Zone (5 feet to 7 feet bgs)				Intermediate Zone (14 feet to 16 feet bgs)				Deep Zone (greater than 16 feet bgs)			
Analyte	Number of Samples Analyzed [a]	Number of Detections	Minimum and Maximum Detected Concentrations (µg/L)	Frequency of Detection (%)	Number of Samples Analyzed [a]	Number of Detections	Minimum and Maximum Detected Concentrations (µg/L)	Frequency of Detection (%)	Number of Samples Analyzed [a]	Number of Detections	Minimum and Maximum Detected Concentrations (µg/L)	Frequency of Detection (%)
1,2,4-Trimethylbenzene	7	3	0.003 - 0.004	43	8	3	0.003 - 0.006	38	13	10	0.003 - 0.010	77
1,3,5-Trimethylbenzene	7	0	-	0	8	0	-	0	13	1	0.003	8
2-Butanone	7	4	0.008 - 0.569	57	8	6	0.033 - 19.183	75	13	6	0.026 - 0.069	46
2-Propanol	7	6	0.040 - 0.087	86	8	6	0.032 - 0.097	75	13	11	0.021 - 0.117	85
Acetone	7	6	0.009 - 0.022	86	8	8	0.016 - 5.553	100	13	12	0.012 - 0.021	92
Benzene	7	1	0.003	14	8	1	0.003 J	13	13	9	0.002 - 0.007	69
Carbon Disulfide	7	0	-	0	8	0	-	0	13	4	0.007 - 0.020	31
Chloromethane	7	3	0.002 - 0.003	43	8	2	0.002 - 0.006	25	13	4	0.002 - 0.003	31
Ethanol	7	2	0.004 - 0.006	29	8	1	0.023	13	13	8	0.004 - 0.015	62
Ethyl Benzene	7	0	-	0	8	0	-	0	13	4	0.002 - 0.004	31
Freon 11	7	0	-	0	8	1	0.003	13	13	1	0.004	8
Freon 113	7	1	0.009	14	8	1	0.027	13	13	1	0.028	8
Freon 12	7	5	0.003 - 0.004	71	8	2	0.004 - 0.005	25	13	12	0.003 - 0.131	92
Heptane	7	0	-	0	8	0	-	0	13	1	0.018	8
Hexane	7	0	-	0	8	0	-	0	13	1	0.012	8
m,p-Xylene	7	6	0.003 - 0.007	86	8	1	0.011	13	13	12	0.003 - 0.018	92
Methylene Chloride	7	6	0.010 - 0.014	86	8	4	0.008 - 0.019	50	13	8	0.002 - 0.011	62
o-Xylene	7	0	-	0	8	0	-	0	13	5	0.003 - 0.007	38
Tetrachloroethane	7	0	-	0	8	0	-	0	13	3	0.004 - 0.006	23
Tetrahydrofuran	7	7	-26.976	100	8	8	0.022 - 74.933	100	13	13	0.007 - 12.888	100
Toluene	7	6	-0.008	86	8	3	0.005 - 0.011	38	13	12	0.004 - 0.172	92
Trichloroethene	7	0	-	0	8	0	-	0	13	1	0.006	8
Vinyl Chloride	7	0	-	0	8	0	-	0	13	1	0.001	8

Notes:

[a] Number of samples analyzed for the specified analyte, including duplicates, if any.

µg/L = micrograms per liter

RSE = removal site evaluation

% = percent

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Table 6-14: Summary of Field Screening Results – Round 3 (July 2003) Perimeter Soil Gas Sampling – RSE Investigation

Well ID	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Lower Explosive Limit (%)	Flame Ionization Detector Reading (ppm)
PZ1	0.0	1.6	17.5	0.0	5.0
PZ2	0.0	1.9	17.8	0.0	4.3
PZ3	0.0	2.4	16.7	0.0	4.4
PG01S	0.0	0.0	19.7	0.0	7.6
PG01M	0.0	0.0	19.7	0.0	12.9
PG01D	0.0	0.0	19.7	0.0	0.0
PG02S	0.0	0.0	19.6	0.0	8.6
PG02M	0.0	0.9	18.6	0.0	6.7
PG02D	0.0	1.8	17.9	0.0	7.9
PG03S	0.0	0.5	19.9	0.0	6.6
PG03M	0.0	1.0	19.2	0.0	9.6
PG03D	0.0	1.6	18.6	0.0	5.3

Notes:
% = percent
ID = identification
ppm = parts per million
RSE = removal site evaluation

Table 6-15: Summary of Field Screening Results – Round 4 (November 2003) Perimeter Soil Gas Sampling – RSE Investigation

Well ID	Pressure Reading (inch of water)	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Lower Explosive Limit (%)	Photoionization Detector Reading (ppm)
PZ1	-0.08	0	3.7	16.5	0.0	0.1
PZ2	-0.11	0	3.0	17.5	0.0	0.1
PZ3	-0.06	0	5.0	15.0	0.0	0.1
PG01S	-0.08	0	0.9	19.3	0.0	0.1
PG01M	-0.20	0	9.5	7.4	0.0	0.1
PG01D	-0.14	0	10.8	5.5	0.0	0.1
PG02S	-0.15	0	0.6	19.8	0.0	0.1
PG02M	-0.16	0	1.5	18.9	0.0	0.1
PG02D	-0.15	0	3.2	17.2	0.0	0.3
PG03S	-0.12	0	0.7	19.8	0.0	0.1
PG03M	-0.12	0	1.8	19.0	0.0	4.9
PG03D	+0.01	0	2.5	18.4	0.0	0.1

Notes:
% = percent
ID = identification
+ = plus
ppm = parts per million
RSE = removal site evaluation
- = minus

Table 6-16: Summary of Field Screening Results – Round 5 (April 2004) Perimeter Soil Gas Sampling – RSE Investigation

Well ID	Pressure Reading (inch of water)	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Lower Explosive Limit (%)	Photoionization Detector Reading (ppm)
PZ1	Not recorded					
PZ2	Not recorded					
PZ3	Not recorded					
PG01S	+0.02	0	1.6	19.3	0.0	--
PG01M	+0.08	0	9.0	7.5	0.0	--
PG01D	+0.1	0	12.8	4.8	0.0	--
PG02S	0.0	0	1.8	19.1	0.0	--
PG02M	+0.01	0	1.7	18.8	0.0	--
PG02D	+0.02	0	2.7	18.0	0.0	--
PG03S	0.0	0	0	19.8	0.0	--
PG03M	+0.01	0	1.5	19.7	0.0	--
PG03D	+0.09	0	1.1	20.3	0.0	--
Manhole	0	0	0	0	0	--

Notes:
% = percent
ID = identification
+ = plus
ppm = parts per million
RSE = removal site evaluation
- = minus

Table 6-17: Summary of Field Screening Results – Round 6 (July 2004) Perimeter Soil Gas Sampling – RSE Investigation

Well ID	Pressure Reading (inch of water)	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Lower Explosive Limit (%)	Flame ionization Detector Reading (ppm)
PZ1	-0.03	0	4.8	15.3	0.0	0.0
PZ2	-0.21	0	3.9	16.6	0.0	0.0
PZ3	-0.03	0	4.8	15.3	0.0	0.0
PG01S	-0.37	0	2.4	18.4	0.0	0.3
PG01M	-0.19	0	9.9	3.8	0.0	0.2
PG01D	-0.89	0	12.1	2.2	0.0	Flame out
PG02S	+0.0	0	2.0	19.7	0.0	1.2
PG02M	+0.01	0	2.5	18.4	0.0	0.8
PG02D	+0.02	0	3.8	16.6	0.0	0.8
PG03S	+0.05	0	1.9	19.4	0.0	2.0
PG03M	-0.02	0	2.5	18.8	0.0	1.3
PG03D	+0.0	0	3.0	18.1	0.0	0.4

Notes:
% = percent
ID = identification
+ = plus
ppm = parts per million
RSE = removal site evaluation
- = minus

Table 6-18: Summary of Field Screening Results – Round 7 (October 2004) Perimeter Soil Gas Sampling – RSE Investigation

Well ID	Pressure Reading (inch of water)	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Lower Explosive Limit (%)	Photoionization Detector Reading (ppm)
PZ1	0.0	0	4.1	16.8	0.0	2.2
PZ2	0.0	0	3.5	17.3	0.0	0.0
PZ3	0.0	0	5.6	14.3	0.0	8.3
PG01S	-0.1	0	2.4	18.2	0.0	22.5
PG01M	-0.2	0	10.5	5.4	0.0	14.8
PG01D	-0.2	0	12.5	2.2	0.0	13.1
PG02S	-0.2	0	1.3	18.9	0.0	40.3
PG02M	-0.3	0	2.1	18.4	0.0	9.8
PG02D	-0.2	0	3.5	16.9	0.0	39.7
PG03S	0.0	0	1.5	19.4	0.0	11.1
PG03M	0.0	0	2.8	18.8	0.0	22.3
PG03D	0.0	0	3.0	18.1	0.0	11.6

Notes:
% = percent
ID = identification
+ = plus
ppm = parts per million
RSE = removal site evaluation
- = minus

Table 6-19: Summary of Field Screening Results – Round 8 (February 2005) Perimeter Soil Gas Sampling – RSE Investigation

Well ID	Pressure Reading (inch of water)	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Lower Explosive Limit (%)	Flame ionization Detector Reading (ppm)
PZ1	-0.3	0	0.0	20.5	0.0	0.45
PZ2	+0.38	0	0.0	20.4	0.0	0.5
PZ3	-0.24	0	0.0	20.5	0.0	2.5
PG01S	+1.03	0	0.0	20.6	0.0	0.4
PG01M	+1.06	0	0.0	20.6	0.0	1.65
PG01D	+1.25	0	0.0	20.7	0.0	0.15
PG02S	-0.63	0	0.0	20.5	0.0	1.35
PG02M	+0.12	0	0.0	20.6	0.0	2.27
PG02D	-1.05	0	0.0	20.6	0.0	8.0
PG03S	+0.08	0	0.0	20.6	0.0	1.48
PG03M	+0.11	0	0.0	20.6	0.0	0.0
PG03D	+0.26	0	0.0	20.6	0.0	0.83

Notes:
% = percent
ID = identification
+ = plus
ppm = parts per million
RSE = removal site evaluation
- = minus

6.3.4 Summary of Nature and Extent of Chemical Contamination – Subsurface Soil Gas

None of the 33 shallow soil gas samples collected from within the debris placement boundary, as part of the soil gas survey, had detected concentrations of the 51 VOC analytes and methane. Similarly, none of the 43 subsurface soil gas samples (also collected from within the debris placement boundary as part of the soil gas survey) had any detected concentrations of the 51 VOC analytes. However, the field screening results for the subsurface soil gas samples showed non-detect methane concentrations at 25 of 33 sampling locations, with detected concentrations (at 8 locations) ranging from 6,000 ppm_v to 230,000 ppm_v. The 8 locations with detectable methane concentrations were confined to the central portion of the site, with only 3 central sampling locations (out of 33 total locations) exceeding Title 27 CCR stipulated LEL of 50,000 ppm_v for methane. No methane was detected in any of the perimeter soil gas wells during 8 rounds of sampling. The detection of several VOCs in the perimeter soil vapor wells was inconsistent with the non-detect VOC results in all of the shallow and subsurface soil gas samples collected from within the debris placement boundary.

These results support the initial premise that primarily construction-related debris was placed at AA 3. The results indicate that subsurface methane occurs at depths deeper than 5 feet and is confined to the central portion of the debris placement boundary, and is not migrating. The non-detect VOC results in all 76 shallow and subsurface soil gas samples also indicate that there are no VOCs associated with the site. Additionally, to address the potential for methane migration, the Navy reached an agreement with the Federal Facility Agreement (FFA) signatories (including CIWMB) regarding the engineering and institutional controls pertaining to the landfill gas at AA 3 (see Appendix L).

6.4 SOIL SAMPLING RESULTS

To support the RSE DQO Project Decision #3, surface soil samples were collected to evaluate the risk at the site.

For the purposes of RSE investigation, surface soil samples were defined as samples collected from 0-foot to 1-foot bgs and subsurface soil samples were defined as samples collected from depths greater than 1-foot bgs to the maximum depth of debris placement (35 feet bgs). However, for the purposes of evaluating human health risk, surface samples are defined as ranging from 0-foot to 1-foot bgs and subsurface samples as ranging from depths of 0-foot to 10 feet bgs.

Extensive subsurface soil samples (deeper than 1-foot bgs and ranging between 4 feet to 35 feet bgs) were collected from the exploratory trenches (see Section 3.5, and Tables 3-3 and 3-4) during the previous investigation. Therefore, a data set necessary for estimating the risk due to subsurface contamination was available. In addition, as part of the RSE investigation, provisions to collect subsurface soil samples were made in the sampling design. It was proposed that subsurface soil samples (8 feet to 9 feet bgs) would be collected only if the soil vapor sample at the 5-foot depth had detected concentrations of target analytes. In such a case, soil sampling would continue at 10-foot intervals to the base of the fill. Since none of the shallow soil vapor samples from all 33 locations had detected concentrations of target analytes, soil samples from greater depths were not collected.

During the previous investigation, surface soil samples (0-foot to 1 foot bgs) were not collected. In order to have an adequate data set to evaluate the risk posed due to surface contamination at the site and to support the RSE Decision Rule #3, surface soil samples were collected from the same boreholes that were drilled at the centers of the 100-foot by 100-foot grids as part of the soil gas survey.

This section presents the nature and extent of surface soil samples collected during this RSE investigation, as well as the subsurface soil samples collected during the previous investigation.

6.4.1 Surface Soil Sampling Results - RSE Investigation

Thirty-seven surface soil samples, including four duplicate samples were collected from 0-foot to 1-foot depths. The sample collection details are presented in Appendix B. The complete data sets for the surface soil samples are provided in Appendix B. Summarized detected results (except dioxins/furans) are presented in Table 6-20. Target compounds for dioxin and dioxin-like compounds are the analytes in the WHO list of compounds with toxicity equivalency factors (TEFs). The products of the analyte concentrations and its associated TEFs were summed and compared with the residential and industrial soil PRG for the dioxin 2,3,7,8-tetrachlorodibenzodioxin (TCDD) for the evaluation of dioxin contamination in residential and industrial settings. Dioxin results and details of quantification of total 2,3,7,8-TCDD concentrations for 10 surface soil samples are presented in Table 6-21. Figure 6-9 shows the spatial distribution of the detected analytes in the surface soil at AA 3. All the detected organic compounds are shown on Figure 6-9. Statistics performed on the detected analytes, including a comparison to residential PRGs, is presented in Table 6-22.

None of the 37 samples (including duplicates) analyzed for VOCs had detectable concentrations. Petroleum hydrocarbons were detected at very low concentrations in most locations. Detected SVOCs included bis(2-ethylhexyl)phthalate, diethylphthalate, anthracene, benzo(a)- anthracene, B[a]P, benzo[b]fluoranthene, benzo(g,h,i)perylene, benzo[k]fluoranthene, chrysene, dibenz[a,h]-anthracene, fluoranthene, indeno[1,2,3-c,d]pyrene, phenanthrene, and pyrene (see Table 6-20, Table 6-21, and Figure 6-9). Most of the SVOCs detected were from locations HA01, HA03, HA15, and HA29. The maximum concentrations of SVOCs detected were from location HA15, and 4 of the SVOC detections (benzo[a]anthracene [730 J micrograms per kilogram (µg/kg)], benzo(b)-fluoranthene [1,790 J µg/kg], benzo(k)-fluoranthene [510 J µg/kg], and dibenz(a,h)-anthracene [97 J µg/kg]) exceeded their respective residential PRGs at this location. The B[a]P concentration (1,030J µg/kg) at HA15 exceeded both its residential and industrial PRGs. In summary, only 5 SVOCs at only 1 location (HA15) out of 33 surface soil sampling locations exceeded residential PRGs.

All ten samples that were analyzed for dioxins and furans constituents had detected concentrations. Only two surface samples (regular sample [20.21 pg/g TEQ] and its duplicate [16.67 pg/g TEQ]) collected from location HA26 had total 2,3,7,8-TCDD concentrations exceeding the residential and industrial PRG of 3.9 pg/g and 20 pg/g, respectively. Location HA26 is approximately 50 feet south of the subsurface location (6 feet bgs) of the dioxin detection recorded in the previous investigation. All other samples had total 2,3,7,8-TCDD concentrations of less than 1 pg/g TEQ. In summary, 2,3,7,8-TCDD exceeded its residential PRG at only one out of nine surface soil sampling locations analyzed for dioxins and furans.

The decision input section (Section 4.2.3 of the RSE Work Plan) of the DQO process, specifies that of the total metals detected, only those metals that exceeded former MCAS El Toro background concentrations would be compared with the PRGs. However, even though arsenic was detected in the surface soil at concentrations within former MCAS El Toro background value (6.86 mg/kg) (BNI 1996), it is presented in Table 6-22 since all samples exceeded the residential and industrial PRG values (0.39 mg/kg and 1.6 mg/kg, respectively). Figure 6-9 presents only those detected metals that exceed the former MCAS El Toro background concentrations.

No other metals exceeded the PRG concentrations; however, metals that exceeded former MCAS El Toro background concentrations include aluminum (one sample – 15,800 mg/kg), barium (one sample – 187 mg/kg), cobalt (three samples ranging from 7.3 to 7.6 mg/kg), copper (two samples with 2.8 and 10.8 mg/kg), iron (two samples with 18,400 and 19,100 mg/kg), lead (four samples ranging from 15.5 to 20.7 mg/kg), selenium (twenty-one samples ranging from 0.27 to 1.1 mg/kg), and silver (one sample – 2 mg/kg). In summary, at all thirty-three surface soil sampling locations, all metals analyzed were either less than PRG concentrations or within background concentrations.

6.4.2 Subsurface Soil Sampling – Previous Investigation

As part of the March 2000 exploratory trenching activity at AA 3, 24 subsurface soil samples (including duplicates) were collected. These samples were analyzed for petroleum hydrocarbons, VOCs, SVOCs including PAH compounds, metals, asbestos, and perchlorate. Section 3.5 and Tables 3-3 and 3-4 present details of the subsurface soil sampling. Two out of twenty-four samples were also analyzed for dioxins and furans. For convenience, the summary of detected analytes is presented again in this section as Table 6-23. Table 6-24 presents the frequency of detection of analytes and a comparison with PRGs. The table also presents a comparison of metals to former MCAS El Toro background concentrations and the PRGs. Figure 6-10 presents the spatial distribution of detected analytes.

None of the samples analyzed for asbestos and perchlorate had detectable concentrations. TPHs (diesel range) were detected in 19 of 24 soil samples, with a maximum concentration of 5,600 mg/kg in sample 20242-1102. Detected VOCs include 2-butanone (detected in 17 percent of the samples), acetone (21 percent of the samples), benzene (4 percent of the samples), methylene chloride (33 percent of the samples, and styrene (4 percent of the samples); none of the detected VOCs exceeds residential or industrial PRGs. Sample 20242-111 collected from Trench H5 at a depth of 7 feet bgs reported maximum concentrations of all of the SVOC analytes (benzo[a]anthracene, B[a]P, benzo[b]fluoranthene, chrysene, diethylphthalate, fluoranthene, indeno[1,2,3-cd]pyrene, phenanthrene and pyrene).

The frequency of all SVOC detections was less than 8 percent of the collected samples. Only one SVOC (B[a]P) in only one sample (20242-1111) out of twenty-four samples exceeded its residential PRG. The two samples analyzed for dioxins and furans reported total 2,3,7,8-TCDD (TEQ) concentrations of 0.05 pg/g and 0.42 pg/g, respectively. Both detections are below the 2,3,7,8-TCDD residential PRG of 3.9 pg/g.

In the case of metals, Table 6-24 presents metals that exceeded the PRG values and former MCAS El Toro background concentrations. The metals not listed in Table 6-24 but detected include copper (nine detections; 10.7 to 2,040 mg/kg), lead (three detections; 24.6 to 677 mg/kg), and zinc (two detections; 146 mg/kg and 6,030 J mg/kg).

The maximum concentrations of all the metals that were detected above background levels and residential PRGs (antimony, arsenic, cadmium, lead, and molybdenum) are reported from sample 20242-1096 collected from Trench 1E at 16 feet bgs. This sample also had the maximum number of metals that exceeded background concentrations (see Table 6-23). However, it should be noted that samples collected deeper within Trench 1E at 22 feet bgs (20242-1099) and 20 feet bgs (20242-1101) reported metal concentrations that were within the background values and was consistent with the rest of the subsurface samples collected at the site. As can be seen in Table 6-24, only two in 24 samples for arsenic and only one in twenty-four samples for antimony, cadmium, lead, and molybdenum exceeded both background concentrations and PRGs.

Table 6-20: Summary of Detected Analytes (Except Dioxins/Furans) - Surface Soil (0-foot to 1-foot bgs) - RSE Investigation

	PRGs		Background	Sample ID:	LK017	LK020	LK023	LK026	LK029	LK032	LK035	LK038	LK041	LK044	LK047	LK050	LK117	LK053
				Location ID:	HA01	HA02	HA03	HA04	HA05	HA06	HA07	HA08	HA09	HA10	HA11	HA12	HA12	HA13
				Sample Type:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular
				Sample Date:	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/10/2002	10/10/2002	10/10/2002	10/10/2002	10/10/2002	10/11/2002	10/11/2002	10/10/2002
Parameter	Residential	Industrial	(0.95 Quantile)	Sample Depth:	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
TPH (8015B DRO)[b]				Units														
Motor Oils	-	-	-	mg/kg	10J	12U	86	160	11U	10U	3J	43	8J	13U	11U	14	7J	11U
PHC as diesel fuel	-	-	-	mg/kg	12U	12U	15	100U	11U	10U	10U	2J	0.8J	13U	11U	3J	11U	11U
PHC as gasoline	-	-	-	mg/kg	0.04J	0.03J	0.03J	0.1J	0.03J	0.02J	0.03J	10U	0.04J	0.04J	0.03J	0.03J	0.03J	0.03J
SVOCs (EPA Method 8270C)[b]																		
Bis(2-ethylhexyl)phthalate	34,700	123,000	-	µg/kg	610U	580U	1200U	1000U	560U	520U	520U	65J	520U	630U	540U	530U	540U	550U
Diethylphthalate	48,882,000	100,000,000	-	µg/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U
Phenol	37,000,000	100,000,000	-	µg/kg	610U	110J	410J	1000U	560U	520U	520U	1000U	210J	150J	220J	530U	540U	550U
PAHs (PAH-SIM)[b]																		
Anthracene	21,896,121	100,000,000	-	µg/kg	30UJ	29UJ	29UJ	25UJ	28UJ	26UJ	26UJ	25UJ	26UJ	32UJ	27UJ	26UJ	27UJ	27UJ
Benzo(a)anthracene	621	2,110	-	µg/kg	16J	29UJ	19J	18J	28UJ	26UJ	7J	25UJ	26UJ	32UJ	27UJ	26UJ	27UJ	27UJ
Benzo(a)pyrene	62	211	-	µg/kg	30U	29U	11J	10J	28U	26U	26U	25U	26U	32U	27U	26U	27U	27U
Benzo(b)fluoranthene	621	2,110	-	µg/kg	8J	29UJ	17J	15J	28UJ	26UJ	26UJ	25UJ	26UJ	32UJ	27UJ	26UJ	27UJ	27UJ
Benzo(g,h,i)perylene	-	-	-	µg/kg	30U	29U	11J	7J	28U	26U	26U	25U	26U	32U	27U	26U	27U	27U
Benzo(k)fluoranthene	378	1,283	-	µg/kg	30UJ	29UJ	13J	7J	28UJ	26UJ	26UJ	25UJ	26UJ	32UJ	27UJ	26UJ	27UJ	27UJ
Chrysene	3,781	12,834	-	µg/kg	10J	29U	29U	8J	28U	26U	26U	25U	26U	32U	27U	26U	27U	27U
Dibenz(a,h)anthracene	62	211	-	µg/kg	30U	29U	29UJ	25U	28U	26U	26U	25U	26U	32U	27U	26U	27U	27U
Fluoranthene	2,293,610	22,000,353	-	µg/kg	16J	29U	8J	11J	28U	26U	26U	25U	26U	32U	27U	26U	27U	27U
Indeno(1,2,3-C,D)pyrene	621	2,110	-	µg/kg	30UJ	29UJ	29UJ	25UJ	28UJ	26UJ	26UJ	25UJ	26UJ	32UJ	27UJ	26UJ	27UJ	27UJ
Phenanthrene	-	-	-	µg/kg	9J	29U	29U	25U	28U	26U	26U	25U	26U	32U	27U	26U	27U	27U
Pyrene	2,315,951	29,126,201	-	µg/kg	16J	29UJ	11J	14J	28UJ	26UJ	26UJ	25U	26U	32U	27U	26U	27U	27U
Metals (EPA Method 6010B)[a]																		
Aluminum	76,000	100,000	14,800	mg/kg	6550	4330	8190	8960	9680	6650	5320	7120	3570	7700	12400	14300	12100	11100
Antimony	31	410	3.06	mg/kg	2.1	7U	7.1U	6U	6.8U	6.2U	6.3U	6.1U	6.2U	0.29UJ	6.5U	6.3U	6.5U	6.5U
Arsenic	0.39	1.6	6.86	mg/kg	**2.6**	**1.7**	**3.1**	**3.3**	**3.1**	**2.2**	**1.9**	**2.7**	**1.6**	**4.1**	**3.5**	**3.7**	**3.8**	**3.3**
Barium	5,400	67,000	173	mg/kg	98.5	50.9	67.8	110	98.8	77.8	59.6	111	105	95.4	119	118	115	120
Beryllium	154	1,941	0.669	mg/kg	0.48U	0.46U	0.099UJ	0.029UJ	0.091UJ	0.1UJ	0.059UJ	0.41U	0.41U	0.056UJ	0.15UJ	0.33	0.13UJ	0.44U
Cadmium	1.7	7.4	2.35	mg/kg	0.28	0.44	0.35	0.49	0.67	0.48	0.46	0.56	0.093J	0.39	0.98	0.88	0.78	0.6
Calcium	-	-	46,000	mg/kg	5120	1590	4960	7110	4110	2390	2000	4090	2980J	4480J	3940J	4090J	4290J	5920J
Chromium	211	448	26.9	mg/kg	7.8	5.2	10.9	11.9	12.4	6.2	6.3	8.8	8.9	9	12.2	12.1	11.3	11.5
Cobalt	903	1,921	6.98	mg/kg	4.4	2.5	4.6	5.4	5.2	3.4	3	4.4	2.8	5.3	5.8	5.8	6	5.6
Copper	3,129	40,877	10.5	mg/kg	3.9	2.9	7	8.2	8.2	3.5	3.3	4.6	2.4	8	7.2	7.4	8.7	6
Iron	23,463	100,000	18,400	mg/kg	9540	5880	10200	12400	12500	8440	6990	10400	6820J	12000J	13700J	15100J	13800J	13200J
Lead	150	750	15.1	mg/kg	4.7	1.6	15.5	20.7	9.5	2.6	4.2	7.2	2.5	20.6	4.7	5	10	4.7
Magnesium	-	-	8,370	mg/kg	3320	1780	3110	4490	4960	2790	2260	3620	2030J	3860J	5000J	5540J	5150J	4840J
Manganese	1,762	19,458	291	mg/kg	177J	104J	151J	201J	193J	145J	128J	173J	119	180	242	234	228	217
Mercury (EPA Method 7471A)	23.5	307	0.22	mg/kg	0.038	0.034	0.069	0.051	0.039	0.028	0.041	0.028	0.02	0.037	0.027	0.027	0.023	0.028
Nickel	1,564	20,439	15.3	mg/kg	4.7	4.4	7.4	7.8	8.2	5.2	4.9	6.2	5.1	6.4	10.1	9.5	8.5	7.9
Potassium	-	-	4,890	mg/kg	2290J	1210J	1800J	2760J	3310J	1850J	1560J	2490J	1100J	2500J	3010J	3280J	3070J	2920J
Selenium	391	5,110	0.32	mg/kg	0.48	0.47	0.57	0.73	0.5	0.49	0.41	0.76	0.27	0.68	0.53	0.87	0.82	0.72
Silver	391	5,110	0.539	mg/kg	1.2U	1.2U	1.2U	1U	1.1U	1U	1U	1U	1U	1.3UJ	1.1UJ	1.1UJ	1.1UJ	1.1UJ
Vanadium	547	7,154	71.8	mg/kg	21.6	13.5	22.7	28.2	26.8	18	15.4	24.3	16.4	26.1	31.5	33.5	32.4	31.7
Zinc	23,463	100,000	77.9	mg/kg	28	16.4	37.1	50.3	41.6	23.3	21.6	45	15.8	37.2	38.1	41.2	43.5	40.1

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Table 6-20: Summary of Detected Analytes (Except Dioxins/Furans) - Surface Soil (0 foot - 1 foot bgs) - RSE Investigation

Parameter	PRGs Residential	PRGs Industrial	Background (0.95 Quantile)	Sample ID:	LK116	LK056	LK059	LK062	LK065	LK068	LK071	LK074	LK077	LK080	LK083	LK086	LK089	LK092
				Location ID:	HA13	HA14	HA15	HA16	HA17	HA18	HA19	HA20	HA21	HA22	HA23	HA24	HA25	HA26
				Sample Type:	Duplicate	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular
				Sample Date:	10/10/2002	10/11/2002	10/11/2002	10/11/2002	10/11/2002	10/11/2002	10/11/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002
				Sample Depth:	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
TPH (8015B DRO)[b]				Units														
MOTOR OILS	-	-	-	mg/kg	8J	5J	49	12U	11U	18	14	11U	40	11U	12U	10U	12U	20
PHC AS DIESEL FUEL	-	-	-	mg/kg	0.9J	11U	3J	12U	11U	1J	11U	1J	4J	11U	12U	10U	12U	2J
PHC AS GASOLINE	-	-	-	mg/kg	0.03J	0.03J	0.04J	0.03J	0.03J	0.03J	0.03J	0.02J	0.02J	0.03J	12U	11U	12U	0.05J
SVOCs (EPA Method 8270C)[b]																		
BIS(2-ETHYLHEXYL)PHTHALATE	34,700	123,000	-	ug/kg	600U	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U
DIETHYLPHTHALATE	48,882,000	100,000,000	-	ug/kg	600U	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U
PHENOL	37,000,000	100,000,000	-	ug/kg	110J	570U	1000U	590U	560U	530U	695	540U	540U	936	450J	520U	250J	590U
PAHs (PAH-SIM)[b]																		
ANTHRACENE	21,896,121	100,000,000	-	ug/kg	30UJ	29UJ	44J	29UJ	28UJ	26UJ	28UJ	27UJ	27UJ	28UJ	31UJ	26UJ	29UJ	30UJ
BENZO(A)ANTHRACENE	621	2,110	-	ug/kg	30UJ	29UJ	**730J**	29UJ	28UJ	26UJ	28UJ	27UJ	27UJ	28UJ	31UJ	26UJ	29UJ	13J
BENZO(A)PYRENE	62	211	-	ug/kg	30U	29U	**1030J**	29U	28U	26U	28U	27U	27U	28U	31U	26U	29U	30U
BENZO(B)FLUORANTHENE	621	2,110	-	ug/kg	30UJ	29UJ	**1790J**	29UJ	28UJ	26UJ	28UJ	27UJ	27UJ	28UJ	31UJ	26UJ	29UJ	30UJ
BENZO(G,H,I)PERYLENE	-	-	-	ug/kg	30U	29U	440J	29U	28U	26U	28U	27U	27U	28U	31U	26U	29U	30U
BENZO(K)FLUORANTHENE	378	1,283	-	ug/kg	30UJ	29UJ	**510J**	29UJ	28UJ	26UJ	28UJ	27UJ	27UJ	28UJ	31UJ	26UJ	29UJ	30UJ
CHRYSENE	3,781	12,834	-	ug/kg	30U	29U	870	29U	28U	26U	28U	27U	27U	28U	31U	26U	29U	30U
DIBENZ(A,H)ANTHRACENE	62	211	-	ug/kg	30U	29U	**97J**	29U	28U	26U	28U	27U	27U	28U	31U	26U	29U	30U
FLUORANTHENE	2,293,610	22,000,353	-	ug/kg	30U	29U	1000	29U	28U	26U	28U	27U	27U	28U	31U	26U	29U	30U
INDENO(1,2,3-C,D)PYRENE	621	2,110	-	ug/kg	30UJ	29UJ	460J	29UJ	28UJ	26UJ	28UJ	27UJ	27UJ	28UJ	31UJ	26UJ	29UJ	30UJ
PHENANTHRENE	-	-	-	ug/kg	30U	29U	290	29U	28U	26U	28U	27U	27U	28U	31U	26U	29U	30U
PYRENE	2,315,951	29,126,201	-	ug/kg	30U	29U	960	29U	28U	26U	28U	27U	27UJ	28U	31U	26U	29U	30U
Metals (EPA Method 6010B)[a]																		
ALUMINUM	76,000	100,000	14,800	mg/kg	12100	8030	9350	7860	7980	9340	9690	10900	5590	15000	13200	9320	6920	14300
ANTIMONY	31	410	3.06	mg/kg	7.2U	6.8U	6.2U	7.1U	0.32UJ	6.3U	0.28UJ	6.5U	6.5U	6.8U	7.4U	6.3U	7U	7.1U
ARSENIC	0.39	1.6	6.86	mg/kg	**4.7**	**2.9**	**2.9**	**2.2**	**3**	**2.9**	**2.8**	**2.7**	**2.2**	**4.6**	**3.6**	**3**	**2.5**	**4.7**
BARIUM	5,400	67,000	173	mg/kg	142	73.6	89	87.9	94.5	101	93.3	105	60.3	187	122	104	79.3	163
BERYLLIUM	154	1,941	0.669	mg/kg	0.13UJ	0.053UJ	0.1UJ	0.47U	0.14UJ	0.16UJ	0.098UJ	0.14	0.052UJ	0.29	0.31	0.22	0.12	0.27
CADMIUM	1.7	7.4	2.35	mg/kg	1.1	0.46	0.59	0.62	0.69	0.78	0.83	0.65	0.55	1	0.92	0.86	0.62	0.98
CALCIUM	-	-	46,000	mg/kg	5060J	5250J	25200J	2510J	3800J	3300J	3260J	5340	2720	6050	4720	3600	3540	5540
CHROMIUM	211	448	26.9	mg/kg	13.6	8.3	8.7	14.6	8.8	8.9	9.7	12.3	5.8	15.8	13	10.6	7.1	18.2
COBALT	903	1,921	6.98	mg/kg	6.7	3.8	4	4.2	4.7	4.5	5	4.7	3	7.6	5.5	4.8	3.8	7.3
COPPER	3,129	40,877	10.5	mg/kg	12.8	3.6	4.3	5.1	5.2	5.6	6.8	7	3.3	10.8	7.6	6.8	4.4	12.8
IRON	23,463	100,000	18,400	mg/kg	15700J	9310J	10100J	9650J	11000J	11100J	11800J	13000	8070	19400	15300	12600	9990	19100
LEAD	150	750	15.1	mg/kg	17	2.5	2.9	7.5	6.3	4.3	8.3	4.7	2	12.4	5.8	9.2	2.9	15
MAGNESIUM	-	-	8,370	mg/kg	5620J	3350J	3820J	3060J	3910J	3750J	4090J	4230	2530	6770	5190	4140	3340	6790
MANGANESE	1,762	19,458	291	mg/kg	252	161	167	178	207	197	216	221J	126J	289J	227J	197J	164J	277J
MERCURY (EPA Method 7471A)	23.5	307	0.22	mg/kg	0.029	0.021	0.022	0.029	0.027	0.019	0.041	0.018	0.012	0.021	0.026	0.02	0.021	0.02
NICKEL	1,564	20,439	15.3	mg/kg	10.6	6	6.4	9	7.4	7	7.7	7.8	4.7	12.1	9	8.3	5.7	11.8
POTASSIUM	-	-	4,890	mg/kg	3540J	1880J	2150J	2190J	2470J	2450J	2530J	2670J	1440J	3970J	3300J	2670J	1980J	4170J
SELENIUM	391	5,110	0.32	mg/kg	0.63	0.45	0.42	0.54	0.65	0.72	1.1	0.65U	0.29	0.68U	0.74U	0.63U	0.7U	0.71U
SILVER	391	5,110	0.539	mg/kg	1.2UJ	1.1UJ	1UJ	1.2UJ	1.1UJ	1.1UJ	1.1UJ	1.1U	1.1U	1.1U	1.2U	1U	1.2U	1.2U
VANADIUM	547	7,154	71.8	mg/kg	35.4	22.1	25.1	22.2	23.1	24.2	27.3	29.2	17.4	44.1	33.3	27.5	21.6	41.7
ZINC	23,463	100,000	77.9	mg/kg	57.8	23.7	26.8	30.8	30.8	30.9	34.1	33.5	20.9	57.1	49.6	36.6	26.7	60.8

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Table 6-20: Summary of Detected Analytes (Except Dioxins/Furans) - Surface Soil (0 foot - 1 foot bgs) - RSE Investigation

Parameter	PRGs Residential	PRGs Industrial	Background (0.95 Quantile)	Units	LK118	LK095	LK098	LK101	LK104	LK107	LK110	LK113	LK119
				Location ID:	HA26	HA27	HA28	HA29	HA30	HA31	HA32	HA33	HA33
				Sample Type:	Duplicate	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate
				Sample Date:	10/14/2002	10/14/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002
				Sample Depth:	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
TPH (8015B DRO)[b]													
MOTOR OILS	-	-	-	mg/kg	10U	11U	7J	26	27	3J	19	7J	12U
PHC AS DIESEL FUEL	-	-	-	mg/kg	10U	11U	2J	5J	2J	10U	0.9J	12U	12U
PHC AS GASOLINE	-	-	-	mg/kg	11U	0.02J	10U	9.9U	0.02J	9.5U	0.05J	0.03J	0.03J
SVOCs (EPA Method 8270C)[b]													
BIS(2-ETHYLHEXYL)PHTHALATE	34,700	123,000	-	ug/kg	510U	540U	530U	70J	520U	520U	51J	620U	620U
DIETHYLPHTHALATE	48,882,000	100,000,000	-	ug/kg	510U	540U	530U	540U	520U	520U	610U	620U	140J
PHENOL	37,000,000	100,000,000	-	ug/kg	510U	902	530U	540U	520U	520U	610U	210J	250J
PAHs (PAH-SIM)[b]													
ANTHRACENE	21,896,121	100,000,000	-	ug/kg	25UJ	27UJ	26UJ	27UJ	26UJ	26UJ	31UJ	31UJ	31UJ
BENZO(A)ANTHRACENE	621	2,110	-	ug/kg	25UJ	27UJ	26UJ	12J	26UJ	26UJ	31UJ	31UJ	31UJ
BENZO(A)PYRENE	62	211	-	ug/kg	25U	27U	26U	15J	26U	26U	31U	31U	31U
BENZO(B)FLUORANTHENE	621	2,110	-	ug/kg	25UJ	27UJ	26UJ	34J	26UJ	26UJ	31UJ	31UJ	31UJ
BENZO(G,H,I)PERYLENE	-	-	-	ug/kg	25U	27U	26U	16J	26U	26U	31U	31U	31U
BENZO(K)FLUORANTHENE	378	1,283	-	ug/kg	25UJ	27UJ	26UJ	11J	26UJ	26UJ	31UJ	31UJ	31UJ
CHRYSENE	3,781	12,834	-	ug/kg	25U	27U	26U	24J	26U	26U	31U	31U	31U
DIBENZ(A,H)ANTHRACENE	62	211	-	ug/kg	25U	27U	26U	27U	26U	26U	31U	31U	31U
FLUORANTHENE	2,293,610	22,000,353	-	ug/kg	25U	27U	26U	14J	26U	26U	31U	31U	31U
INDENO(1,2,3-C,D)PYRENE	621	2,110	-	ug/kg	25U	27U	26U	27U	26U	26UJ	31UJ	31UJ	31UJ
PHENANTHRENE	-	-	-	ug/kg	25U	27U	26U	27U	26U	26U	31U	31U	31U
PYRENE	2,315,951	29,126,201	-	ug/kg	25U	27U	26U	17J	26U	26U	31U	31U	31U
Metals (EPA Method 6010B)[a]													
ALUMINUM	76,000	100,000	14,800	mg/kg	7860	8830	15800	8760	6870	9010	12100	13500	7860
ANTIMONY	31	410	3.06	mg/kg	6.1U	6.5U	6.3U	6.5U	6.2U	6.3U	7.4U	7.4U	7.5U
ARSENIC	0.39	1.6	6.86	mg/kg	**2.2**	**2.3**	**4.2**	**2.8**	**2.5**	**3.2**	**3.2**	**3.5**	**2.2**
BARIUM	5,400	67,000	173	mg/kg	71.6	88.6	145	96.8	77.7	110	103	111	74.4
BERYLLIUM	154	1,941	0.669	mg/kg	0.089UJ	0.12	0.21	0.43U	0.085	0.088UJ	0.11UJ	0.49U	0.5U
CADMIUM	1.7	7.4	2.35	mg/kg	0.6	0.76	0.5	0.31	0.58	0.55	0.76	0.42	0.39
CALCIUM	-	-	46,000	mg/kg	3160	16400	6000	4090	4690	7110	4430	6000	1990
CHROMIUM	211	448	26.9	mg/kg	8.6	8.6	14.3	8.4	7.3	9.6	12.7	12.2	12.2
COBALT	903	1,921	6.98	mg/kg	3.9	4.2	7.2	5.2	3.6	5.1	5.4	6.3	3.5
COPPER	3,129	40,877	10.5	mg/kg	4.9	4.9	9.4	5.7	4	6.5	7.9	6.4	6.8
IRON	23,463	100,000	18,400	mg/kg	10000	10600	18400	12300	9270	12700	14100	15400	7670
LEAD	150	750	15.1	mg/kg	2.7	3.5	6	6	2.5	4.9	12.7	3.5	4.3
MAGNESIUM	-	-	8,370	mg/kg	3390	3700	6900	4310	3150	4530	5040	5920	2180
MANGANESE	1,762	19,458	291	mg/kg	146J	168J	227J	181J	156J	196J	175J	225J	88.1J
MERCURY (EPA Method 7471A)	23.5	307	0.22	mg/kg	0.015	0.012	0.021	0.013	0.015	0.029	0.025	0.011	0.019
NICKEL	1,564	20,439	15.3	mg/kg	7.5	6.2	9.5	5.1	5.4	6.9	7	7.6	7.4
POTASSIUM	-	-	4,890	mg/kg	1940J	2170J	3600J	2740J	1900J	2440J	2730J	3270J	902J
SELENIUM	391	5,110	0.32	mg/kg	0.61U	0.65U	0.63U	0.65U	0.62U	0.63U	0.74U	0.74U	0.75U
SILVER	391	5,110	0.539	mg/kg	1UJ	1.1U	1.1U	1.1U	1UJ	1UJ	2	1.2UJ	1.2UJ
VANADIUM	547	7,154	71.8	mg/kg	24	24.6	40.4	27	20.5	27.7	31.6	35.1	21.5
ZINC	23,463	100,000	77.9	mg/kg	26.2	27.8	46.5	33	25.1	33.2	43.7	37.5	28.4

Notes:

U = indicates the analyte was not detected at or above the stated limit.
UJ = indicates the analyte was not detected at or above the stated limit. The sample detection limit is an estimated value.
J = indicates an estimated value.
RSE = removal site evaluation
ID = identification
SVOC = semivolatile organic compound
' = foot
[a] For metals, values in bold indicate concentrations exceeding both the residential and industrial PRGs, however their values are below the MCAS El Toro background concentrations (BNI 1996).
[b] For organics,
values in bold indicate concentrations exceeding only the residential PRGs.
values in bold and highlighted indicate concentrations exceeding the residential and industrial PRGs.

TPH = total petroleum hydrocarbons
EPA = Environmental Protection Agency
PRG = preliminary remediation goals
- = PRGs or background concentration values not established for this particular analyte.
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
PAH = polynuclear aromatic hydrocarbon

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Table 6-21: Quantification of Total 2,3,7,8-TCDD Concentrations for Surface Soil Samples (0-foot to 1-foot bgs) - RSE Investigation

		Sample ID:	LK047		LK056		LK068		LK077	
		Location ID:	HA11		HA14		HA18		HA21	
		Sample Type:	Regular		Regular		Regular		Regular	
		Sample Date:	10/10/2002		10/11/2002		10/11/2002		10/14/2002	
		Sample Depth:	0 - 1'		0 - 1'		0 - 1'		0 - 1'	
Parameter	WHO TEF Value	Units	Lab	TEQ	Lab	TEQ	Lab	TEQ	Lab	TEQ
Dioxins/Furans (EPA Method 8290)										
1,2,3,4,6,7,8-HpCDD	1.00E-02	pg/g	0.947	0.0095	1.88	0.0188	2.41	0.0241	3.12	0.0312
1,2,3,4,6,7,8-HpCDF	1.00E-02	pg/g	0.417	0.0042	0.637	0.0064	1.36	0.0136	0.893	0.0089
1,2,3,4,7,8,9-HpCDF	1.00E-02	pg/g	0.116	0.0012	0.241 U	0.0012	0.239 U	0.0012	0.252 U	0.0013
1,2,3,4,7,8-HxCDD	1.00E-01	pg/g	0.0835	0.0084	0.241 U	0.0121	0.391	0.0391	0.252 U	0.0126
1,2,3,4,7,8-HxCDF	1.00E-01	pg/g	0.0944	0.0094	0.0617	0.0062	0.084	0.0084	0.0967	0.0097
1,2,3,6,7,8-HxCDD	1.00E-01	pg/g	0.171	0.0171	0.135	0.0135	0.353	0.0353	0.345	0.0345
1,2,3,6,7,8-HxCDF	1.00E-01	pg/g	0.101	0.0101	0.083	0.0083	0.122	0.0122	0.125	0.0125
1,2,3,7,8,9-HxCDD	1.00E-01	pg/g	0.184	0.0184	0.125	0.0125	0.469	0.0469	0.401	0.0401
1,2,3,7,8,9-HxCDF	1.00E-01	pg/g	0.193	0.0193	0.241 U	0.0121	0.33	0.0330	0.31	0.0310
1,2,3,7,8-PeCDD	1.00E+00	pg/g	0.0791	0.0791	0.241 U	0.1205	0.193	0.1930	0.169	0.1690
1,2,3,7,8-PeCDF	5.00E-02	pg/g	0.114	0.0057	0.241 U	0.0060	0.0744	0.0037	0.101	0.0051
2,3,4,6,7,8-HxCDF	1.00E-01	pg/g	0.134	0.0134	0.162	0.0162	0.177	0.0177	0.204	0.0204
2,3,4,7,8-PeCDF	5.00E-01	pg/g	0.141	0.0705	0.081	0.0405	0.239	0.1195	0.181	0.0905
2,3,7,8-TCDD	1.00E+00	pg/g	0.103	0.1030	0.0965 U	0.0483	0.107	0.1070	0.105	0.1050
2,3,7,8-TCDF	1.00E-01	pg/g	0.119	0.0119	0.0617	0.0062	0.137	0.0137	0.147	0.0147
OCDD	1.00E-04	pg/g	8.93	0.0009	17	0.0017	30	0.0030	40.3	0.0040
OCDF	1.00E-04	pg/g	1.97	0.0002	1.35	0.0001	6.87	0.0007	6.59	0.0007
Total HpCDDs	na	pg/g	1.9	na	3.8	na	5.71	na	6.32	na
Total HpCDFs	na	pg/g	0.417	na	1.39	na	3.05	na	2.32	na
Total HxCDDs	na	pg/g	0.604	na	0.413	na	1.2	na	1.23	na
Total HxCDFs	na	pg/g	0.916	na	1.92	na	2.55	na	2.03	na
Total PeCDDs	na	pg/g	0.294 U	na	0.0444	na	0.282	na	0.183	na
Total PeCDFs	na	pg/g	0.681	na	1.63	na	2.66	na	2.18	na
Total TCDDs	na	pg/g	0.226 U	na	0.178 U	na	0.139	na	0.216	na
Total TCDFs	na	pg/g	0.514	na	0.324	na	1.19	na	1.34	na
	Residential PRGs (pg/g)	**Industrial PRGs (pg/g)**								
Total 2,3,7,8-TCDDs	**3.9**	**20**	0.3822		0.3304		0.6721		0.5911	

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Table 6-21: Quantification of Total 2,3,7,8-TCDD Concentrations for Surface Soil Samples (0-foot to 1-foot bgs) - RSE Investigation

			Sample ID:	LK089		LK092		LK118		LK095	
			Location ID:	HA25		HA26		HA26		HA27	
			Sample Type:	Regular		Regular		Duplicate		Regular	
			Sample Date:	10/14/2002		10/14/2002		10/14/2002		10/14/2002	
			Sample Depth:	0 - 1'		0 - 1'		0 - 1'		0 - 1'	
Parameter	**WHO TEF Value**	**Units**	**Analysis**	Lab	TEQ	Lab	TEQ	Lab	TEQ	Lab	TEQ
Dioxins/Furans											
1,2,3,4,6,7,8-HpCDD	1.00E-02	pg/g	8290	2.04	0.0204	9.92	0.0992	10.3	0.1030	1.55	0.0155
1,2,3,4,6,7,8-HpCDF	1.00E-02	pg/g	8290	0.579	0.0058	7.92	0.0792	6.59	0.0659	0.436	0.0044
1,2,3,4,7,8,9-HpCDF	1.00E-02	pg/g	8290	0.295 U	0.0015	0.329	0.0033	0.394 U	0.0020	0.261 U	0.0013
1,2,3,4,7,8-HxCDD	1.00E-01	pg/g	8290	0.364	0.0364	0.362	0.0362	0.475	0.0475	0.444 U	0.0222
1,2,3,4,7,8-HxCDF	1.00E-01	pg/g	8290	0.0851	0.0085	1.58	0.1580	1.34	0.1340	0.261 U	0.0131
1,2,3,6,7,8-HxCDD	1.00E-01	pg/g	8290	0.328	0.0328	1.87	0.1870	1.6	0.1600	0.345 U	0.0173
1,2,3,6,7,8-HxCDF	1.00E-01	pg/g	8290	0.0874	0.0087	7.68	0.7680	6.09	0.6090	0.261 U	0.0131
1,2,3,7,8,9-HxCDD	1.00E-01	pg/g	8290	0.475	0.0475	0.785	0.0785	0.923	0.0923	0.385 U	0.0193
1,2,3,7,8,9-HxCDF	1.00E-01	pg/g	8290	0.371	0.0371	0.903	0.0903	1.05	0.1050	0.261 U	0.0131
1,2,3,7,8-PeCDD	1.00E+00	pg/g	8290	0.0803	0.0803	0.515	0.5150	0.497	0.4970	0.261 U	0.1305
1,2,3,7,8-PeCDF	5.00E-02	pg/g	8290	0.113	0.0057	1.06	0.0530	0.775	0.0388	0.261 U	0.0065
2,3,4,6,7,8-HxCDF	1.00E-01	pg/g	8290	0.149	0.0149	14.7	1.4700	11.2	1.1200	0.261 U	0.0131
2,3,4,7,8-PeCDF	5.00E-01	pg/g	8290	0.156	0.0780	32.4	16.2000	26.5	13.2500	0.152	0.0760
2,3,7,8-TCDD	1.00E+00	pg/g	8290	0.118 U	0.0590	0.17	0.1700	0.229	0.2290	0.111 U	0.0555
2,3,7,8-TCDF	1.00E-01	pg/g	8290	0.156	0.0156	3.05	0.3050	2.12	0.2120	0.133	0.0133
OCDD	1.00E-04	pg/g	8290	19.8	0.0020	61.7	0.0062	79.8	0.0080	17	0.0017
OCDF	1.00E-04	pg/g	8290	4.13	0.0004	6.92	0.0007	7.46	0.0007	1.1	0.0001
Total HpCDDs	na	pg/g	8290	3.93	na	22	na	22.3	na	3.19	na
Total HpCDFs	na	pg/g	8290	1.45	na	15	na	12.8	na	0.436	na
Total HxCDDs	na	pg/g	8290	1.11	na	20.2	na	17.4	na	0.484 U	na
Total HxCDFs	na	pg/g	8290	1.8	na	201	na	156	na	0.442	na
Total PeCDDs	na	pg/g	8290	0.461	na	5.99	na	3.72	na	0.419 U	na
Total PeCDFs	na	pg/g	8290	1.76	na	752	na	563	na	1.56	na
Total TCDDs	na	pg/g	8290	0.123	na	0.313	na	1.53	na	0.346 U	na
Total TCDFs	na	pg/g	8290	1.35	na	346	na	294	na	0.586	na
	Residential PRGs (pg/g)	**Industrial PRGs (pg/g)**									
Total 2,3,7,8-TCDDs	**3.9**	**20**		0.4546		**20.2196**		**16.6741**		0.4157	

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Table 6-21: Quantification of Total 2,3,7,8-TCDD Concentrations for Surface Soil Samples (0-foot to 1-foot bgs) - RSE Investigation

			Sample ID:	LK101		LK107	
			Location ID:	HA29		HA31	
			Sample Type:	Regular		Regular	
			Sample Date:	10/15/2002		10/15/2002	
			Sample Depth:	0 - 1'		0 - 1'	
Parameter	**WHO TEF Value**	**Units**	**Analysis**	Lab	TEQ	Lab	TEQ
Dioxins/Furans							
1,2,3,4,6,7,8-HpCDD	1.00E-02	pg/g	8290	1.92	0.0192	6.96	0.0696
1,2,3,4,6,7,8-HpCDF	1.00E-02	pg/g	8290	0.394	0.0039	1.35	0.0135
1,2,3,4,7,8,9-HpCDF	1.00E-02	pg/g	8290	0.253 U	0.0013	0.258 U	0.0013
1,2,3,4,7,8-HxCDD	1.00E-01	pg/g	8290	0.253 U	0.0127	0.258 U	0.0129
1,2,3,4,7,8-HxCDF	1.00E-01	pg/g	8290	0.0647	0.0065	0.138	0.0138
1,2,3,6,7,8-HxCDD	1.00E-01	pg/g	8290	0.117	0.0117	0.472	0.0472
1,2,3,6,7,8-HxCDF	1.00E-01	pg/g	8290	0.0829	0.0083	0.153	0.0153
1,2,3,7,8,9-HxCDD	1.00E-01	pg/g	8290	0.115	0.0115	0.377	0.0377
1,2,3,7,8,9-HxCDF	1.00E-01	pg/g	8290	0.253 U	0.0127	0.223	0.0223
1,2,3,7,8-PeCDD	1.00E+00	pg/g	8290	0.253 U	0.1265	0.115	0.1150
1,2,3,7,8-PeCDF	5.00E-02	pg/g	8290	0.253 U	0.0063	0.099	0.0050
2,3,4,6,7,8-HxCDF	1.00E-01	pg/g	8290	0.135	0.0135	0.252	0.0252
2,3,4,7,8-PeCDF	5.00E-01	pg/g	8290	0.154	0.0770	0.221	0.1105
2,3,7,8-TCDD	1.00E+00	pg/g	8290	0.109	0.1090	0.161	0.1610
2,3,7,8-TCDF	1.00E-01	pg/g	8290	0.0687	0.0069	0.144	0.0144
OCDD	1.00E-04	pg/g	8290	16.5	0.0017	59	0.0059
OCDF	1.00E-04	pg/g	8290	0.821	0.0001	4.11	0.0004
Total HpCDDs	na	pg/g	8290	4.35	na	13.7	na
Total HpCDFs	na	pg/g	8290	0.883	na	3.34	na
Total HxCDDs	na	pg/g	8290	0.521	na	2.66	na
Total HxCDFs	na	pg/g	8290	1.48	na	2.92	na
Total PeCDDs	na	pg/g	8290	0.141	na	0.254	na
Total PeCDFs	na	pg/g	8290	2.54	na	2.49	na
Total TCDDs	na	pg/g	8290	0.228 U	na	0.214	na
Total TCDFs	na	pg/g	8290	1.08	na	1.47	na
	Residential PRGs (pg/g)	**Industrial PRGs (pg/g)**					
Total 2,3,7,8-TCDDs	**3.9**	**20**		0.4286		0.6710	

Notes:

U = not detected at the threshold indicated
pg/g = picograms per gram
na = not available

WHO = World Health Organization
PRGs = preliminary remediation goals
' = foot

TEF = toxicity equivalent factor
TEQ = toxicity equivalent quotient
bgs = below ground surface

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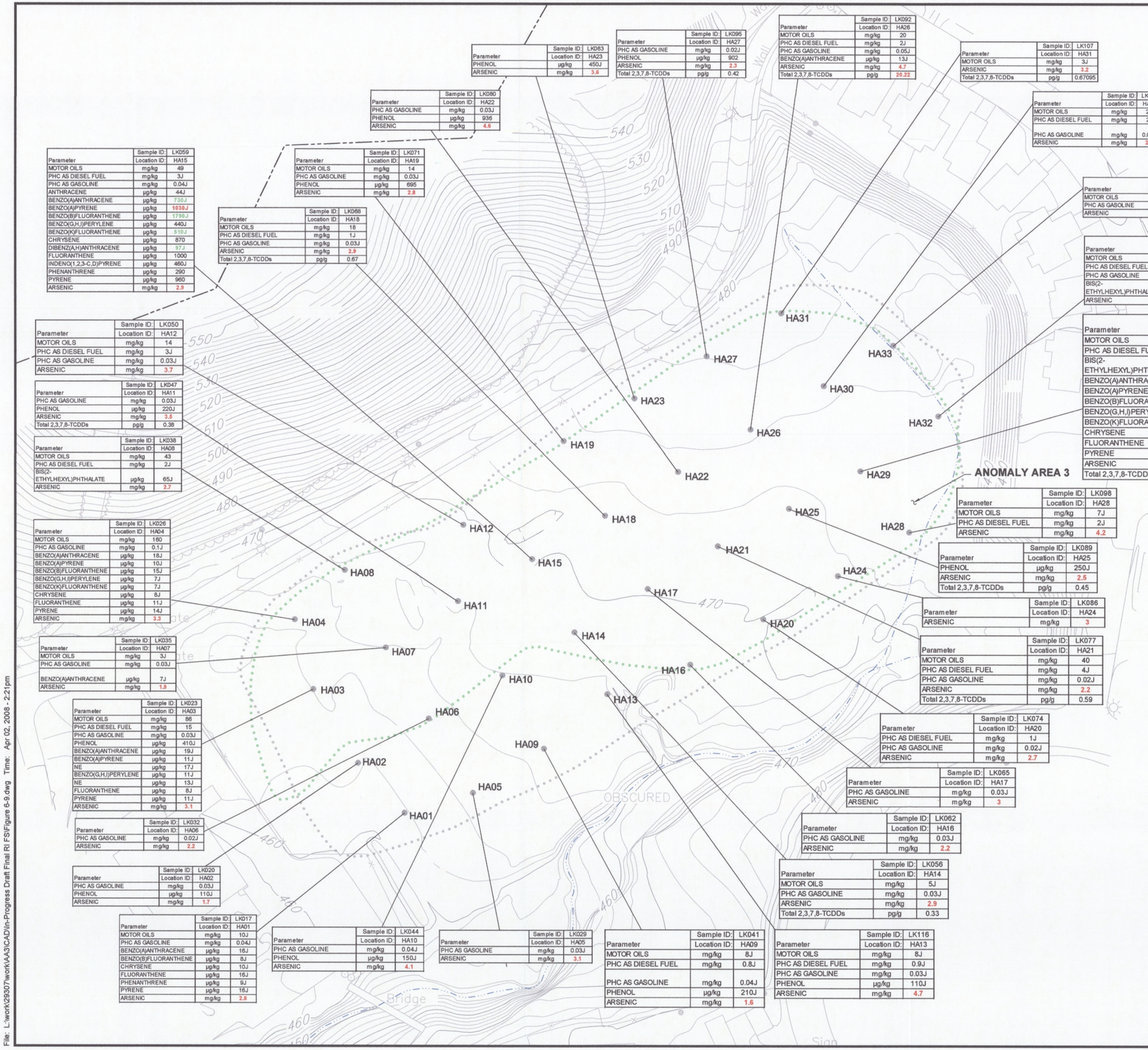

Parameter	Sample ID: / Location ID:	LK059 / HA15
MOTOR OILS	mg/kg	49
PHC AS DIESEL FUEL	mg/kg	3J
PHC AS GASOLINE	mg/kg	0.04J
ANTHRACENE	µg/kg	44J
BENZO(A)ANTHRACENE	µg/kg	730J
BENZO(A)PYRENE	µg/kg	1030J
BENZO(B)FLUORANTHENE	µg/kg	1790J
BENZO(G,H,I)PERYLENE	µg/kg	440J
BENZO(K)FLUORANTHENE	µg/kg	510J
CHRYSENE	µg/kg	870
DIBENZ(A,H)ANTHRACENE	µg/kg	97J
FLUORANTHENE	µg/kg	1000
INDENO(1,2,3-C,D)PYRENE	µg/kg	460J
PHENANTHRENE	µg/kg	290
PYRENE	µg/kg	960
ARSENIC	mg/kg	2.9

Parameter	Sample ID: / Location ID:	LK050 / HA12
MOTOR OILS	mg/kg	14
PHC AS DIESEL FUEL	mg/kg	3J
PHC AS GASOLINE	mg/kg	0.03J
ARSENIC	mg/kg	3.7

Parameter	Sample ID: / Location ID:	LK047 / HA11
PHC AS GASOLINE	mg/kg	0.03J
PHENOL	µg/kg	220J
ARSENIC	mg/kg	3.5
Total 2,3,7,8-TCDDs	pg/g	0.38

Parameter	Sample ID: / Location ID:	LK038 / HA08
MOTOR OILS	mg/kg	43
PHC AS DIESEL FUEL	mg/kg	2J
BIS(2-ETHYLHEXYL)PHTHALATE	µg/kg	65J
ARSENIC	mg/kg	2.7

Parameter	Sample ID: / Location ID:	LK026 / HA04
MOTOR OILS	mg/kg	160
PHC AS GASOLINE	mg/kg	0.1J
BENZO(A)ANTHRACENE	µg/kg	18J
BENZO(A)PYRENE	µg/kg	10J
BENZO(B)FLUORANTHENE	µg/kg	15J
BENZO(G,H,I)PERYLENE	µg/kg	7J
BENZO(K)FLUORANTHENE	µg/kg	7J
CHRYSENE	µg/kg	8J
FLUORANTHENE	µg/kg	11J
PYRENE	µg/kg	14J
ARSENIC	mg/kg	3.3

Parameter	Sample ID: / Location ID:	LK035 / HA07
MOTOR OILS	mg/kg	3J
PHC AS GASOLINE	mg/kg	0.03J
BENZO(A)ANTHRACENE	µg/kg	7J
ARSENIC	mg/kg	1.9

Parameter	Sample ID: / Location ID:	LK023 / HA03
MOTOR OILS	mg/kg	86
PHC AS DIESEL FUEL	mg/kg	15
PHC AS GASOLINE	mg/kg	0.03J
PHENOL	µg/kg	410J
BENZO(A)ANTHRACENE	µg/kg	19J
BENZO(A)PYRENE	µg/kg	11J
NE	µg/kg	17J
BENZO(G,H,I)PERYLENE	µg/kg	11J
NE	µg/kg	13J
FLUORANTHENE	µg/kg	8J
PYRENE	µg/kg	11J
ARSENIC	mg/kg	3.1

Parameter	Sample ID: / Location ID:	LK032 / HA06
PHC AS GASOLINE	mg/kg	0.02J
ARSENIC	mg/kg	2.2

Parameter	Sample ID: / Location ID:	LK020 / HA02
PHC AS GASOLINE	mg/kg	0.03J
PHENOL	µg/kg	110J
ARSENIC	mg/kg	1.7

Parameter	Sample ID: / Location ID:	LK017 / HA01
MOTOR OILS	mg/kg	10J
PHC AS GASOLINE	mg/kg	0.04J
BENZO(A)ANTHRACENE	µg/kg	16J
BENZO(B)FLUORANTHENE	µg/kg	8J
CHRYSENE	µg/kg	10J
FLUORANTHENE	µg/kg	16J
PHENANTHRENE	µg/kg	9J
PYRENE	µg/kg	16J
ARSENIC	mg/kg	2.8

Parameter	Sample ID: / Location ID:	LK044 / HA10
PHC AS GASOLINE	mg/kg	0.04J
PHENOL	µg/kg	150J
ARSENIC	mg/kg	4.1

Parameter	Sample ID: / Location ID:	LK029 / HA05
PHC AS GASOLINE	mg/kg	0.03J
ARSENIC	mg/kg	3.1

Parameter	Sample ID: / Location ID:	LK041 / HA09
MOTOR OILS	mg/kg	8J
PHC AS DIESEL FUEL	mg/kg	0.8J
PHC AS GASOLINE	mg/kg	0.04J
PHENOL	µg/kg	210J
ARSENIC	mg/kg	1.6

Parameter	Sample ID: / Location ID:	LK116 / HA13
MOTOR OILS	mg/kg	8J
PHC AS DIESEL FUEL	mg/kg	0.9J
PHC AS GASOLINE	mg/kg	0.03J
PHENOL	µg/kg	110J
ARSENIC	mg/kg	4.7

Parameter	Sample ID: / Location ID:	LK062 / HA16
PHC AS GASOLINE	mg/kg	0.03J
ARSENIC	mg/kg	2.2

Parameter	Sample ID: / Location ID:	LK056 / HA14
MOTOR OILS	mg/kg	5J
PHC AS GASOLINE	mg/kg	0.03J
ARSENIC	mg/kg	2.9
Total 2,3,7,8-TCDDs	pg/g	0.33

Parameter	Sample ID: / Location ID:	LK065 / HA17
PHC AS GASOLINE	mg/kg	0.03J
ARSENIC	mg/kg	3

Parameter	Sample ID: / Location ID:	LK074 / HA20
PHC AS DIESEL FUEL	mg/kg	1J
PHC AS GASOLINE	mg/kg	0.02J
ARSENIC	mg/kg	2.7

Parameter	Sample ID: / Location ID:	LK077 / HA21
MOTOR OILS	mg/kg	40
PHC AS DIESEL FUEL	mg/kg	4J
PHC AS GASOLINE	mg/kg	0.02J
ARSENIC	mg/kg	2.2
Total 2,3,7,8-TCDDs	pg/g	0.59

Parameter	Sample ID: / Location ID:	LK086 / HA24
ARSENIC	mg/kg	3

Parameter	Sample ID: / Location ID:	LK089 / HA25
PHENOL	µg/kg	250J
ARSENIC	mg/kg	2.5
Total 2,3,7,8-TCDDs	pg/g	0.45

Parameter	Sample ID: / Location ID:	LK098 / HA28
MOTOR OILS	mg/kg	7J
PHC AS DIESEL FUEL	mg/kg	2J
ARSENIC	mg/kg	4.2

Parameter	Sample ID: / Location ID:	LK101 / HA29
MOTOR OILS	mg/kg	26
PHC AS DIESEL FUEL	mg/kg	5J
BIS(2-ETHYLHEXYL)PHTHALATE	µg/kg	70J
BENZO(A)ANTHRACENE	µg/kg	12J
BENZO(A)PYRENE	µg/kg	15J
BENZO(B)FLUORANTHENE	µg/kg	34J
BENZO(G,H,I)PERYLENE	µg/kg	16J
BENZO(K)FLUORANTHENE	µg/kg	11J
CHRYSENE	µg/kg	24J
FLUORANTHENE	µg/kg	14J
PYRENE	µg/kg	17J
ARSENIC	mg/kg	2.8
Total 2,3,7,8-TCDDs	pg/g	0.43

Parameter	Sample ID: / Location ID:	LK110 / HA32
MOTOR OILS	mg/kg	19
PHC AS DIESEL FUEL	mg/kg	0.9J
PHC AS GASOLINE	mg/kg	0.05J
BIS(2-ETHYLHEXYL)PHTHALATE	µg/kg	51J
ARSENIC	mg/kg	3.2

Parameter	Sample ID: / Location ID:	LK113 / HA33
MOTOR OILS	mg/kg	7J
PHC AS GASOLINE	mg/kg	0.03J
ARSENIC	mg/kg	3.5

Parameter	Sample ID: / Location ID:	LK104 / HA30
MOTOR OILS	mg/kg	27
PHC AS DIESEL FUEL	mg/kg	2J
PHC AS GASOLINE	mg/kg	0.02J
ARSENIC	mg/kg	2.5

Parameter	Sample ID: / Location ID:	LK107 / HA31
MOTOR OILS	mg/kg	3J
ARSENIC	mg/kg	3.2
Total 2,3,7,8-TCDDs	pg/g	0.67095

Parameter	Sample ID: / Location ID:	LK092 / HA26
MOTOR OILS	mg/kg	20
PHC AS DIESEL FUEL	mg/kg	2J
PHC AS GASOLINE	mg/kg	0.05J
BENZO(A)ANTHRACENE	µg/kg	13J
ARSENIC	mg/kg	4.7
Total 2,3,7,8-TCDDs	pg/g	20.22

Parameter	Sample ID: / Location ID:	LK095 / HA27
PHC AS GASOLINE	mg/kg	0.02J
PHENOL	µg/kg	902
ARSENIC	mg/kg	2.3
Total 2,3,7,8-TCDDs	pg/g	0.42

Parameter	Sample ID: / Location ID:	LK083 / HA23
PHENOL	µg/kg	450J
ARSENIC	mg/kg	3.8

Parameter	Sample ID: / Location ID:	LK080 / HA22
PHC AS GASOLINE	mg/kg	0.03J
PHENOL	µg/kg	936
ARSENIC	mg/kg	4.8

Parameter	Sample ID: / Location ID:	LK071 / HA19
MOTOR OILS	mg/kg	14
PHC AS GASOLINE	mg/kg	0.03J
PHENOL	µg/kg	695
ARSENIC	mg/kg	2.8

Parameter	Sample ID: / Location ID:	LK068 / HA18
MOTOR OILS	mg/kg	18
PHC AS DIESEL FUEL	mg/kg	1J
PHC AS GASOLINE	mg/kg	0.03J
ARSENIC	mg/kg	2.9
Total 2,3,7,8-TCDDs	pg/g	0.67

LEGEND

- MINOR SURFACE ELEVATION: 2-FOOT INTERVALS
- 460 — MAJOR SURFACE ELEVATION: 10-FOOT INTERVALS
- MCAS EL TORO BOUNDARY
- EXISTING STREAM OR WASH
- ESTIMATED EXTENT OF WASTE PLACEMENT (EARTH TECH 2001)
- REVISED EXTENT OF WASTE PLACEMENT BASED ON TRENCHING ACTIVITY (MARCH 2000 AND OCTOBER 2002)
- HA31 — RSE SOIL/SOIL VAPOR SAMPLING LOCATIONS
- PHC — PETROLEUM HYDROCARBON
- 2,3,7,8 TCDD — 2,3,7,8-TETRACHLORODIBENZODIOXIN

NOTES

1. TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHOD FROM AERIAL PHOTOGRAPHY DATED DECEMBER 2001 BY SAN-LO AERIAL SURVEYS.
2. COORDINATES ARE IN CALIFORNIA STATE PLANE COORDINATE SYSTEM, NAD 83, ZONE 6.
3. ELEVATIONS IN FEET; BENCHMARK BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
4. ALL DETECTED ORGANICS AND ONLY METALS THAT HAVE EXCEEDED THE THRESHOLD CONCENTRATION (PRGs) ARE SHOWN ON THE FIGURE.
5. VALUES IN RED INDICATE THAT ANALYTE CONCENTRATIONS HAVE EXCEEDED BOTH THE RESIDENTIAL AND INDUSTRIAL PRG's, HOWEVER IN CASE OF METALS, THE CONCENTRATIONS ARE BELOW THE MCAS EL TORO BACKGROUND CONCENTRATIONS IN RED (BNI 1996).
6. VALUES IN GREEN INDICATE THAT ANALYTE CONCENTRATIONS EXCEEDED ONLY THE RESIDENTIAL PRG.
7. 2,3,7,8-TCDD CONCENTRATION SHOWN HERE IS THE TOTAL TOXICITY EQUIVALENT QUOTIENT VALUE FOR DIOXIN/FURAN GROUP

NORTH

60 0 60 120 FEET

SCALE: 1" = 60'

RI/FS Report — Draft Final

Detected Surface Soil Sampling Results - RSE Investigation

Anomaly Area 3

Former MCAS El Toro

Date: 04-08

Project No. 29307

EarthTech — A tyco International Ltd. Company

Figure 6-9

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Table 6-22: Statistics of Detected Analytes – Surface Soil Sampling (0-foot to 1-foot bgs) – RSE Investigation

Analyte	Number of Samples Analyzed [a]	Number of Detections	Minimum and Maximum Detected Concentrations (µg/kg)	Frequency of Detection (%)	Detections Above PRG
Motor oils (**mg/kg**)	37	18	3J–160	49	—
PHC as diesel fuel (**mg/kg**)	37	11	0.8J–15	30	—
PHC as gasoline (**mg/kg**)	37	27	0.0.2J–0.1J	73	—
Bis(2-ethylhexyl)phthalate	37	3	51J–65J	8	—
Diethylphthalate	37	1	140J	3	—
Anthracene	37	1	44J	3	—
Benzo[a]anthracene	37	7	7J–730J	19	1
Benzo(a)pyrene	37	3	10–1030J	8	1
Benzo[b]fluoranthene	37	5	8J–1790J	14	1
Benzo(g,h,i)perylene	37	4	7J–440J	11	—
Benzo[k]fluoranthene	37	4	7J–510J	11	1
Chrysene	37	4	8J–870	11	—
Dibenz[a,h]anthracene	37	1	97J	3	1
Fluoranthene	37	5	8J–1000	14	—
Indeno(1,2,3-c,d)pyrene	37	2	15J and 460J	5	—
Phenanthrene	37	2	9J and 290	5	—
Pyrene	37	5	11J–960	14	—
Total 2,3,7,8-TCDD (TEQ) (**pg/g**)	10	10	0.3304–20.21	100	2
Arsenic * (**mg/kg**)	37	37	1.6–4.7	100	37

NOTES:

[a] Number of samples analyzed for the specified analyte, including duplicates, if any.
* All arsenic detections were below former MCAS El Toro background value of 6.86 mg/kg.
% = percent
µg/kg = micrograms per kilogram
bgs = below ground surface
J = indicates an estimated value
mg/kg = milligrams per kilogram
pg/g = picograms per gram
PRG = preliminary remediation goal
TCDD = tetrachlorodibenzodioxin
TEQ = toxicity equivalency quotient

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Table 6-23: Summary of Detected Analytes - Subsurface Soil (greater than 1-foot to 35 feet bgs) - Previous Investigation

Parameter	PRGs Residential	PRGs Industrial	Background (0.95 Quantile)	Units														
				Sample ID:	20242-1095	20242-1102	20242-1109	20242-1106	20242-1097	20242-1112	20242-1111	20242-1113	20242-1098	20242-1108	20242-1100	20242-1105	20242-1096	20242-1099
				Location ID:	AA3-H3-01	AA3-2E-01	AA3-4E-01	AA3-H6-01	AA3-H2-01	AA3-H4-01	AA3-H5-01	AA3-H4-01	AA3-H1-01	AA3-5E-02	AA3-H8-01	AA3-H7-01	AA3-1E-01	AA3-1E-02
				Sample Type:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular	Regular	Regular	Regular	Regular	Regular
				Sample Date:	03/06/96	03/07/96	03/07/96	03/07/96	03/06/96	03/08/96	03/08/96	03/08/96	03/06/96	03/07/96	03/06/96	03/07/96	03/06/96	03/06/96
				Sample Depth :	4.0'	4.0'	6.0'	6.0'	6.0'	7.0'	7.0'	7.5'	10.0'	10.0'	14.0'	18.0'	16.0'	22.0'
TPH (EPA Method 8015M)																		
TPH as Diesel	-	-	-	mg/kg	11 U	5600	170	10.7 U	150	42	12	79	10.9 U	15	10.6 U	150	160	61
VOCs (EPA Method 8260)																		
2-Butanone (MEK)	7,300,000	28,000,000	-	µg/kg	160 U	79 U	62 U	53 U	120 U	64 U	53 U	65 U	60 U	50 U	59 U	160 U	73 U	90 U
Acetone	1,600,000	6,200,000	-	µg/kg	160 U	100	46 J	53 U	120 U	50 J	37 J	80	60 U	66	59 U	33 J	73 U	90 U
Benzene	601	1,315	-	µg/kg	16 U	7.9 U	6.2 U	5.3 U	12 U	6.4 U	5.3 U	1.7 J	6 U	5 U	5.9 U	16 U	7.3 U	9 U
Methylene chloride	9,107	20,527	-	µg/kg	16 U	9.2	6.2 U	5.3 U	12 U	6.4 U	5.3 U	6.5 U	6 U	5 U	5.9 U	14 J	7.3 U	9 U
Styrene	1,700,000	1,700,000	-	µg/kg	16 U	7.9 U	6.2 U	5.3 U	12 U	6.4 U	5.3 U	6.5 U	6 U	5 U	5.9 U	16 U	7.3 U	9 U
SVOCs (EPA Method 8270)																		
Benzo[a]anthracene	621	2,110	-	µg/kg	360 U	21000 U	1800 U	350 U	1800 U	1800 U	270 J	1800 U	360 U	380 U	350 U	3500 U	1700 U	390 U
Benzo[a]pyrene	62	211	-	µg/kg	280 U	16000 U	190 U	35 U	1400 U	1300 U	**230**[b]	1400 U	270 U	38 U	270 U	2700 U	140 J	39 U
Benzo[b]fluoranthene	621	2,110	-	µg/kg	360 U	21000 U	1800 U	350 U	1800 U	1800 U	440	1800 U	360 U	380 U	350 U	3500 U	1700 U	390 U
Chrysene	62,000	211,000	-	µg/kg	360 U	21000 U	1800 U	350 U	1800 U	1800 U	250 J	1800 U	360 U	380 U	350 U	3500 U	1700 U	390 U
Diethyl phthalate	48,882,478	100,000,000	-	µg/kg	360 U	21000 U	1800 U	96 J	1800 U	1800 U	260 J	1800 U	360 U	380 U	350 U	3500 U	1700 U	390 U
Fluoranthene	2,293,610	22,000,353	-	µg/kg	360 U	21000 U	1800 U	350 U	1800 U	1800 U	600	1800 U	360 U	380 U	350 U	3500 U	1700 U	390 U
Indeno[1,2,3-cd]pyrene	621	2,110	-	µg/kg	360 U	21000 U	190 U	35 U	1800 U	1800 U	81	1800 U	360 U	38 U	350 U	3500 U	63 J	39 U
Phenanthrene	-	-	-	µg/kg	360 U	21000 U	1800 U	350 U	1800 U	1800 U	140 J	1800 U	360 U	380 U	350 U	3500 U	1700 U	390 U
Pyrene	2,315,951	29,126,201	-	µg/kg	360 U	21000 U	1800 U	350 U	1800 U	1800 U	460	1800 U	360 U	380 U	350 U	3500 U	1700 U	390 U
Metals (EPA Method 6010B)[a]																		
Antimony	31	410	3.06	mg/kg	11 UJ	10.5 U	11.2 U	10.7 U	11 UJ	10.7 U	10.6 U	10.9 U	10.9 UJ	11.4 U	10.6 UJ	10.7 U	46 J	12 UJ
Arsenic	0.39	1.6	6.86	mg/kg	**3.05**	**2.12**	**2.49**	**1.81**	**4.63**	**4.59**	**2.85**	**4.35**	**3.45**	**3.23**	**3.98**	**1.85**	**211**	**4.04**
Barium	5,400	67,000	173	mg/kg	112	79.4	76	73	101	104	62.3	106	98.3	83.5	79.7	83.9	360	156
Beryllium	154	1,941	0.669	mg/kg	.459 U	.294 U	.298 U	.219 U	.361 U	.459 U	.215 U	.407 U	.419 U	.391 U	.533 U	.253 U	.63 U	.558 U
Cadmium	1.7	7.4	2.35	mg/kg	1.1 U	1.05 U	1.12 U	1.07 U	1.1 U	1.07 U	1.06 U	1.09 U	1.09 U	1.14 U	1.06 U	1.07 U	***2.42***	1.2 U
Chromium	211	448	26.9	mg/kg	10.2	10.4	7.04	4.4	13.2	15.8	12.9	16.9	12.3	9.16	13.2	6.88	53.1	14.9
Cobalt	903	1,921	6.98	mg/kg	3.73	5.33	3.09	2.54	4.18	5.8	2.97	4.52	4.32	3.5	6.1	2.92	72.8	6.74
Copper	3,129	40,877	10.5	mg/kg	6.56	10.7	6.48	3.04	9.28	12.7	5.82	12.6	6.56	6.2	11.3	4.35	2040	12.4
Lead	150	750	15.1	mg/kg	5.47	9.36	9.72	2.22	12.4	14.7	3.87	11.9	3.58	3.56	3.4	6.47	**677**	4.42
Manganese	1,762	19,458	291	mg/kg	211 J	231	156	144	214 J	250	145	213	181 J	123	125 J	149	1350 J	270 J
Molybdenum	390	5100	NE	mg/kg	2.2 UJ	2.1 U	2.24 U	2.14 U	2.19 UJ	2.15 U	2.13 U	2.17 U	2.19 UJ	2.29 U	2.13 J	2.14 U	***490 J***	3.2 UJ
Nickel	1,564	20,439	15.3	mg/kg	7.14	13.7	5.03	2.14 U	8.79	11.6	7.98	10.3	8.07	5.15	9.71	4.92 U	25.4	10.7
Selenium	391	5,110	0.32	mg/kg	1.1 U	1.05 U	1.12 U	1.07 U	1.1 U	1.07 U	1.06 U	1.09 U	1.09 U	1.14 U	1.06 U	1.07 U	3.4	1.2 U
Thallium	5.2	67	0.42	mg/kg	1.19 U	1.05 U	1.12 U	1.07 U	1.32 U	1.07 U	1.06 U	1.09 U	1.09 U	1.14 U	1.06 U	1.07 U	3.98	1.2 U
Vanadium	547	7,154	71.8	mg/kg	27.4	35.6	19.7	16.9	27.3	29.5	18	26.9	32.6	22.8	37.9	20	38.1	43.4
Zinc	23,463	100,000	77.9	mg/kg	37.7 J	45.9 J	35.9	26.2	43 J	50.7	26.2	45.9	36.4 J	32.5	34.1 J	27.5 J	6030 J	88 J
Dioxins/Furans (EPA Method 8290)																		
1,2,3,4,6,7,8-HPCDD	-	-	-	pg/g	4.3 J	NA	39	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-HPCDF	-	-	-	pg/g	1.7 U	NA	2.7 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-HPCDF	-	-	-	pg/g	0.72 U	NA	0.99 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HCDD	-	-	-	pg/g	0.64 U	NA	0.86 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HCDF	-	-	-	pg/g	0.41 U	NA	0.68 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-HCDD	-	-	-	pg/g	0.68 U	NA	1.5 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-HCDF	-	-	-	pg/g	0.39 U	NA	0.66 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-HCDD	-	-	-	pg/g	0.91 U	NA	1.1 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-HCDF	-	-	-	pg/g	0.77 U	NA	0.80 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-PECDD	-	-	-	pg/g	0.82 U	NA	1.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-PECDF	-	-	-	pg/g	0.49 U	NA	0.74 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6,7,8-HCDF	-	-	-	pg/g	0.42 U	NA	0.71 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,7,8-PECDF	-	-	-	pg/g	0.48 U	NA	0.73 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDD	3.9	27	-	pg/g	0.79 U	NA	0.78 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDF	-	-	-	pg/g	0.42 U	NA	0.66 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HPCDDs (total)	-	-	-	pg/g	8.6	NA	66	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HPCDFs (total)	-	-	-	pg/g	1.8	NA	6.8 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HCDDs (total)	-	-	-	pg/g	0.88 U	NA	4.1 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HCDFs (total)	-	-	-	pg/g	0.77 U	NA	1.6 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OCDD	-	-	-	pg/g	40	NA	330 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OCDF	-	-	-	pg/g	5.9 J	NA	10 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PECDDs (total)	-	-	-	pg/g	0.82 U	NA	1.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PECDFs (total)	-	-	-	pg/g	0.77 U	NA	2.0 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TCDDs (total)	-	-	-	pg/g	0.79 U	NA	0.78 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TCDFs (total)	-	-	-	pg/g	0.54 U	NA	0.66 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TEQ (Total 2,3,7,8-TCDD)	3.9	27	-	pg/g	0.048	NA	0.424	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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Table 6-23: Summary of Detected Analytes - Subsurface Soil (greater than 1-foot to 35 feet bgs) - Previous Investigation

Parameter	PRGs Residential	PRGs Industrial	Background (0.95 Quantile)	Units	20242-1101	20242-1103	20242-1110	20242-1114	20242-1107	20242-1117	20242-1118	20242-1104	20242-1116	20242-1115
Sample ID:					20242-1101	20242-1103	20242-1110	20242-1114	20242-1107	20242-1117	20242-1118	20242-1104	20242-1116	20242-1115
Location ID:					AA3-1E-03	AA3-2E-02	AA3-3E-01	AA3-3E-02	AA3-5E-01	AA3-5E-03	AA3-5E-03	AA3-6E-01	AA3-7E-01	AA3-3E-03
Sample Type:					Regular	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular	Regular	Regular
Sample Date:					03/06/96	03/07/96	03/08/96	03/08/96	03/07/96	03/09/96	03/09/96	03/07/96	03/08/96	03/08/96
Sample Depth :					20.0'	22.0'	22.0'	22.0'	22.0'	22.0'	22.5'	22.0'	22.0'	35.0'
TPH (EPA Method 8015M)														
TPH as Diesel	-	-	-	mg/kg	12 U	130	63	110	13	220	130	260	370	1100
VOCs (EPA Method 8260)														
2-Butanone (MEK)	7,300,000	28,000,000	-	µg/kg	78 U	66 U	67 U	52 J	52 U	10 J	13 J	100 U	52 U	11 J
Acetone	1,600,000	6,200,000	-	µg/kg	78 U	50 J	40 J	230 J	46 J	31 J	98	100 J	52 U	77
Benzene	670	1,500	-	µg/kg	7.8 U	6.6 U	6.7 U	6.3 U	5.2 U	5.9 U	5.9 U	10 U	5.2 U	5.9 U
Methylene chloride	8,900	21,000	-	µg/kg	7.8 U	7.7	6.7 U	6.3 U	5.2 U	3.2 J	34	11	3 J	2.7 J
Styrene	1,700,000	1,700,000	-	µg/kg	7.8 U	6.6 U	6.7 U	6.3 U	5.2 U	5.9 U	5.9 U	10 U	32	5.9 U
SVOCs (EPA Method 8270)														
Benzo[a]anthracene	621	2,110	-	µg/kg	400 U	2000 U	400 U	3800 U	390 U	780 U	390 U	3800 U	10000 U	390 U
Benzo[a]pyrene	62	211	-	µg/kg	300 U	1500 U	310 U	2900 U	290 U	590 U	290 U	2900 U	1000 U	290 U
Benzo[b]fluoranthene	621	2,110	-	µg/kg	400 U	2000 U	400 U	3800 U	390 U	780 U	390 U	3800 U	10000 U	390 U
Chrysene	62,000	211,000	-	µg/kg	400 U	2000 U	400 U	3800 U	390 U	780 U	390 U	3800 U	10000 U	390 U
Diethyl phthalate	48,882,478	100,000,000	-	µg/kg	100 J	2000 U	400 U	3800 U	390 U	780 U	390 U	3800 U	10000 U	390 U
Fluoranthene	2,293,610	22,000,353	-	µg/kg	400 U	2000 U	400 U	3800 U	390 U	780 U	390 U	3800 U	10000 U	390 U
Indeno[1,2,3-cd]pyrene	621	2,110	-	µg/kg	400 U	2000 U	400 U	3800 U	390 U	780 U	390 U	3800 U	1000 U	390 U
Phenanthrene	-	-	-	µg/kg	400 U	2000 U	400 U	3800 U	390 U	780 U	390 U	3800 U	10000 U	390 U
Pyrene	2,315,951	29,126,201	-	µg/kg	400 U	2000 U	400 U	3800 U	390 U	780 U	390 U	3800 U	10000 U	390 U
Metals (EPA Method 6010B)[a]														
Antimony	31	410	3.06	mg/kg	12 UJ	12.1 U	12.2 U	11.5 U	11.7 U	11.8 U	11.7 U	11.5 U	10.4 U	11.7 U
Arsenic	0.39	1.6	6.86	mg/kg	**6.78**	**6.47**	**4.92**	**6.56**	**7.74**	**3.25**	**3.05**	**2.99**	**2.6**	**4.82**
arium	5,400	67,000	173	mg/kg	156	101	86.8	100	68.5	88.6	93.5	95.5	55.5	98.1
Beryllium	154	1,941	0.669	mg/kg	.618 U	.419 U	.35 U	.467 U	.378 U	.357	.383	.302 U	.29	.499
Cadmium	1.7	7.4	2.35	mg/kg	1.2 U	1.35	1.22 U	1.15 U	1.17 U	1.18 U	1.17 U	1.15 U	1.84	1.17 U
Chromium	211	448	26.9	mg/kg	21.1	23.8	16	14.1	8.3	7.29	8.08	9.34	10.8	11.2
Cobalt	903	1,921	6.98	mg/kg	4.97	4.03	2.21	4.31	3.43	3.27	3.6	3.55	6.97	4.36
Copper	3,129	40,877	10.5	mg/kg	7.9	17.2	4.3	25.8	4.79	7.48	7.12	6.92	11.1	7.91
Lead	150	750	15.1	mg/kg	5.1	24.6	2.96	6.13	3.7	4.73	3.93	5.53	122	4.39
Manganese	1,762	19,458	291	mg/kg	185 J	175	124	169	91.2	138	136	168	181	107
Molybdenum	390	5100	NE	mg/kg	2.4 UJ	7.81	2.45 U	2.3 U	2.35 U	2.37 U	2.35 U	2.29 U	2.07 U	2.34 U
Nickel	1,564	20,439	15.3	mg/kg	11.5	9.87	6.61	8.51	5.32	7.28	7.4	6.79	8.26	7.12
Selenium	391	5,110	0.32	mg/kg	1.2 U	1.21 U	1.22 U	1.15 U	1.17 U	1.18 U	1.17 U	1.15 U	1.04 U	1.17 U
Thallium	5.2	67	0.42	mg/kg	1.22 U	1.21 U	1.22 U	1.15 U	1.17 U	1.18 U	1.17 U	1.15 U	1.04 U	1.17 U
Vanadium	547	7,154	71.8	mg/kg	43.2	39.7	25.8	33.8	20.8	20.6	22.6	25.9	21.6	26.8
Zinc	23,463	100,000	77.9	mg/kg	52.6 J	72 J	34.7	37.6	21.9	37.5	34.7	39.2 J	146	32.5
Dioxins/Furans (EPA Method 8290)														
1,2,3,4,6,7,8-HPCDD	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-HPCDF	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-HPCDF	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HCDD	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HCDF	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-HCDD	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-HCDF	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-HCDD	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-HCDF	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-PECDD	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-PECDF	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6,7,8-HCDF	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,7,8-PECDF	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDD	3.9	27	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDF	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HPCDDs (total)	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HPCDFs (total)	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HCDDs (total)	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HCDFs (total)	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OCDD	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OCDF	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PECDDs (total)	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PECDFs (total)	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TCDDs (total)	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TCDFs (total)	-	-	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TEQ (Total 2,3,7,8-TCDD)	3.9	27	-	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NOTES:

U = indicates the analyte was not detected at or above the stated limit.
UJ = indicates the analyte was not detected at or above the stated limit. The sample detection limit is an estimated value.
J = indicates an estimated value.
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
pg/g = picogram per per kilogram
NE = not established
NA = not analyzed
' = foot

TPH = total petroleum hydrocarbons
EPA = Environmental Protection Agency
PRG = preliminary remediation goals
VOC = volatile organic compound
SVOCs = semivolatile organic compounds
AA3 = Anomaly Area 3
RSE = Removal Site Evaluation
- = PRGs or background concentration values not established for this particular analyte.
ID = identification

[a] For metals,
Values in **bold and in highlighted cells** indicate concentrations above the MCAS El Toro background concentrations (BNI 1996) and their respective residential and industrial PRGs.
Values in ***bold and italicized*** indicate concentrations exceeding the MCAS El Toro background concentrations (BNI 1996) and residential PRGs; however, their values are below the industrial PRGs.
Values in **bold** indicate concentrations above their respective residential and industrial PRGs, but below the MCAS El Toro background concentrations (BNI 1996).
Values underlined indicate concentrations above the residential PRGs only, but below the MCAS El Toro background concentrations (BNI 1996) and industrial PRGs.
[b] Values in **bold and in highlighted cells** indicate that the particular analyte has concentrations exceeding its residential and industrial PRGs.

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Table 6-24: Statistics of Detected Analytes – Subsurface Soil Sampling (greater than 1-foot to 35 feet bgs) – Previous Investigation

Analyte	Number of Samples Analyzed [a]	Number of Detections	Minimum and Maximum Detected Concentrations (µg/kg)	Frequency of Detection (%)	Detections Above PRGs	Detections Above Former MCAS El Toro Background Concentrations and PRGs
TPH as Diesel (**mg/kg**)	24	19	12 – 5600	79	—	—
2-Butanone (MEK)	24	4	11J – 52	17	—	—
Acetone	24	15	31J – 230J	21	—	—
Benzene	24	1	1.7J	4	—	—
Methylene chloride	24	8	2.7J – 34	33	—	—
Styrene	24	1	32	4	—	—
Benzo[a]anthracene	24	1	270J	4	—	—
Benzo[a]pyrene	24	2	140J and 230	8	1	—
Benzo[b]fluoranthene	24	1	440	4	—	—
Chrysene	24	1	250J	4	—	—
Diethyl phthalate	24	2	100J and 260J	8	—	—
Fluoranthene	24	1	600	4	—	—
Indeno[1,2,3-cd]pyrene	24	2	63J and 81	8	—	—
Phenanthrene	24	1	140J	4	—	—
Pyrene	24	1	460	4	—	—
Antimony (**mg/kg**)	24	1	46 J	4	1	1
Arsenic (**mg/kg**)	24	24	1.81 – 211	100	24	2
Cadmium (**mg/kg**)	24	3	1.35 – 2.42	13	2	1
Chromium (**mg/kg**)	24	24	4.4 – 53.1	100	—	—
Cobalt (**mg/kg**)	24	24	2.21 – 72.8	100	—	—
Copper (**mg/kg**)	24	24	3.04 – 2040	100	—	—
Lead (**mg/kg**)	24	24	2.22 – 677	100	1	1
Manganese (**mg/kg**)	24	24	91.2 – 1350J	100	—	—
Molybdenum (**mg/kg**)	24	3	2.13J – 490J	13	1	1*
Nickel (**mg/kg**)	24	22	5.03 – 25.4	92	—	—
Selenium (**mg/kg**)	24	1	3.4	4	—	—
Thallium (**mg/kg**)	24	1	3.98	4	—	—
Vanadium (**mg/kg**)	24	24	16.9 – 43.4	100	—	—
Zinc (**mg/kg**)	24	24	21.9 – 6030J	100	—	—
Total 2,3,7,8-TCDD (**pg/g**)	2	2	0.0476 – 0.424	100	—	—

Notes:

* Background concentrations not established for this analyte.
[a] Number of samples analyzed for the specified analyte, including duplicates, if any.
% = percent
µg/kg = micrograms per kilogram
bgs = below ground surfaceJ = indicates an estimated value
mg/kg = milligrams per kilogram
pg/g = picograms per gram
PRG = preliminary remediation goal
TPH = total petroleum hydrocarbons

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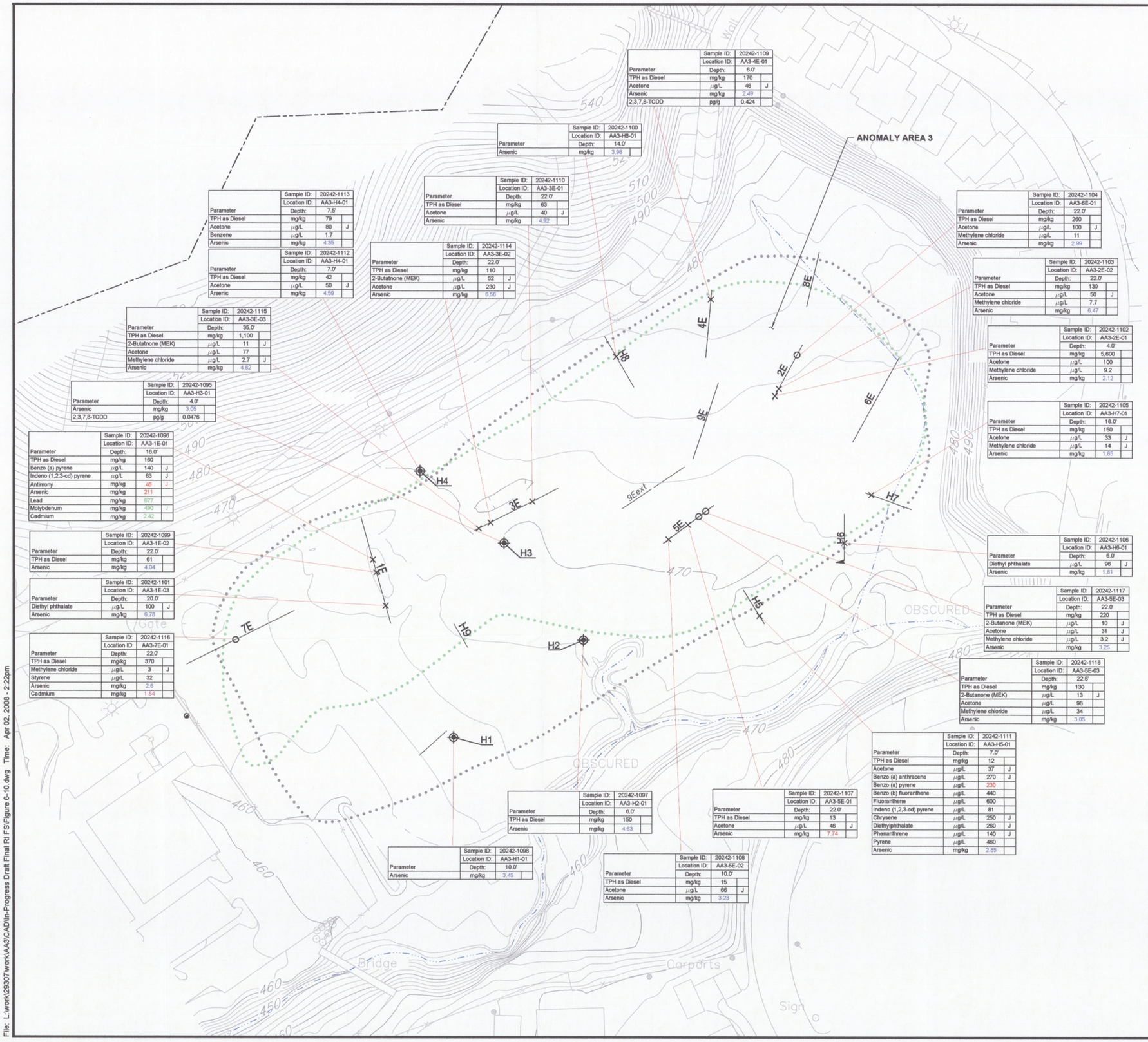

Parameter	Sample ID:	20242-1109	
	Location ID:	AA3-4E-01	
	Depth:	6.0'	
TPH as Diesel	mg/kg	170	
Acetone	µg/L	46	J
Arsenic	mg/kg	2.49	
2,3,7,8-TCDD	pg/g	0.424	

Parameter	Sample ID:	20242-1100	
	Location ID:	AA3-H8-01	
	Depth:	14.0'	
Arsenic	mg/kg	3.98	

Parameter	Sample ID:	20242-1113	
	Location ID:	AA3-H4-01	
	Depth:	7.5'	
TPH as Diesel	mg/kg	79	
Acetone	µg/L	80	J
Benzene	µg/L	1.7	
Arsenic	mg/kg	4.35	

Parameter	Sample ID:	20242-1110	
	Location ID:	AA3-3E-01	
	Depth:	22.0'	
TPH as Diesel	mg/kg	63	
Acetone	µg/L	40	J
Arsenic	mg/kg	4.92	

Parameter	Sample ID:	20242-1104	
	Location ID:	AA3-6E-01	
	Depth:	22.0'	
TPH as Diesel	mg/kg	260	
Acetone	µg/L	100	J
Methylene chloride	µg/L	11	
Arsenic	mg/kg	2.99	

Parameter	Sample ID:	20242-1112	
	Location ID:	AA3-H4-01	
	Depth:	7.0'	
TPH as Diesel	mg/kg	42	
Acetone	µg/L	50	J
Arsenic	mg/kg	4.59	

Parameter	Sample ID:	20242-1114	
	Location ID:	AA3-3E-02	
	Depth:	22.0'	
TPH as Diesel	mg/kg	110	
2-Butatnone (MEK)	µg/L	52	J
Acetone	µg/L	230	J
Arsenic	mg/kg	6.56	

Parameter	Sample ID:	20242-1103	
	Location ID:	AA3-2E-02	
	Depth:	22.0'	
TPH as Diesel	mg/kg	130	
Acetone	µg/L	50	J
Methylene chloride	µg/L	7.7	
Arsenic	mg/kg	6.47	

Parameter	Sample ID:	20242-1115	
	Location ID:	AA3-3E-03	
	Depth:	35.0'	
TPH as Diesel	mg/kg	1,100	
2-Butatnone (MEK)	µg/L	11	J
Acetone	µg/L	77	
Methylene chloride	µg/L	2.7	J
Arsenic	mg/kg	4.82	

Parameter	Sample ID:	20242-1102	
	Location ID:	AA3-2E-01	
	Depth:	4.0'	
TPH as Diesel	mg/kg	5,600	
Acetone	µg/L	100	
Methylene chloride	µg/L	9.2	
Arsenic	mg/kg	2.12	

Parameter	Sample ID:	20242-1095	
	Location ID:	AA3-H3-01	
	Depth:	4.0'	
Arsenic	mg/kg	3.05	
2,3,7,8-TCDD	pg/g	0.0476	

Parameter	Sample ID:	20242-1105	
	Location ID:	AA3-H7-01	
	Depth:	18.0'	
TPH as Diesel	mg/kg	150	
Acetone	µg/L	33	J
Methylene chloride	µg/L	14	J
Arsenic	mg/kg	1.85	

Parameter	Sample ID:	20242-1096	
	Location ID:	AA3-1E-01	
	Depth:	16.0'	
TPH as Diesel	mg/kg	160	
Benzo (a) pyrene	µg/L	140	J
Indeno (1,2,3-cd) pyrene	µg/L	63	J
Antimony	mg/kg	46	J
Arsenic	mg/kg	211	
Lead	mg/kg	677	
Molybdenum	mg/kg	490	J
Cadmium	mg/kg	2.42	

Parameter	Sample ID:	20242-1106	
	Location ID:	AA3-H6-01	
	Depth:	6.0'	
Diethyl phthalate	µg/L	96	J
Arsenic	mg/kg	1.81	

Parameter	Sample ID:	20242-1099	
	Location ID:	AA3-1E-02	
	Depth:	22.0'	
TPH as Diesel	mg/kg	61	
Arsenic	mg/kg	4.04	

Parameter	Sample ID:	20242-1117	
	Location ID:	AA3-5E-03	
	Depth:	22.0'	
TPH as Diesel	mg/kg	220	
2-Butanone (MEK)	µg/L	10	J
Acetone	µg/L	31	J
Methylene chloride	µg/L	3.2	J
Arsenic	mg/kg	3.25	

Parameter	Sample ID:	20242-1101	
	Location ID:	AA3-1E-03	
	Depth:	20.0'	
Diethyl phthalate	µg/L	100	J
Arsenic	mg/kg	6.78	

Parameter	Sample ID:	20242-1118	
	Location ID:	AA3-5E-03	
	Depth:	22.5'	
TPH as Diesel	mg/kg	130	
2-Butanone (MEK)	µg/L	13	J
Acetone	µg/L	98	
Methylene chloride	µg/L	34	
Arsenic	mg/kg	3.05	

Parameter	Sample ID:	20242-1116	
	Location ID:	AA3-7E-01	
	Depth:	22.0'	
TPH as Diesel	mg/kg	370	
Methylene chloride	µg/L	3	J
Styrene	µg/L	32	
Arsenic	mg/kg	2.6	
Cadmium	mg/kg	1.84	

Parameter	Sample ID:	20242-1111	
	Location ID:	AA3-H5-01	
	Depth:	7.0'	
TPH as Diesel	mg/kg	12	
Acetone	µg/L	37	J
Benzo (a) anthracene	µg/L	270	J
Benzo (a) pyrene	µg/L	230	
Benzo (b) fluoranthene	µg/L	440	
Fluoranthene	µg/L	600	
Indeno (1,2,3-cd) pyrene	µg/L	81	
Chrysene	µg/L	250	J
Diethylphthalate	µg/L	260	J
Phenanthrene	µg/L	140	J
Pyrene	µg/L	460	
Arsenic	mg/kg	2.85	

Parameter	Sample ID:	20242-1097	
	Location ID:	AA3-H2-01	
	Depth:	6.0'	
TPH as Diesel	mg/kg	150	
Arsenic	mg/kg	4.63	

Parameter	Sample ID:	20242-1107	
	Location ID:	AA3-5E-01	
	Depth:	22.0'	
TPH as Diesel	mg/kg	13	
Acetone	µg/L	46	J
Arsenic	mg/kg	7.74	

Parameter	Sample ID:	20242-1098	
	Location ID:	AA3-H1-01	
	Depth:	10.0'	
Arsenic	mg/kg	3.45	

Parameter	Sample ID:	20242-1108	
	Location ID:	AA3-5E-02	
	Depth:	10.0'	
TPH as Diesel	mg/kg	15	
Acetone	µg/L	66	J
Arsenic	mg/kg	3.23	

LEGEND

- MINOR SURFACE ELEVATION: 2-FOOT INTERVALS
- 460 — MAJOR SURFACE ELEVATION: 10-FOOT INTERVALS
- MCAS EL TORO BOUNDARY
- EXISTING STREAM OR WASH
- ESTIMATED EXTENT OF WASTE PLACEMENT (EARTH TECH 2001)
- REVISED EXTENT OF WASTE PLACEMENT BASED ON TRENCHING ACTIVITY (MARCH 2000 AND OCTOBER 2002)
- 5E — TRENCH LOCATIONS
- H4 — TRENCH/POTHOLE LOCATIONS
- × SAMPLE LOCATION
- O SAMPLE LOCATION NOT SPECIFIED

NOTES

1. TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHOD FROM AERIAL PHOTOGRAPHY DATED DECEMBER 2001 BY SAN-LO AERIAL SURVEYS.
2. COORDINATES ARE IN CALIFORNIA STATE PLANE COORDINATE SYSTEM, NAD 83, ZONE 6.
3. ELEVATIONS IN FEET; BENCHMARK BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
4. SOIL SAMPLES COLLECTED DURING MARCH 2000 EXPLORATORY TRENCHING ACTIVITY.
5. CONCENTRATIONS IN RED > RESIDENTIAL AND INDUSTRIAL PRGS. IN CASE OF METALS, CONCENTRATIONS IN RED > MCAS EL TORO BACKGROUND CONCENTRATIONS (BNI 1996).
6. METALS ONLY - CONCENTRATIONS IN BLUE > RESIDENTIAL AND INDUSTRIAL PRGS. < MCAS EL TORO BACKGROUND VALUES
7. CONCENTRATIONS IN GREEN > RESIDENTIAL PRGS AND MCAS EL TORO BACKGROUND VALUES < INDUSTRIAL PRGS
8. CONCENTRATIONS IN MAGENTA > RESIDENTIAL PRGS < INDUSTRIAL PRGS AND MCAS EL TORO BACKGROUND VALUES

NORTH

60 0 60 120 FEET

SCALE: 1"=60'

RI/FS Report — Draft Final

Detected Subsurface Soil Sampling Results - Previous Investigation

Anomaly Area 3

Date: 04-08 | Former MCAS El Toro | Figure 6-10

Project No. 29307 | EarthTech — A tyco International Ltd. Company

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6.4.3 Summary of Soil Sampling Results

Based on the results of the two trenching activities (previous and RSE investigations) and subsurface exploration during the soil gas survey, it was confirmed that there is an average of 4.5 feet of soil cover with isolated areas having 2 feet of soil cover over the construction debris. The purpose of the surface soil sampling was to quantify the risk due to chemical contamination in surface soil (existing soil cover) to human and ecological receptors at the site.

The purpose of subsurface soil sampling was to help adequately characterize the nature of the debris and evaluate the risk of adverse human health and ecological effects at this site.

For surface soils (0-foot to 1-foot bgs), no VOCs were detected in any of the surface soil samples (37 samples at 33 locations). Petroleum hydrocarbons were detected at very low concentrations ranging from 0.02 J mg/kg to 160 mg/kg. Only 5 SVOCs (benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, B[a]P and dibenz[a,h]anthracene) at only 1 location (HA15) out of 33 surface soil sampling locations exceeded residential PRGs. 2,3,7,8-TCDD exceeded its residential PRG at only 1 out of 9 surface soil sampling locations (HA26) where samples were collected and analyzed for dioxins and furans. All metals that were analyzed were either less than PRGs or within the background concentrations at all 33 surface soil sampling locations. It can be concluded that metals are detected in the surface soil at a frequency that reflects their natural variation in the soils. In subsurface soil samples, with the exception of common laboratory contaminants such as acetone, 2-butanone, and methylene chloride, the frequency of detection of the VOCs and SVOCs is less than 4 percent and 8 percent, respectively. None of the detected VOCs exceeded residential or industrial PRGs. Only 1 SVOC (B[a]P) in only 1 sample (20242-1111) out of 24 samples exceeded its residential PRG.

Asbestos and perchlorate were not detected in any of the subsurface soil samples. Of 24 samples analyzed, 19 samples had detected concentrations of diesel range petroleum hydrocarbons. Of these 19 detections, 2 had concentrations of 1,100 mg/kg and 5,600 mg/kg; all others ranged from 12 to 370 mg/kg. The maximum concentrations of all the metals that were detected above background levels and residential PRGs (antimony, arsenic, cadmium, lead, and molybdenum) and the maximum number of metals that exceeded background concentrations are reported from one sample (20242-1096) collected from Trench 1E at 16 feet bgs. Metal analytical results indicated high variability in concentrations of metals at the site, which is not uncommon and can be attributed to natural conditions. Only 2 in 24 samples for arsenic and only 1 in 24 samples for antimony, cadmium, lead, and molybdenum exceeded both background concentrations and PRGs.

These sampling results and the physical characterization of areas that contained significant volumes of construction debris support the previous conclusions that only construction-related debris was placed at AA 3. In addition, characterization of the near-surface soil does not show that significant levels of contamination exist. These data, coupled with the human health and ecological risk assessments, can be used to develop a response action that is protective of human and ecological receptors.

6.5 GROUNDWATER

The RSE DQO Decision Rule #4 of the RSE investigation recommended additional groundwater sampling if the groundwater was not adequately characterized...

Four wells (MW01 through MW04) existed at the site before the RSE investigation The well locations are presented on Figure 4-1. Wells MW05 through MW10, including dual nested wells at

MW09, were installed as part of the RSE investigation. Monitoring Wells MW03 and MW06 were installed as upgradient wells and MW01, MW02, and MW10 (screened in bedrock) were installed as downgradient wells. Sample results from Wells MW02, MW04, and MW10 were used to characterize the groundwater from the deepest section of the fill (south and northeast of the intersection of cross section lines AA 3-2-2' and AA 3-12-12' [see Figure 5-7]).

Dual nested Wells MW09A and MW09B were installed close to the debris between existing Well MW01 and Well MW08 to verify if multiple water bearing zones were present at the site and to evaluate if there is any radial migration of constituents in groundwater from the lowest portion of the debris placement area.

Additional groundwater Monitoring Wells, MW11 through MW14, were installed in February 2005. Wells MW11, MW12, and MW14 were installed within the waste placement area and Well MW13 was installed as an upgradient well. Well MW 14 was installed at a location where the waste and groundwater interface was encountered (i.e., the groundwater at this location was encountered within the waste). It was presumed that these would provide conclusive evidence of whether the wastes that are placed at AA 3 are adversely impacting the groundwater.

As part of previous sampling events (4 November 1999 and 20 April 2000), the existing four wells (MW01, MW02, MW03, and MW04) were gauged and sampled. The samples were analyzed for petroleum hydrocarbons, VOCs, SVOCs, metals, perchlorate, nitrates, and radionuclides. A summary of detected analytes from these previous sampling events is presented in Table 6-25.

6.5.1 November 1999 Groundwater Sampling Event

Five groundwater samples (including a duplicate at MW01) were collected during the November 1999 sampling event. An anomalous detection (less than its MCL of 13 µg/L) of methyl tertiary butyl ether (MTBE) was reported from the sample and its duplicate (2.6 J and 2.5 J µg/L) collected from Well MW01 during the November 1999 sampling event. In Well MW03, selenium was the only metal that was detected at a concentration (50.3 µg/L) slightly exceeding its MCL value (50 µg/L). Gross alpha concentrations from all wells exceeded the MCL value of 15 picocuries per liter (pCi/L).

6.5.2 April 2000 Groundwater Sampling Event

Four samples were collected during the April 2000 sampling event. The MTBE detection in the November 1999 sampling event from Well MW01 was not confirmed in the April 2000 sampling event. Chromium was detected in Well MW02 (357 µg/L) above its MCL value (50 µg/L). Of all the radionuclides detected, only gross alpha and uranium (MCL of 20 pCi/L) concentrations exceeded the MCL value in all of the wells.

6.5.3 December 2002 Sampling Event – Round 1 RSE Investigation

Twelve groundwater samples (including one duplicate from Well MW10) were analyzed for petroleum hydrocarbons, VOCs, SVOCs, metals, and perchlorate (Appendix B). A complete data set for Round 1 groundwater sampling is presented in Appendix B. Radionuclide analyses were not conducted for groundwater because Phases I and II radionuclide evaluations (Earth Tech 2001) concluded that the radionuclides in the groundwater were naturally occurring, and not anthropogenic, and there was no evidence that the gross alpha and gross beta detected at the former MCAS El Toro were caused by Marine Corps activities. Therefore, no further evaluation of the origin of the radionuclides in groundwater was recommended. The December 2002 groundwater

Table 6-25: Summary of Detected Analytes - Groundwater Sampling - AA3 Previous Sampling Events

Parameter	Regulatory Threshold Concentrations (µg/L)	Sample ID:	20242-987	20242-990	20242-1123	20242-984	20242-1124	20242-989	20242-1120	20242-981	20242-1122
		Location ID:	AA3-MW-01	AA3-MW-01	AA3-MW-01	AA3-MW-02	AA3-MW-02	AA3-MW-03	AA3-MW-03	AA3-MW-04	AA3-MW-04
		Sample Type:	Regular	Duplicate	Regular	Regular	Regular	Regular	Regular	Regular	Regular
		Sample Date:	11/03/99	11/03/99	04/19/00	11/02/99	04/19/00	11/03/99	04/18/00	11/01/99	04/19/00
VOCs (EPA 8260A)		Unit									
Methyl tert-butyl ether (MTBE)	13[c]	µg/L	2.6 J	2.5 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Metals (EPA 6010)											
Arsenic	50[c]	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	26.4	23.2
Chromium	50[c]	µg/L	50 U	50 U	50 U	50 U	**357**	50 U	50 U	50 U	50 U
Manganese	50[d]	µg/L	**80.2**	**77.1**	20 U	**259**	**433**	20.9	20 U	48.1	20 U
Selenium	50[c]	µg/L	5.47 J	9.32 J	12.9 U	18 U	11.8 U	**50.3**	37.7	22.8	19.4 U
Zinc	-	µg/L	20 U	20 U	20 U	29.4	20 U	20 U	20 U	20 U	20 U
Miscellaneous											
Nitrate (NO^3) (EPA 300.0)	45[c]	mg/L	1.33	1.32	NA	3.23	NA	1.14	NA	5.52	NA
Radionuclides											
Americium 241 (ASTM D3972)	-	pCi/L	NA	NA	0.026	NA	0.016	NA	0.018	NA	0.012
Thorium 228 (ASTM D3972)	-	pCi/L	NA	NA	0.056 U	NA	0.097 U	NA	0.04 U	NA	0.027 U
Thorium 230 (ASTM D3972)	-	pCi/L	NA	NA	0.119 U	NA	0.13 U	NA	0.114 U	NA	0.144 U
Thorium 232 (ASTM D3972)	-	pCi/L	NA	NA	0.008 U	NA	0.015 U	NA	0.011 U	NA	0.057 U
Total Uranium (ASTM D3972)	20[a,c]	pCi/L	NA	NA	**47.4**	NA	**31.63**	NA	**50.02**	NA	**56.01**
Lead 210 (ASTM D5811M)	-	pCi/L	NA	NA	0.49 J	NA	0.45 J	NA	0.51 J	NA	0.93 J
Total (Radium 226) (EPA 903.0)	5[b,c]	pCi/L	NA	NA	0.09	NA	0.1	NA	0.02	NA	0.35
Gross Alpha (EPA 9310)	15[c]	pCi/L	**34.6**	**35.3**	**27.6**	**23.5**	**28.3**	**35.5**	**35.7**	**50**	**45.9**
Gross Beta (EPA 9310)	50[c]	pCi/L	11.4	11.5	21.8	34.7	22.7	12.8	30	20.5	34.8
Radium 228 (EPA 904.0)	5[b]	pCi/L	NA	NA	0.66	NA	0.29	NA	-0.01	NA	0.13

Notes:

µg/L = micrograms per liter
mg/L = milligram per liter
pCi/L = picocuries per liter
AA3 = Anomaly Area 3
NA = not analyzed
ASTM = American Society of Testing and Materials
VOC = volatile organic compound

U = indicates the analyte was not detected at or above the stated limit.
J = indicates an estimated value.
MCL = maximum contaminant level
- = Regulatory Threshold Concentrations not established for this particular analyte.
EPA = Environmental Protection Agency
ID = identification

[a] The regulatroy threshold limit is for total uranium constituents.
[b] The regulatory threshold limit is for total radium constiuents.
[c] Value represents the stringent concentration of Federal and California MCLs.
[d] Value represents the secondary MCL.
Values in **bold** indicate that the particular analyte had exceeded its regulatory threshold limit.

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samples were collected as part of the first sampling event of the RSE investigation. Detected analytes from this sampling event are presented in Table 6-26.

VOCs were not detected in any of the wells sampled with the exception of detection of chloroform (0.61 µg/L compared to its MCL of 100 µg/L) at MW08.

Random and very low detections (much lower than tap water PRGs) of diethylphthalate (non-detect to 2 J µg/L in MW01 and MW08), m/p-creosol (non-detect to 6 J µg/L in MW02), and phenol (non-detect to 12 µg/L in MW02) were reported.

A groundwater sample collected from Well MW01 had nickel concentrations (105 µg/L) exceeding the MCL of 100 µg/L. Chromium concentrations in MW02, exceeding the MCL in the April 2000 sampling event was confirmed in the December 2002 sampling event (296 µg/L).

Motor oils (0.37 milligrams per liter [mg/L]) and petroleum hydrocarbons as diesel fuel (1.3 mg/L) were the other analytes reported from this well. No other well reported motor oils or petroleum hydrocarbons as diesel, except for trace detection (0.008J mg/L) of diesel fuel in MW08.

6.5.4 March 2003 Sampling Event – Round 2 RSE Investigation

Fourteen groundwater samples (including three duplicates) were analyzed for petroleum hydrocarbons, VOCs, SVOCs, metals, and perchlorate. A complete data set for Round 2 groundwater sampling is presented in Appendix B.

The March 2003 groundwater samples were collected as part of the second RSE investigation sampling event. Detected analytes from this sampling event are presented in Table 6-26.

No VOCs were detected in any of the wells sampled with the exception of 4-methyl-2-pentanone (detections of 0.3 µg/L, 0.5 µg/L, and 2 µg/L at three wells). No SVOCs were detected in any of wells sampled with the exception of low detection of butyl benzyl phthalate (0.7 µg/L) in one well and bis(2-ethylhexyl)phthalate (2 µg/L) in one well.

The chromium concentrations in MW02 were significantly below the MCL concentration of 50 µg/L. In contrast, chromium concentrations in Well MW02 during the April 2000 and December 2002 sampling events were 357 µg/L and 296 µg/L, respectively. Chromium concentrations in the MW01 groundwater sample and its duplicate were 203 µg/L and 120 µg/L, respectively. All groundwater samples had nickel concentrations significantly lower than its MCL value of 100 µg/L. At one well, thallium was reported at a concentration of 5.7 µg/L, exceeding its MCL of 5 µg/L.

Motor oils (0.08 J mg/L) and petroleum hydrocarbons as diesel fuel (0.2 J mg/L) were the other analytes reported from MW02. No other well sampled reported motor oils or petroleum hydrocarbons as diesel.

The results were consistent with the previous sampling events.

6.5.5 November 2003 Sampling Event – Round 3 RSE Investigation

Fourteen groundwater samples (including three duplicates) were analyzed for petroleum hydrocarbons, VOCs, SVOCs, metals, and perchlorate. A complete data set for Round 3 groundwater sampling is presented in Appendix B.

The November 2003 groundwater samples were collected as part of the third sampling event of the RSE investigation. Detected analytes from this sampling event are presented in Table 6-26.

VOCs and SVOCs were not detected in any of the wells sampled.

All groundwater samples reported metal concentrations that were lower than their respective MCL values, in particular, chromium, nickel, and thallium. The chromium concentrations in Wells MW01 and MW02 were significantly below the MCL concentration of 50 µg/L.

Petroleum hydrocarbons as gasoline were detected in seven wells ranging from 0.02 J mg/L to 0.03 J mg/L. There were no detections of motor oils or petroleum hydrocarbons as diesel in any of the wells sampled.

6.5.6 April 2004 Sampling Event – Round 4 RSE Investigation

Eighteen groundwater samples (including five duplicates) were analyzed for petroleum hydrocarbons, VOCs, SVOCs, metals, and perchlorate. A complete data set for Round 4 groundwater sampling is presented in Appendix B.

At selected wells, the sampling suite for this round also included dissolved metals and hexavalent chromium analyses. Groundwater samples were collected from upgradient Well (MW06) and downgradient Wells MW01 and MW02 for dissolved metals (EPA Method 6010) and hexavalent chromium (EPA Method 7199) analysis. Dissolved metal analysis was conducted to distinguish the dissolved metal concentrations from the total metal concentrations. A comparison of dissolved and total metal concentrations in the upgradient well with the dissolved and total concentrations in the downgradient wells was also conducted to help in the fate and transport evaluation of inorganic constituents. Hexavalent chromium analysis was performed to evaluate if there was any contribution of hexavalent chromium in the total chromium value reported from the selected wells.

The April 2004 groundwater samples were collected as part of the fourth sampling event of the RSE investigation. Detected analytes from this sampling event are presented in Table 6-26. The results are consistent with the previous November 2003 sampling event.

VOCs and SVOCs were not detected in any of the wells sampled.

All groundwater samples reported metal (total and dissolved) concentrations that were lower than their respective MCL values, in particular, chromium, nickel, and thallium. The dissolved metal concentrations reported from Wells MW01, MW02 and MW06 groundwater samples were comparable to their total metal concentrations. The chromium concentrations in Wells MW01 and MW02 were significantly below the MCL concentration of 50 µg/L. Downgradient well samples that were analyzed for hexavalent chromium (MW01 and MW02) reported no hexavalent chromium contribution. However, upgradient Well MW06, reported hexavalent chromium at a concentration of 0.24 µg/L.

Petroleum hydrocarbons as gasoline were detected in 10 wells ranging from 0.02 J mg/L to 0.04 J mg/L. There were no detections of motor oils or petroleum hydrocarbons as diesel in any of the wells sampled.

Table 6-26: Summary of Detected Analytes - Round 1 through Round 8 Groundwater Sampling - RSE Investigation

PARAMETER	Regulatory Threshold Concentrations (µg/L)	Units	Method	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW01
			EPA ID:	LK256	LK332	LK333	LK362	LK363	LK391	LK392	LK393	LK394	LK419	LK420	LK421	LK454	LK455	LK456	LK484	LK485	LK524	LK525
			SAMPLE DATE:	12/3/2002	4/1/2003	4/1/2003	11/18/2003	11/18/2003	4/6/2004	4/6/2004	4/6/2004	4/6/2004	7/6/2004	7/6/2004	7/6/2004	10/7/2004	10/7/2004	10/7/2004	2/23/2005	2/23/2005	4/28/2005	4/28/2005
			SAMPLE TYPE:	Regular	Regular	Duplicate	Regular	Duplicate	Regular	Regular	Duplicate	Duplicate	Regular	Regular	Duplicate	Regular	Duplicate	Regular	Regular	Regular	Regular	Regular
			ROUND #:	Round 1	Round 2		Round 3		Round 4				Round 5			Round 6			Round 7		Round 8	
PETROLEUM HYDROCARBONS																						
Motor Oil	-	mg/L	8015B DRO	0.096 U	0.096 U	0.096 U	0.13 U	0.13 U	0.096 U	--	0.096 U	--	0.096 U	--	0.03 J	0.096 U	0.096 U	--	0.096 U	--	0.096 U	--
Diesel Fuel	-	mg/L	8015B DRO	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	--	0.096 U	--	0.096 U	--	0.096 U	0.096 U	0.096 U	--	0.096 U	--	0.096 U	--
Gasoline	-	mg/L	8015B DRO	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.02 J	--	0.03 J	--	0.1 U	--	0.1 U	0.05 J	0.1 U	--	0.1 U	--	0.1 U	--
VOCs																						
4-Methyl-2-Pentanone	-	ug/L	8260B	50 U	50 U	50 U	50 UJ	50 UJ	50 UJ	--	50 UJ	--	50 U	--	50 U	50 UJ	50 UJ	--	50 U	--	50 U	--
Chloroform	100[b]	ug/L	8260B	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.11 U	--	0.11 U	--	0.11 U	--	0.11 U	0.1 U	0.1 U	--	0.1 U	--	0.1 U	--
2-Butanone (MEK)	-	ug/L	8260B	100 U	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	--	100 UJ	--	100 UJ	--	100 UJ	100 U	100 U	--	100 UJ	--	100 U	--
Methylene Chloride	-	ug/L	8260B	3 U	3 U	3 U	3 U	3 U	3 UJ	--	3 UJ	--	3 U	--	3 U	3 U	3 U	--	3 U	--	3 U	--
SVOCs																						
4-Methylphenol	180[d]	ug/L	8270C	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--
Acenaphthene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--
Anthracene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--
Benzo(a)anthracene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--
Benzo(a)pyrene	0.2[b]	ug/L	8270 SIM	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	--	0.19 U	--	0.19 U	--	0.19 U	0.19 U	0.19 U	--	0.19 U	--	0.19 U	--
Benzo(b)fluoranthene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--
Benzo(g,h,i)perylene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--
Bis(2-Ethylhexyl)Phthalate	-	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--
Bis(2-chloroethoxy)methane	-	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--
Butyl Benzyl Phthalate	-	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--
Chrysene	0.4[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--
Dibenz(a,h)anthracene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--
Diethyl Phthalate	29000[d]	ug/L	8270C	2 J	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--
Fluoranthene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--
Fluorene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--
Indeno(1,2,3-c,d)pyrene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--
Napthalene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--
Phenanthrene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--
Phenol	22000[d]	ug/L	8270C	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--
Pyrene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--
METALS																						
Aluminum	1000[b]	ug/L	6010B	13.1	22.5 UJ	8.2 UJ	38.2 UJ	24.4 UJ	16.7 J	12.9 J	200 UJ	200 UJ	6.9 UJ	14.6 UJ	14.8 UJ	83	11.4 UJ	32.3	16.8 J	200 UJ	24.2 UJ	200 U
Antimony	6[b]	ug/L	6010B	4.4 UJ	3.8	60 U	5.8 UJ	7.8 UJ	8.2 UJ	60 U	3.1 UJ	3.1 UJ	3.3 UJ	2.5 UJ	60 U	60 UJ	3	2.4	5.4	60 U	60 U	5
Arsenic	50[b]	ug/L	6010B	8.4 UJ	5.3	3.7	10 UJ	1.7 J	7.5 UJ	7.2 UJ	7.1 UJ	5.8 UJ	4.2 UJ	6 UJ	4.7 UJ	4.9 UJ	3.8 UJ	2.6 UJ	2.9 J	2.3 J	8.8 UJ	10.1 UJ
Barium	1000[b]	ug/L	6010B	45.6	36.8	36.1	36.4	36	36	36.9	35.1	37.9	38	40	37.5	42.9	36.8	3.4	40.1	39.6	38.2 J	39.3 J
Cadmium	-	ug/L	6010B	0.15 UJ	5 U	0.15 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	0.63 UJ	0.44 UJ	0.97 UJ	5 U	5 U	5 U	5 U
Calcium	-	ug/L	6010B	170000	134000	131000	126000	128000	135000	139000	133000	138000	145000	144000	139000	135000	133000	116	144000	143000	140000 J	144000 J
Chromium	50[b]	ug/L	6010B	27.4	203	120	5.1	3.5	47.4	2.3	18.9	3.5	4.8	1.3	10.1	50.4	47.9	4.3	20.6	0.62 UJ	10 UJ	10 UJ
Cobalt	-	ug/L	6010B	1.1 UJ	0.55 UJ	50 U	50 U	50 U	0.63 UJ	50 U	50 U	0.29 UJ	50 U	50 U	50 U	50 U	50 U	50 U	8.8 J	7.9	50 UJ	50 UJ
Copper	1300[a]	ug/L	6010B	5.9 UJ	7.4	3.2	6.3	3.6	8.4 J	5.3	4.5 J	6.8	6.4 UJ	11 UJ	4 UJ	6.6 UJ	11.5	12.1	7.7 J	7	3.5 J	2.7
Iron	300[c]	ug/L	6010B	475	992	613	49.3 UJ	28.8 UJ	227 J	148	86.4 J	122	33.8 J	57.9 J	61.7 J	206	150	91.3	62.1 J	100 UJ	13.4 UJ	100 UJ
Lead	15[a]	ug/L	6010B	3.1 UJ	3 U	3 U	1 UJ	1 UJ	3 U	3 U	3 U	3 U	1.6	2.6	1.4	2.9	3.7	9.3	1.5	1.6	3 U	3 U
Magnesium	-	ug/L	6010B	83600	68000	67600	68600	69200	69000	71700	68700	70500	70100	70900	68300	63800	64400	56.5	75600	73600	76400	78800
Manganese	50[c]	ug/L	6010B	19.6	7.5	5.2	2.1 UJ	2.1 UJ	3.9 UJ	4.1 UJ	3.2 UJ	4.5	1.8 UJ	2.9 UJ	2 UJ	4.8	3.2	3.9	1.4 J	1.2	15 UJ	15 UJ
Mercury	2[b]	ug/L	7470A	0.18	0.15 UJ	0.12 UJ	0.067 J	0.07 J	0.11 J	0.15	0.085 J	0.099	0.018	0.046	0.027	1.1	0.97	0.96	0.34 J	0.31	0.2 J	0.24J
Nickel	100[b]	ug/L	6010B	105	55.3 J	40.8 J	7.1	6.9	29.1	15	16.6	16.1	2.2 UJ	3.1 UJ	4.8 UJ	21.7	20	18.8	7.5	5.7 UJ	3.8	4.5
Potassium	-	ug/L	6010B	3410	2670 J	2570 J	2500	2590	2670 J	2810 J	2690 J	2670 J	3010	2890	2780	2520	2270	1930	3120	2970	2990 J	3120 J
Selenium	50[b]	ug/L	6010B	14.3	11.8	13.4	17.9	16.1	12.4	13.3	14.1	13.5	21.9	17.2	16.7	18.1	15.1	13.6	26.1	29.1	26.9 UJ	30.6 UJ
Silver	100[c]	ug/L	6010B	1.2	2.3 UJ	2.5 UJ	0.94 UJ	2.5 UJ	10 U	10 U	10 U	10 U	1.5 UJ	1.1 UJ	10 U	10 UJ	10 U	0.97	2.1 UJ	10 U	2 UJ	3.3 UJ
Sodium	-	ug/L	6010B	451000	357000	359000	377000	383000	395000	410000	394000	405000	369000	375000	360000	342000	348000	308000	386000	378000	448000 J	465000 J
Thallium	5[b]	ug/L	6010B	10 U	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Vanadium	-	ug/L	6010B	25.2	22.6	22.3	22.2	22.7	23.8	21.6	20.6	24.5	20.6	20.7	20.1	18.6	18.9	16.1	20.4	19.7	21.9	22.2 J
Zinc	5000[c]	ug/L	6010B	48	6.6	6.6	26.2 J	33.4 J	5.1 J	2.8 UJ	1.9 UJ	4 UJ	4.3 J	29.3 J	17.6 J	22.1	4.2	13.1	21.1 J	5.4 UJ	20 UJ	20 UJ
Miscellaneous																						
pH	-	pH	9040	7	7	7.06	6.99	7	7.01	--	6.97	--	7.03	--	7.06	7.26	7.29	--	--	--	7.02	--
Chromium, hexavalent	50[c]	ug/L	7199	--	--	--	--	--	1 U	--	--	--	1 U	--	--	1 U	--	--	--	--	--	--

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Table 6-26: Summary of Detected Analytes - Round 1 through Round 8 Groundwater Sampling - RSE Investigation

PARAMETER	Regulatory Threshold Concentrations (µg/L)	Units	Method	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02
			EPA ID:	LK264	LK340	LK341	LK368	LK369	LK395	LK396	LK397	LK398	LK425	LK426	LK427	LK428	LK460	LK461	LK462	LK488	LK489	LK522	LK523
			SAMPLE DATE:	12/4/2002	4/2/2003	4/2/2003	11/19/2003	11/19/2003	4/6/2004	4/6/2004	4/6/2004	4/6/2004	7/7/2004	7/7/2004	7/7/2004	7/7/2004	10/8/2004	10/8/2004	10/8/2004	2/24/2005	2/24/2005	4/28/2005	4/28/2005
			SAMPLE TYPE:	Regular	Regular	Duplicate	Regular	Duplicate	Regular	Regular	Duplicate	Duplicate	Regular	Duplicate	Regular	Duplicate	Regular	Duplicate	Regular	Regular	Regular	Regular	Regular
			ROUND #:	Round 1	Round 2		Round 3		Round 4				Round 5				Round 6			Round 7		Round 8	
PETROLEUM HYDROCARBONS																							
Motor Oil	-	mg/L	8015B DRO	0.37	0.096 U	0.08 J	0.096 U	0.096 U	0.096 U	–	0.096 U	–	0.02 J	0.02 J	–	–	0.096 U	0.096 U	–	0.02 J	–	0.07 J	–
Diesel Fuel	-	mg/L	8015B DRO	1.3	0.096 U	0.02 J	0.096 U	0.096 U	0.096 U	–	0.096 U	–	0.02 J	0.02 J	–	–	0.096 U	0.096 U	–	0.03 J	–	0.06 J	–
Gasoline	-	mg/L	8015B DRO	0.1 U	0.1 U	0.1 U	0.02 J	0.02 J	0.03 J	–	0.1 U	–	0.1 U	0.1 U	–	–	0.1 U	0.02 J	–	0.1 U	–	0.1 U	–
VOCs																							
4-Methyl-2-Pentanone	-	ug/L	8260B	50 U	50 U	2 J	50 U	50 U	50 UJ	–	50 UJ	–	50 U	50 U	–	–	50 UJ	50 UJ	–	50 U	–	50 U	–
Chloroform	100[b]	ug/L	8260B	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.11 U	–	0.11 U	–	0.11 U	0.11 U	–	–	0.1 U	0.1 U	–	0.1 U	–	0.1 U	–
2-Butanone (MEK)	-	ug/L	8260B	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	–	100 UJ	–	100 UJ	100 UJ	–	–	100 U	100 U	–	100 UJ	–	100 U	–
Methylene Chloride	-	ug/L	8260B	3 U	3 U	3 U	3 U	3 U	3 UJ	–	3 UJ	–	3 U	3 U	–	–	3 U	3 U	–	3 U	–	3 U	–
SVOCs																							
4-Methylphenol	180[d]	ug/L	8270C	6 J	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	–	9.6 U	–	9.6 U	9.6 U	–	–	9.6 U	9.6 U	–	9.6 U	–	9.6 U	–
Acenaphthene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	–	0.48 U	–	0.48 U	0.48 U	–	–	0.48 U	0.48 U	–	0.48 U	–	0.48 U	–
Anthracene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	–	0.48 U	–	0.48 U	0.48 U	–	–	0.48 U	0.48 U	–	0.48 U	–	0.48 U	–
Benzo(a)anthracene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	–	0.48 U	–	0.48 U	0.48 U	–	–	0.48 U	0.48 U	–	0.48 U	–	0.48 U	–
Benzo(a)pyrene	0.2[b]	ug/L	8270 SIM	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	–	0.19 U	–	0.19 U	0.19 U	–	–	0.19 U	0.19 U	–	0.19 U	–	0.19 U	–
Benzo(b)fluoranthene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	–	0.48 U	–	0.48 U	0.48 U	–	–	0.48 U	0.48 U	–	0.48 U	–	0.48 U	–
Benzo(g,h,i)perylene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	–	0.48 U	–	0.48 U	0.48 U	–	–	0.48 U	0.48 U	–	0.48 U	–	0.48 U	–
Bis(2-Ethylhexyl)Phthalate	-	ug/L	8270C	9.6 UJ	9.6 U	2 J	9.6 U	9.6 U	9.6 U	–	9.6 U	–	9.6 U	3 J	–	–	9.6 U	9.6 U	–	9.6 U	–	9.6 U	–
Bis(2-chloroethoxy)methane	-	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	–	9.6 U	–	9.6 U	9.6 U	–	–	9.6 U	9.6 U	–	9.6 U	–	9.6 U	–
Butyl Benzyl Phthalate	-	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	–	9.6 U	–	9.6 U	9.6 U	–	–	9.6 U	9.6 U	–	9.6 U	–	9.6 U	–
Chrysene	0.4[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	–	0.48 U	–	0.48 U	0.48 U	–	–	0.48 U	0.48 U	–	0.48 U	–	0.48 U	–
Dibenz(a,h)anthracene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	–	0.48 U	–	0.48 U	0.48 U	–	–	0.48 U	0.48 U	–	0.48 U	–	0.48 U	–
Diethyl Phthalate	29000[d]	ug/L	8270C	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	–	9.6 U	–	9.6 U	9.6 U	–	–	9.6 U	9.6 U	–	9.6 U	–	9.6 U	–
Fluoranthene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	–	0.48 U	–	0.48 U	0.48 U	–	–	0.48 U	0.48 U	–	0.48 U	–	0.48 U	–
Fluorene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	–	0.48 U	–	0.48 U	0.48 U	–	–	0.48 U	0.48 U	–	0.48 U	–	0.48 U	–
Indeno(1,2,3-c,d)pyrene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	–	0.48 U	–	0.48 U	0.48 U	–	–	0.48 U	0.48 U	–	0.48 U	–	0.48 U	–
Napthalene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	–	0.48 U	–	0.48 U	0.48 U	–	–	0.48 U	0.48 U	–	0.48 U	–	0.48 U	–
Phenanthrene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	–	0.48 U	–	0.48 U	0.48 U	–	–	0.48 U	0.48 U	–	0.48 U	–	0.48 U	–
Phenol	22000[d]	ug/L	8270C	12	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	–	9.6 U	–	9.6 U	9.6 U	–	–	9.6 U	9.6 U	–	9.6 U	–	9.6 U	–
Pyrene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	–	0.48 U	–	0.48 U	0.48 U	–	–	0.48 U	0.48 U	–	0.48 U	–	0.48 U	–
METALS																							
Aluminum	1000[b]	ug/L	6010B	315	25.7 UJ	20.3 UJ	33.9 UJ	28.1 UJ	11.4 J	7.8 J	14.7 J	18.7 J	29.5 UJ	34.1	12.5 UJ	23.5 UJ	12.7 UJ	18.3 UJ	50.6	45.5 UJ	70.7 UJ	31.8 UJ	28.5 UJ
Antimony	6[b]	ug/L	6010B	4.2 UJ	60 U	2.7	5.9 UJ	2.5 UJ	2.3 UJ	6.5 UJ	2.3 UJ	3.5 UJ	7.2 UJ	7.2 UJ	7.3 UJ	3.1 UJ	60 U	2.9	60 U	60 U	60 U	60 U	4.2
Arsenic	50[b]	ug/L	6010B	12 UJ	11.1	13.4	10 UJ	10 UJ	5.3 UJ	7 UJ	5.3 UJ	6.8 UJ	2.6	10 U	10 U	10 U	2.9 UJ	3.1 UJ	3 UJ	7.6	7.6	10.2 UJ	8.6 UJ
Barium	1000[b]	ug/L	6010B	48.4	44.1	43.1	41.5	40.5	41.6	41.5	40.3	40	45	44.5	42.5	44.1	41.2	40.1	39.7	37.5	38.7	50.4 J	52.4 J
Cadmium	-	ug/L	6010B	0.25 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	0.74 UJ	1.7	0.85 UJ	5 UJ	5 UJ	5 U	5 U
Calcium	-	ug/L	6010B	183000	177000	173000	176000	173000	188000	193000	187000	186000	191000	191000	188000	193000	182000	180000	171000	141000	148000	203000 J	207000 J
Chromium	50[b]	ug/L	6010B	296	15.4	11.4	12.8	12.8	11.8	1.8	13.2	5.7	15.8	10.3	2	1.8	5.6	5.2	6	8.4	3.5 UJ	12.8	10 U
Cobalt	-	ug/L	6010B	3.9 UJ	50 U	50 U	50 U	50 U	0.71 UJ	0.66 UJ	0.56 UJ	0.54 UJ	0.9 UJ	0.96 UJ	0.74 UJ	0.47 UJ	0.45	0.48	0.55	0.71 UJ	0.62 UJ	50 UJ	50 U
Copper	1300[a]	ug/L	6010B	47.2	8.5	5	6	5.8	5.8 J	4.7	6.8 J	9.6	7.7	14.6	5.3	5.7	5.1 UJ	6.8 UJ	8.1 UJ	14.8	14.4	20.6 J	17.2
Iron	300[c]	ug/L	6010B	3430	3660	3150	1100	1060	1030 J	894 J	1440 J	1190 J	516	495	458	394	509	490	556	32.8 J	25.9 J	70.1	11.5 UJ
Lead	15[a]	ug/L	6010B	2.9 UJ	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	1.4	3 U	3.2 J	12.3 J	5.9	1.9 J	1.2	3 UJ	3 U
Magnesium	-	ug/L	6010B	94500	96100	95000	97600	95700	96400	99400	96400	96200	99700	100000	98600	100000	88600	88000	82000	66500	69300	106000	113000
Manganese	50[c]	ug/L	6010B	829	799	768	688	663	714	729	710	706	725	722	712	723	717	707	659	7.1 UJ	8 UJ	121 J	141 J
Mercury	2[b]	ug/L	7470A	0.2 U	0.33	0.15 UJ	0.036 J	0.017 J	0.15 J	0.081	0.064 J	0.15	0.021 J	0.2 U	0.2 U	0.019	1.4 J	1 J	0.9	0.13 J	0.11	0.35 J	0.27 J
Nickel	100[b]	ug/L	6010B	54.2	19.3 J	6.9 J	12.8	12.2	18.4	17.6	18.4	16.7	18.6	17.3	14.6	18.3	13.3	11.8	13.2	7.6	7.8	15.7	17.1
Potassium	-	ug/L	6010B	5670	8690 J	8020 J	7090	6520	7150 J	7200 J	6630 J	6670 J	6790	6650	6190	6580	5090	4890	4370	15300	15800	7890 J	8360 J
Selenium	50[b]	ug/L	6010B	15.3	5.7	8	11.9	10.9	15.1	14.3	13.8	14	21	17.6	18	19.5	18.5 J	20.3 J	19.2	23.7	29.4	23.5 UJ	30.4 UJ
Silver	100[c]	ug/L	6010B	0.4	2.7 UJ	3 UJ	3.1 UJ	3.3 UJ	10 U	10 U	10 U	10 U	1.4 UJ	10 U	1.4 UJ	10 U	10 U	10 U	53.8	0.88 UJ	0.83 UJ	4.3 UJ	3.9 UJ
Sodium	-	ug/L	6010B	413000	399000	397000	413000	407000	430000	444000	433000	433000	411000	417000	413000	416000	373000	370000	347000	387000	404000	408000 J	436000 J
Thallium	5[b]	ug/L	6010B	10 U	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	4.6 UJ	4.1 UJ	7.8	7.2
Vanadium	-	ug/L	6010B	8	0.98 UJ	0.8 UJ	1.3 UJ	1.3 UJ	3.4	2.9 UJ	3.7	3.8	3.4	4.1	4.9	4.3	4.4	4.9	4.8	15.3	15.4	12.9	12.7
Zinc	5000[c]	ug/L	6010B	26.4	6.6	115	24 J	6.3 J	2.7 UJ	2.9 UJ	14.4 J	7.4	4 J	5.6 J	5.4	6.1	2 J	2.9 J	13.5	6 J	22.2	20 UJ	20 UJ
Miscellaneous																							
pH	-	pH	9040	7	6.89	6.95	6.9	6.97	6.89	–	6.94	–	6.94	6.93	–	–	7.09	7.1	–	–	–	6.86	–
Chromium, hexavalent	50[c]	ug/L	7199	–	–	–	–	–	1 U	–	1 U	–	1 U	–	–	–	1 U	–	–	–	–	–	–

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Table 6-26: Summary of Detected Analytes - Round 1 through Round 8 Groundwater Sampling - RSE Investigation

PARAMETER	Regulatory Threshold Concentrations (µg/L)	Units	Method	AA3-MW03	AA3-MW03	AA3-MW03	AA3-MW04	AA3-MW04	AA3-MW04	AA3-MW04	AA3-MW04	AA3-MW04	AA3-MW04	AA3-MW04
			EPA ID:	LK261	LK297	LK346	LK258	LK329	LK359	LK384	LK418	LK451	LK482	LK515
			SAMPLE DATE:	12/4/2002	3/19/2003	11/11/2003	12/3/2002	3/28/2003	11/17/2003	4/5/2004	7/6/2004	10/7/204	2/18/2005	4/27/2005
			SAMPLE TYPE:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular
			ROUND #:	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8
PETROLEUM HYDROCARBONS														
Motor Oil	-	mg/L	8015B DRO	0.096 U	0.13 U	0.096 U	0.096 U	0.13 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U
Diesel Fuel	-	mg/L	8015B DRO	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.008 J	0.096 U	0.096 U
Gasoline	-	mg/L	8015B DRO	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.02 J	0.04 J	0.1 U	0.1 U	0.1 U	0.1 U
VOCs														
4-Methyl-2-Pentanone	-	ug/L	8260B	50 U	50 U	50 UJ	50 U	50 U	50 UJ	50 U	50 U	50 UJ	50 UJ	50 U
Chloroform	100[b]	ug/L	8260B	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.11 U	0.1 U	0.1 U	0.1 U
2-Butanone (MEK)	-	ug/L	8260B	100 U	100 UJ	100 UJ	100 U	100 UJ	100 U	100 U	100 UJ	100 U	100 U	100 U
Methylene Chloride	-	ug/L	8260B	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 UJ	3 U
SVOCs														
4-Methylphenol	180[d]	ug/L	8270C	9.6 U	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Acenaphthene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Anthracene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(a)anthracene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(a)pyrene	0.2[b]	ug/L	8270 SIM	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Benzo(b)fluoranthene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(g,h,i)perylene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Bis(2-Ethylhexyl)Phthalate	-	ug/L	8270C	9.6 UJ	10 U	9.6 U	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Bis(2-chloroethoxy)methane	-	ug/L	8270C	9.6 UJ	10 U	9.6 U	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Butyl Benzyl Phthalate	-	ug/L	8270C	9.6 UJ	10 U	9.6 U	9.6 U	0.7 J	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Chrysene	0.4[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Dibenz(a,h)anthracene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Diethyl Phthalate	29000[d]	ug/L	8270C	9.6 U	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Fluoranthene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Fluorene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Indeno(1,2,3-c,d)pyrene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Napthalene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Phenanthrene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Phenol	22000[d]	ug/L	8270C	9.6 U	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 UJ	9.6 U
Pyrene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
METALS														
Aluminum	1000[b]	ug/L	6010B	18.4 J	200 U	9.4 UJ	31.4	36.6	31.2 UJ	6 J	19.6 UJ	23.4 J	39.4 UJ	35.3 UJ
Antimony	6[b]	ug/L	6010B	60 U	60 U	60 UJ	3.2 UJ	60 U	60 U	5 UJ	60 U	3.7	60 U	60 U
Arsenic	50[b]	ug/L	6010B	5.9 UJ	7.2 UJ	6.2 UJ	19.1	22.8	24.5	22.3 UJ	24.6	26	24.2	14.7 J
Barium	1000[b]	ug/L	6010B	23.9	21.6	19.6	30.3	30	31.2	27.4	33	31.5	31.3	27.2
Cadmium	-	ug/L	6010B	0.22 UJ	5 U	5 U	0.49 UJ	5 U	0.4 UJ	0.39 UJ	5 U	0.24 UJ	0.57 UJ	5 U
Calcium	-	ug/L	6010B	180000	173000	163000	191000	192000	196000	189000	205000	190000	208000	192000
Chromium	50[b]	ug/L	6010B	5.2	0.68 UJ	27.5	20.1	4.7	2	1.3	1.2	4.8 J	3.5	5.1
Cobalt	-	ug/L	6010B	0.37 UJ	50 U	0.39 UJ	0.36 UJ	50 U	50 U	50 U	0.59 UJ	0.32 UJ	1.7 UJ	50 U
Copper	1300[a]	ug/L	6010B	5 UJ	2	3.1 UJ	15.2	6.1	5 UJ	3.8 J	12.6 UJ	5.9 J	5.6	13.6
Iron	300[c]	ug/L	6010B	38.9 UJ	100 U	143 J	258	430	100 U	20 J	37.3 J	102 J	37.2 UJ	42.2 UJ
Lead	15[a]	ug/L	6010B	3.8	3 U	3 U	3.3 UJ	3 UJ	3 U	2.9 UJ	2.5	1.9 UJ	3 U	3 U
Magnesium	-	ug/L	6010B	83000	83000	76000	110000	112000	108000	106000	111000	107000	114000	108000
Manganese	50[c]	ug/L	6010B	12.9 J	7.6	11	59.7	53.3	27.3	26.1	30	21.5	22.1	4.8
Mercury	2[b]	ug/L	7470A	0.037 J	0.067	0.087 J	0.098	0.15	0.2 U	0.08 J	0.076	0.85 J	0.29 J	0.28 J
Nickel	100[b]	ug/L	6010B	4.8 UJ	6.1 UJ	14.2	31.1	23.3 UJ	10.9	33.8	33	17.1	81.9	32.8
Potassium	-	ug/L	6010B	5750	6620	5880	3100	3300	3090	3060	3440	3040	3940	3000
Selenium	50[b]	ug/L	6010B	35.8	49.9	30.6	12.4	19.2	17.5 UJ	12.7 J	18.1	17 UJ	12.8 UJ	35.2
Silver	100[c]	ug/L	6010B	1	2.6 UJ	2.6 UJ	0.53	2 UJ	1.7 UJ	10 U	1.6 UJ	3.6 J	10 U	2.8
Sodium	-	ug/L	6010B	303000	302000	315000	386000	389000	387000	462000	394000	400000	441000	393000
Thallium	5[b]	ug/L	6010B	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	5.1 UJ	10 U
Vanadium	-	ug/L	6010B	15.8	14.2	15	43.6	37.1	42	39.7	44.4	41.9	55.3	57.5
Zinc	5000[c]	ug/L	6010B	20 J	20 U	15.1 J	20.9	11.8	30.9	2.3 UJ	9.1 J	11.9 J	10.2 J	20 U
Miscellaneous														
pH	-	pH	9040	6.89	6.86	6.82	6.84	6.85	6.91	6.8	6.89	6.86	--	6.84
Chromium, hexavalent	50[d]	ug/L	7199	--	--	--	--	--	--	--	--	--	--	--

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Table 6-26: Summary of Detected Analytes - Round 1 through Round 8 Groundwater Sampling - RSE Investigation

PARAMETER	Regulatory Threshold Concentrations (µg/L)	Units	Method	AA3-MW05	AA3-MW05	AA3-MW05	AA3-MW05	AA3-MW05	AA3-MW05	AA3-MW05	AA3-MW05
			EPA ID:	LK243	LK324	LK355	LK378	LK412	LK446	LK498	LK513
			SAMPLE DATE:	11/27/2002	3/27/2003	11/13/2003	4/1/2004	7/1/2004	10/6/2004	2/28/2005	4/27/2005
			SAMPLE TYPE:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular
			ROUND #:	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8
PETROLEUM HYDROCARBONS											
Motor Oil	-	mg/L	8015B DRO	100 U	0.14 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.05 J
Diesel Fuel	-	mg/L	8015B DRO	0.096 U	0.1 U	0.096 U	0.096 U	0.01 J	0.096 U	0.096 U	0.06 J
Gasoline	-	mg/L	8015B DRO	0.1 U	0.1 U	0.03 J	0.03 J	0.1 U	0.02 J	0.1 U	0.1 U
VOCs											
4-Methyl-2-Pentanone	-	ug/L	8260B	50 U	50 U	50 UJ	50 U	50 U	50 U	50 U	50 U
Chloroform	100[b]	ug/L	8260B	0.1 U	0.1 U	0.1 U	0.11 U	0.11 U	0.1 U	0.1 U	0.1 U
2-Butanone (MEK)	-	ug/L	8260B	100 UJ	100 UJ	100 U	100 UJ	100 UJ	100 U	100 UJ	100 U
Methylene Chloride	-	ug/L	8260B	3 U	3 U	3 U	3 U	3 U	0.5 J	3 U	3 U
SVOCs											
4-Methylphenol	180[d]	ug/L	8270C	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Acenaphthene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Anthracene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(a)anthracene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(a)pyrene	0.2[b]	ug/L	8270 SIM	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Benzo(b)fluoranthene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(g,h,i)perylene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Bis(2-Ethylhexyl)Phthalate	-	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Bis(2-chloroethoxy)methane	-	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Butyl Benzyl Phthalate	-	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Chrysene	0.4[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Dibenz(a,h)anthracene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Diethyl Phthalate	29000[d]	ug/L	8270C	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Fluoranthene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Fluorene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Indeno(1,2,3-c,d)pyrene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Napthalene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Phenanthrene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Phenol	22000[d]	ug/L	8270C	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 UJ
Pyrene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
METALS											
Aluminum	1000[b]	ug/L	6010B	120 J	141	43.1 UJ	33	42.4 UJ	96.4	59.8 J	159
Antimony	6[b]	ug/L	6010B	60 U	60 U	60 U	60 UJ	60 U	4.7	60 U	60 U
Arsenic	50[b]	ug/L	6010B	7.8 UJ	7.8	6.6	7.3	4.7	8.5 UJ	5.6	6.1
Barium	1000[b]	ug/L	6010B	23.2	24.3	23.2	18.8	22.3	22.1	26.5	19.8
Cadmium	-	ug/L	6010B	0.45 UJ	5 U	5 U	0.62 J	5 U	0.42 UJ	0.16 UJ	5 U
Calcium	-	ug/L	6010B	129000	134000	138000	122000	143000	137000	149000	92500
Chromium	50[b]	ug/L	6010B	2 UJ	4.6	1.9 UJ	0.79 J	1.6 J	2.1	1.9	1 J
Cobalt	-	ug/L	6010B	0.84 UJ	50 U	50 U	50 U	50 U	50 U	0.44 UJ	50 U
Copper	1300[a]	ug/L	6010B	2.7 UJ	4.8	4.3 UJ	5	6.8 UJ	8	2.7 UJ	2.3 J
Iron	300[c]	ug/L	6010B	181	199	46.5 UJ	42.8 J	45.9 J	120	37.1 UJ	217
Lead	15[a]	ug/L	6010B	3 U	3 UJ	1.3 UJ	2.5	2.4 UJ	3 U	3 U	3 U
Magnesium	-	ug/L	6010B	69700	73600	77600	65400	78400	75400	78300	48600
Manganese	50[c]	ug/L	6010B	60.5	11.5	10.9	3.8	7.5	7.8	1.9 UJ	40.1
Mercury	2[b]	ug/L	7470A	0.021	0.18	0.013	0.028 J	0.047 J	0.63	0.24 J	0.44 J
Nickel	100[b]	ug/L	6010B	4.9 UJ	2.8 UJ	1.8 UJ	0.95 UJ	1.4 UJ	1.2	40 U	1.2 UJ
Potassium	-	ug/L	6010B	7810	5260	5020	4640	5440	4810	4980	3840
Selenium	50[b]	ug/L	6010B	21.6	27.6	32.4	26.5	37.2	33.2 UJ	28.6	17 UJ
Silver	100[c]	ug/L	6010B	10 U	1.9 UJ	1.7 UJ	10 UJ	1.3 UJ	0.64 J	10 U	10 U
Sodium	-	ug/L	6010B	464000	413000	426000	454000	466000	458000	477000	361000
Thallium	5[b]	ug/L	6010B	8 UJ	10 U	10 U	10 U	10 U	10 U	2.9	10 U
Vanadium	-	ug/L	6010B	19.7	21.3	21.4	18.3	22.1	21.3	24.1	20.7
Zinc	5000[c]	ug/L	6010B	9 UJ	40.8	14.2	4.4 UJ	5 J	14.3	2.8 UJ	32
Miscellaneous											
pH	-	pH	9040	7.12	7.17	6.97	7.01	7.03	6.96	–	7.39
Chromium, hexavalent	50[c]	ug/L	7199	–	–	–	–	–	–	–	–

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Table 6-26: Summary of Detected Analytes - Round 1 through Round 8 Groundwater Sampling - RSE Investigation

PARAMETER	Regulatory Threshold Concentrations (µg/L)	Units	Method	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW06
			EPA ID:	LK240	LK299	LK347	LK389	LK390	LK409	LK410	LK411	LK441	LK442	LK443	LK500	LK501	LK502	LK503	LK533	LK534
			SAMPLE DATE:	11/26/2002	3/20/2003	11/11/2003	4/6/2004	4/6/2004	7/1/2004	7/1/2004	7/1/2004	10/6/2004	10/6/2004	10/6/2004	2/28/2005	2/28/2005	2/28/2005	2/28/2005	4/29/2005	4/29/2005
			SAMPLE TYPE:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular
			ROUND #:	Round 1	Round 2	Round 3	Round 4		Round 5			Round 6			Round 7				Round 8	
PETROLEUM HYDROCARBONS																				
Motor Oil	-	mg/L	8015B DRO	0.096 U	0.13 U	0.096 U	0.096 U	--	0.01 J	--	--	0.096 U	--	--	0.1	--	--	--	0.07 J	--
Diesel Fuel	-	mg/L	8015B DRO	0.096 U	0.096 U	0.096 U	0.096 U	--	0.01 J	--	--	0.01 J	--	--	0.2	--	--	--	0.096 U	--
Gasoline	-	mg/L	8015B DRO	0.1 U	0.1 U	0.1 U	0.03 J	--	0.1 U	--	--	0.1 U	--	--	0.1 U	--	--	--	0.1 U	--
VOCs																				
4-Methyl-2-Pentanone	-	ug/L	8260B	50 U	0.5 J	50 UJ	50 UJ	--	50 U	--	--	50 U	--	--	50 U	--	--	--	50 U	--
Chloroform	100[b]	ug/L	8260B	0.1 U	0.1 U	0.1 U	0.11 U	--	0.11 U	--	--	0.1 U	--	--	0.95 J	--	--	--	0.1 U	--
2-Butanone (MEK)	-	ug/L	8260B	100 UJ	100 UJ	100 UJ	100 UJ	--	100 UJ	--	--	100 U	--	--	100 UJ	--	--	--	100 U	--
Methylene Chloride	-	ug/L	8260B	3 UJ	3 U	3 U	3 UJ	--	3 U	--	--	3 U	--	--	3 U	--	--	--	3 UJ	--
SVOCs																				
4-Methylphenol	180[d]	ug/L	8270C	9.6 U	10 U	9.6 U	9.6 U	--	9.6 U	--	--	9.6 U	--	--	9.6 U	--	--	--	9.6 U	--
Acenaphthene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--
Anthracene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--
Benzo(a)anthracene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--
Benzo(a)pyrene	0.2[b]	ug/L	8270 SIM	0.19 U	0.19 U	0.19 U	0.19 U	--	0.19 U	--	--	0.19 U	--	--	0.19 U	--	--	--	0.19 U	--
Benzo(b)fluoranthene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--
Benzo(g,h,i)perylene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--
Bis(2-Ethylhexyl)Phthalate	-	ug/L	8270C	9.6 UJ	10 U	9.6 U	9.6 U	--	9.6 U	--	--	9.6 U	--	--	9.6 U	--	--	--	9.6 U	--
Bis(2-chloroethoxy)methane	-	ug/L	8270C	9.6 UJ	10 U	9.6 U	9.6 U	--	9.6 U	--	--	9.6 U	--	--	9.6 U	--	--	--	9.6 U	--
Butyl Benzyl Phthalate	-	ug/L	8270C	9.6 UJ	10 U	9.6 U	9.6 U	--	9.6 U	--	--	9.6 U	--	--	9.6 U	--	--	--	9.6 U	--
Chrysene	0.4[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--
Dibenz(a,h)anthracene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--
Diethyl Phthalate	29000[d]	ug/L	8270C	9.6 U	10 U	9.6 U	9.6 U	--	9.6 U	--	--	9.6 U	--	--	9.6 U	--	--	--	9.6 U	--
Fluoranthene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--
Fluorene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--
Indeno(1,2,3-c,d)pyrene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--
Napthalene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--
Phenanthrene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--
Phenol	22000[d]	ug/L	8270C	9.6 U	10 U	9.6 U	9.6 U	--	9.6 U	--	--	9.6 U	--	--	9.6 U	--	--	--	9.6 U	--
Pyrene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--
METALS																				
Aluminum	1000[b]	ug/L	6010B	101 J	53.5 UJ	21.4 UJ	76.1	11.1 J	575	--	35 UJ	25.3 J	--	3.7 J	121 J	--	15.6 J	12.3 J	165	28.7 UJ
Antimony	6[b]	ug/L	6010B	60 U	60 U	60 UJ	4.1 UJ	60 U	60 U	--	4.2 UJ	5.7	--	3.7	60 U	--	60 U	60 U	9.7	60 U
Arsenic	50[b]	ug/L	6010B	2.4	12.4 UJ	4.5 UJ	9.9 UJ	10.1 UJ	4.5	--	9.1	8.5 UJ	--	5.7 UJ	5.5	--	5.6	6.3	10 U	10 U
Barium	1000[b]	ug/L	6010B	24.1	29.8	21.9	26 UJ	23.4 UJ	38.8	--	23.5	23.6	--	23.2	30.5	--	29.2	29.9	34.1 J	30 J
Cadmium	-	ug/L	6010B	0.47 UJ	5 UJ	0.25 UJ	0.31 J	0.35	0.55 UJ	--	0.31 UJ	0.29 UJ	--	0.3 UJ	0.57 UJ	--	0.53 UJ	0.67 UJ	5 U	5 U
Calcium	-	ug/L	6010B	205000	225000	203000	219000	217000	213000	--	208000	203000	--	207000	208000	--	213000	212000	150000 J	149000 J
Chromium	50[b]	ug/L	6010B	1.8	3.8 UJ	4.1 J	7.6	2.2	4.3 J	--	1.9 J	3.4	--	1.7	3.2	--	2.1	1.9	3.4 J	3 J
Cobalt	-	ug/L	6010B	50 U	50 UJ	50 U	50 U	50 U	0.75 UJ	--	50 U	50 U	--	50 U	1.2 UJ	--	1.2 UJ	1.1 UJ	50 UJ	50 UJ
Copper	1300[a]	ug/L	6010B	2.2 UJ	3.2 UJ	4.4 UJ	7.1 J	4.5	7.7 UJ	--	8 UJ	3.6	--	3.3	9.9 UJ	--	8.4 UJ	11 UJ	11.7	10.2
Iron	300[c]	ug/L	6010B	79.1 UJ	54.2 UJ	26.3 UJ	611 J	73 J	495	--	15.1 UJ	33.2 J	--	10.7 J	120	--	22.3 UJ	23.4 UJ	155	25.8 UJ
Lead	15[a]	ug/L	6010B	3 U	3 U	3 U	3 U	1.5 UJ	3 U	--	1.6 UJ	3 U	--	3 U	3 U	--	3 U	0.98 UJ	3 U	4.5
Magnesium	-	ug/L	6010B	98300	106000	101000	104000	105000	103000	--	101000	101000	--	99800	101000	--	101000	101000	74000	75000
Manganese	50[c]	ug/L	6010B	24	30.7	2.4 UJ	10.9	2.4	16.8	--	0.7	0.88 J	--	15 U	284	--	290	274	16.3 J	10.3 J
Mercury	2[b]	ug/L	7470A	0.2 U	0.2	0.057 J	0.12 J	0.12	0.035 J	--	0.036 J	0.57 J	--	0.57 J	0.19 J	--	0.13 J	0.15 J	0.29 J	0.48 J
Nickel	100[b]	ug/L	6010B	2.9 UJ	3.6 UJ	5.4 UJ	2.1 UJ	2.4 UJ	2.9 UJ	--	1.8 UJ	2.4	--	1.6	5.8	--	5.3	5.6	6.2	3.9 J
Potassium	-	ug/L	6010B	5350	5540 J	4810	5050 J	5100 J	5120	--	4910	5020	--	4720	5990	--	6020	5930	3060 J	2910 J
Selenium	50[b]	ug/L	6010B	26	28.2	18.1	23.2	22.7	26.1	--	26.4	28.5 UJ	--	30.7 UJ	5 U	--	5 U	5 U	11.2 UJ	15 UJ
Silver	100[c]	ug/L	6010B	10 U	10 UJ	2.5 UJ	10 U	10 U	2.2 UJ	--	1.7 UJ	3.1 J	--	10 UJ	10 U	--	10 U	0.97	2.1 UJ	2.7 UJ
Sodium	-	ug/L	6010B	358000	406000	389000	390000	401000	380000	--	375000	376000	--	377000	248000	--	252000	251000	188000 J	190000 J
Thallium	5[b]	ug/L	6010B	6.6 UJ	5.7	10 U	10 U	10 UJ	10 U	--	10 U	10 U	--	10 U	5.3	--	2.8	3.4	10 U	10 U
Vanadium	-	ug/L	6010B	17.2	18.9	18.2	21.3	19.5	22.9	--	19.4	19.6	--	18.4	21.5	--	21.3	21.2	16.3	15.9
Zinc	5000[c]	ug/L	6010B	11.2 UJ	5.9 UJ	16 J	7.5 J	14.9	12.9 J	--	10.8 J	14.3 J	--	11.5 J	4.2 UJ	--	3.4 UJ	4.8 UJ	13 J	2.3 J
Miscellaneous																				
pH	-	pH	9040	6.78	6.71	6.76	6.84	--	6.86	--	--	6.63	--	--	--	--	--	--	6.97	--
Chromium, hexavalent	50[c]	ug/L	7199	--	--	--	0.24	--	0.6	0.54	--	0.25 J	0.24	--	1 U	1 U	--	--	0.23	--

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Table 6-26: Summary of Detected Analytes - Round 1 through Round 8 Groundwater Sampling - RSE Investigation

PARAMETER	Regulatory Threshold Concentrations (µg/L)	Units	Method	AA3-MW07	AA3-MW07	AA3-MW07	AA3-MW07	AA3-MW07	AA3-MW07	AA3-MW07	AA3-MW07
			EPA ID:	LK237	LK325	LK358	LK381	LK415	LK449	LK480	LK514
			SAMPLE DATE:	11/26/2002	3/27/2003	11/17/2003	4/2/2004	7/2/2004	10/7/2004	2/18/2005	4/27/2005
			SAMPLE TYPE:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular
			ROUND #:	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8
PETROLEUM HYDROCARBONS											
Motor Oil	-	mg/L	8015B DRO	0.096 U	0.14 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U
Diesel Fuel	-	mg/L	8015B DRO	0.096 U	0.1 U	0.096 U	0.096 U	0.007 J	0.096 U	0.096 U	0.096 U
Gasoline	-	mg/L	8015B DRO	0.1 U	0.1 U	0.03 J	0.02 J	0.1 U	0.02 J	0.1 U	0.1 U
VOCs											
4-Methyl-2-Pentanone	-	ug/L	8260B	50 U	50 U	50 UJ	50 U	50 U	50 U	50 UJ	50 U
Chloroform	100[b]	ug/L	8260B	0.1 U	0.1 U	0.1 U	0.11 U	0.11 U	0.1 U	0.1 U	0.1 U
2-Butanone (MEK)	-	ug/L	8260B	100 UJ	100 UJ	100 U	100 U	100 UJ	100 U	100 U	100 U
Methylene Chloride	-	ug/L	8260B	3 U	3 U	3 U	3 U	3 UJ	3 U	3 UJ	3 UJ
SVOCs											
4-Methylphenol	180[d]	ug/L	8270C	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Acenaphthene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Anthracene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(a)anthracene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(a)pyrene	0.2[b]	ug/L	8270 SIM	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Benzo(b)fluoranthene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(g,h,i)perylene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Bis(2-Ethylhexyl)Phthalate	-	ug/L	8270C	10 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Bis(2-chloroethoxy)methane	-	ug/L	8270C	10 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Butyl Benzyl Phthalate	-	ug/L	8270C	10 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Chrysene	0.4[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Dibenz(a,h)anthracene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Diethyl Phthalate	29000[d]	ug/L	8270C	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Fluoranthene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Fluorene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Indeno(1,2,3-c,d)pyrene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Napthalene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Phenanthrene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Phenol	22000[d]	ug/L	8270C	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 UJ	9.6 U
Pyrene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
METALS											
Aluminum	1000[b]	ug/L	6010B	302	169	370	56.6 UJ	1700	72.8	39.4 UJ	115 UJ
Antimony	6[b]	ug/L	6010B	60 U	60 U	3.2	60 U	3.6 UJ	60 U	60 U	60 U
Arsenic	50[b]	ug/L	6010B	3.6	8	4.6	10 U	7 UJ	7.7 UJ	4.4	4.3 UJ
Barium	1000[b]	ug/L	6010B	52.7	53.3	71.3	57.8	230	53	55.7	78 J
Cadmium	-	ug/L	6010B	0.98 UJ	0.71 UJ	0.84 UJ	0.68 UJ	1.6 UJ	1.1 UJ	0.4 UJ	5 U
Calcium	-	ug/L	6010B	243000	238000	244000	261000	250000	236000	221000	172000
Chromium	50[b]	ug/L	6010B	11	4	3.7	1.1	6.8	1.2 UJ	1.3	2.8 UJ
Cobalt	-	ug/L	6010B	0.82 UJ	50 U	50 U	50 U	2.4 UJ	50 U	0.55 UJ	50 U
Copper	1300[a]	ug/L	6010B	6.7 UJ	7.8	5.1 UJ	5.2	8.7 UJ	6.5 J	2.1	3.1
Iron	300[c]	ug/L	6010B	430	244	421	41.4 UJ	3400	114 J	33.9 UJ	76.3
Lead	15[a]	ug/L	6010B	0.84 J	3 UJ	3 U	3 U	1.7	3.1 UJ	3 U	1.8
Magnesium	-	ug/L	6010B	99900	104000	99600	111000	99300	102000	85600	67700
Manganese	50[c]	ug/L	6010B	71.5	54.2	104	91.9	275	156	12.3	9 J
Mercury	2[b]	ug/L	7470A	0.027 J	0.17	0.014	0.074 J	0.064 J	0.58 J	0.29 J	0.37 J
Nickel	100[b]	ug/L	6010B	12.6 J	9.7 UJ	12.2	12.3	25	19.1	4.2	2.1 UJ
Potassium	-	ug/L	6010B	5800	3800	3440	3690 J	4380	3270	3770	2860 J
Selenium	50[b]	ug/L	6010B	33.2	32.8	34.3	39.4	31.9	38 UJ	25.2 UJ	19.6
Silver	100[c]	ug/L	6010B	10 U	2.8 UJ	2.7 UJ	1.7 UJ	1.9 UJ	1.5 J	10 U	3.4
Sodium	-	ug/L	6010B	371000	361000	355000	377000	353000	375000	353000	288000
Thallium	5[b]	ug/L	6010B	6.8 UJ	10 U	10 U	10 U	10 U	10 U	3.6 UJ	10 U
Vanadium	-	ug/L	6010B	18.3	20.3	22.8	23.1 J	31.5	21.2	19.5	18.2 J
Zinc	5000[c]	ug/L	6010B	48.3 J	40.8	27.5	20 U	19.3 J	14.5 J	8.3 J	20 U
Miscellaneous											
pH	-	pH	9040	6.7	6.96	6.81	6.8	7	6.84	–	7.01
Chromium, hexavalent	50[a]	ug/L	7199	–	–	–	–	–	–	–	–

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Table 6-26: Summary of Detected Analytes - Round 1 through Round 8 Groundwater Sampling - RSE Investigation

PARAMETER	Regulatory Threshold Concentrations (µg/L)	Units	Method	AA3-MW08	AA3-MW08	AA3-MW08	AA3-MW08	AA3-MW08	AA3-MW08	AA3-MW08	AA3-MW08	AA3-MW08	AA3-MW08	AA3-MW08	AA3-MW08
			EPA ID:	LK255	LK337	LK338	LK364	LK365	LK385	LK386	LK424	LK452	LK495	LK528	LK529
			SAMPLE DATE:	12/3/2002	4/2/2003	4/2/2003	11/18/2003	11/18/2003	4/5/2004	4/5/2004	7/7/2004	10/7/2004	2/25/2005	4/29/2005	4/29/2005
			SAMPLE TYPE:	Regular	Regular	Duplicate	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate
			ROUND #:	Round 1	Round 2		Round 3		Round 4		Round 5	Round 6	Round 7	Round 8	
PETROLEUM HYDROCARBONS															
Motor Oil	-	mg/L	8015B DRO	0.096 U	0.096 U	0.096 U	0.13 U	0.13 U	0.096 U	0.096 U	0.02 J	0.096 U	0.096 U	0.096 U	0.096 U
Diesel Fuel	-	mg/L	8015B DRO	0.008 J	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.02 J	0.096 U	0.096 U	0.096 U	0.096 U
Gasoline	-	mg/L	8015B DRO	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.04 J	0.1 U	0.1 U	0.03 J	0.1 U	0.1 U	0.1 U
VOCs															
4-Methyl-2-Pentanone	-	ug/L	8260B	50 U	50 U	50 U	50 UJ	50 UJ	50 U	50 U	50 U	50 UJ	50 UJ	50 U	50 U
Chloroform	100[b]	ug/L	8260B	0.61	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.11 U	0.1 U	0.1 U	0.1 U	0.1 U
2-Butanone (MEK)	-	ug/L	8260B	100 U	100 UJ	100 UJ	100 UJ	100 UJ	100 U	100 U	100 UJ	1 J	100 U	100 U	100 U
Methylene Chloride	-	ug/L	8260B	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
SVOCs															
4-Methylphenol	180[d]	ug/L	8270C	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Acenaphthene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Anthracene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(a)anthracene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.04 J	0.48 U	0.48 U
Benzo(a)pyrene	0.2[b]	ug/L	8270 SIM	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.46	0.19 U	0.19 U
Benzo(b)fluoranthene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.6	0.48 U	0.48 U
Benzo(g,h,i)perylene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.4 J	0.48 U	0.48 U
Bis(2-Ethylhexyl)Phthalate	-	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Bis(2-chloroethoxy)methane	-	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Butyl Benzyl Phthalate	-	ug/L	8270C	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Chrysene	0.4[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.04 J	0.48 U	0.48 U
Dibenz(a,h)anthracene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.1 J	0.48 U	0.48 U
Diethyl Phthalate	29000[d]	ug/L	8270C	2 J	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Fluoranthene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Fluorene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Indeno(1,2,3-c,d)pyrene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.4 J	0.48 U	0.48 U
Napthalene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.4 J	0.48 U	0.48 U
Phenanthrene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Phenol	22000[d]	ug/L	8270C	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Pyrene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
METALS															
Aluminum	1000[b]	ug/L	6010B	287	82 UJ	70.3 UJ	213	279	196	159	293	211	91	181	369
Antimony	6[b]	ug/L	6010B	2.8 UJ	2.9	60 U	6.7 UJ	6.3 UJ	60 U	60 U	4.8 UJ	4	60 U	60 U	60 U
Arsenic	50[b]	ug/L	6010B	4.7 UJ	10 U	4.9	10 UJ	10 UJ	4.3 UJ	6.6 UJ	10 U	6.7 UJ	2.8	8.1 UJ	7.8 J
Barium	1000[b]	ug/L	6010B	39.5	18.6	18.5	18.3	18.4	16.4	16.2	19.7	19.2	19.7	19.9 J	21 J
Cadmium	-	ug/L	6010B	0.28 UJ	5 U	5 U	5 U	0.26 UJ	0.38 UJ	0.42 UJ	5 U	0.2 UJ	5 UJ	5 U	5 U
Calcium	-	ug/L	6010B	96800	92000	91900	89700	89200	92300	92400	100000	99200	110000	117000	114000
Chromium	50[b]	ug/L	6010B	5.3	3.3	3	1.5	2.6	0.78	0.82	1.6 J	1.6 J	2.2 UJ	10 UJ	10 UJ
Cobalt	-	ug/L	6010B	0.59 UJ	50 U	50 U	50 U	50 U	50 U	0.5 UJ	50 U	50 U	0.76 UJ	50 UJ	0.82 J
Copper	1300[a]	ug/L	6010B	6.6	3.3	1.9	3.5	3.4	3.6 J	4.8 J	5.2	2.2 J	2.1	2.7	2.8
Iron	300[c]	ug/L	6010B	381	92.9	178	297	375	229	178	274	348	96.3	204	410
Lead	15[a]	ug/L	6010B	2.3 UJ	3 U	3 U	2 UJ	0.98 UJ	5 UJ	5.9 UJ	1.5	2.2 UJ	3 U	3 U	3 U
Magnesium	-	ug/L	6010B	52400	49500	50000	49300	49900	48500	48600	53000	53100	56900	65400	64000
Manganese	50[c]	ug/L	6010B	145	160	164	197	218	150	150	73.7 J	195	109	245 J	275 J
Mercury	2[b]	ug/L	7470A	0.12	0.18	0.12 UJ	0.1 J	0.061 J	0.094 J	0.12 J	0.027 J	0.7 J	0.47 J	0.31 J	0.32 J
Nickel	100[b]	ug/L	6010B	5.2 UJ	1.9 UJ	1.6 UJ	8.9	1.3 UJ	1.8 UJ	1.9 UJ	1.3	1.8 J	2.3 UJ	1.3 J	1.6 J
Potassium	-	ug/L	6010B	11100	5120 J	5090 J	3920	3970	3950	3860	3880	4120	4570	5080 J	4910 J
Selenium	50[b]	ug/L	6010B	4.8 J	5 U	3.8	5.3 UJ	2.8 UJ	5 UJ	5 UJ	4.2 UJ	7 UJ	5 U	12.2 UJ	12.9 UJ
Silver	100[c]	ug/L	6010B	10 U	1.5 UJ	0.98 UJ	2.4 UJ	2.2 UJ	10 U	10 U	10 U	1.4 J	0.96 UJ	2.5 UJ	2.3 UJ
Sodium	-	ug/L	6010B	364000	369000	369000	371000	378000	436000	433000	392000	410000	435000	499000 J	483000 J
Thallium	5[b]	ug/L	6010B	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	3.6 UJ	3.1	5.5
Vanadium	-	ug/L	6010B	5.7	1.9 UJ	1.9 UJ	3.4 UJ	3 UJ	2.8 UJ	2.7 UJ	3.2	2.3	2.2	2.8	3.8
Zinc	5000[c]	ug/L	6010B	19.8	36.6	6.8	28.7 J	31.8 J	3.4 UJ	32.4	5.3 J	13.3 J	17.2 J	20 UJ	1.3 J
Miscellaneous															
pH	-	pH	9040	7.28	7.19	7.16	7.11	7.08	7.03	7.06	7.15	7.05	–	7.03	7.08
Chromium, hexavalent	50[c]	ug/L	7199	–	–	–	–	–	–	–	–	–	–	–	–

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Table 6-26: Summary of Detected Analytes - Round 1 through Round 8 Groundwater Sampling - RSE Investigation

PARAMETER	Regulatory Threshold Concentrations (µg/L)	Units	Method	AA3-MW09A	AA3-MW09A	AA3-MW09A	AA3-MW09A	AA3-MW09A	AA3-MW09A	AA3-MW09A	AA3-MW09A	AA3-MW09B	AA3-MW09B	AA3-MW09B	AA3-MW09B	AA3-MW09B	AA3-MW09B	AA3-MW09B	AA3-MW09B
			EPA ID:	LK246	LK319	LK351	LK374	LK405	LK437	LK491	LK508	LK249	LK320	LK354	LK375	LK406	LK438	LK493	LK509
			SAMPLE DATE:	11/27/2002	3/26/2003	11/12/2003	3/31/2004	6/30/2004	10/5/2004	2/24/2005	4/26/2005	11/27/2002	3/26/2003	11/13/2003	3/31/2004	6/30/2004	10/5/2004	2/25/2005	4/26/2005
			SAMPLE TYPE:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular
			ROUND #:	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8
PETROLEUM HYDROCARBONS																			
Motor Oil	-	mg/L	8015B DRO	100 U	0.14 U	0.13 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	100 U	0.14 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U
Diesel Fuel	-	mg/L	8015B DRO	0.096 U	0.1 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.1 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U
Gasoline	-	mg/L	8015B DRO	0.1 U	0.1 U	0.02 J	0.03 J	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.02 J	0.02 J	0.1 U	0.1 U	0.1 U	0.1 U
VOCs																			
4-Methyl-2-Pentanone	-	ug/L	8260B	50 U	50 U	50 UJ	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 UJ	50 U	50 U	50 U	50 UJ	50 U
Chloroform	100[b]	ug/L	8260B	0.1 U	0.1 U	0.1 U	0.11 U	0.11 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.11 U	0.11 U	0.1 U	0.1 U	0.1 U
2-Butanone (MEK)	-	ug/L	8260B	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 U	100 UJ	100 U	100 UJ	100 UJ	100 U	100 UJ	100 UJ	100 U	100 U	100 U
Methylene Chloride	-	ug/L	8260B	3 U	3 U	3 U	3 U	3 UJ	3 U	3 U	3 UJ	3 U	3 U	3 U	3 U	3 UJ	3 U	3 U	3 UJ
SVOCs																			
4-Methylphenol	180[d]	ug/L	8270C	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Acenaphthene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Anthracene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(a)anthracene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(a)pyrene	0.2[b]	ug/L	8270 SIM	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Benzo(b)fluoranthene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(g,h,i)perylene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Bis(2-Ethylhexyl)Phthalate	-	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Bis(2-chloroethoxy)methane	-	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Butyl Benzyl Phthalate	-	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Chrysene	0.4[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Dibenz(a,h)anthracene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Diethyl Phthalate	29000[d]	ug/L	8270C	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Fluoranthene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Fluorene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Indeno(1,2,3-c,d)pyrene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Napthalene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Phenanthrene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Phenol	22000[d]	ug/L	8270C	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Pyrene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
METALS																			
Aluminum	1000[b]	ug/L	6010B	195	297	413	248	183	131	654	309	204	156	179	66.6	12.1 J	365	76.7 UJ	70.6 UJ
Antimony	6[b]	ug/L	6010B	60 U	60 U	60 UJ	60 UJ	2.4 UJ	9	60 U	60 U	60 U	60 U	60 U	60 UJ	60 U	60 U	60 U	60 U
Arsenic	50[b]	ug/L	6010B	9.9 UJ	7.4 J	9.4 UJ	5.7	3.8	6.6 UJ	9.5	8.5	7.9 UJ	4.6	5.7	3.7	4	8 UJ	3.4	4.7
Barium	1000[b]	ug/L	6010B	50.1	60.4	62.6	61.5	67.2	29.5	51.8	47.3	36.4	29.8	29.6	25.3	28.7	63.1	28	25.9
Cadmium	-	ug/L	6010B	0.33 UJ	0.34 UJ	0.27 UJ	5 U	5 U	5 U	5 UJ	5 U	0.4 UJ	0.54 UJ	5 U	5 U	0.31 UJ	0.39 UJ	5 UJ	5 UJ
Calcium	-	ug/L	6010B	116000	116000	135000	147000	165000	134000	114000	105000	114000	118000	126000	120000	135000	155000	135000	139000
Chromium	50[b]	ug/L	6010B	1.9 UJ	2 UJ	3 J	0.82 J	0.81 J	1.1 UJ	2.4 UJ	10 U	3.1 UJ	2.6 UJ	5.7	0.83 J	10 U	1.3 UJ	1.9 UJ	10 U
Cobalt	-	ug/L	6010B	0.8 UJ	50 U	0.4 UJ	50 U	50 U	0.37 UJ	0.83 UJ	50 UJ	0.61 UJ	50 U	50 U	50 U	50 U	50 U	0.46 UJ	50 U
Copper	1300[a]	ug/L	6010B	4.2 UJ	1.7	4.3 UJ	5.3 J	12.1 UJ	2.4	2.3 J	25 U	2.6 UJ	25 U	3.8 UJ	5.8 J	9.9 UJ	5.6	1.9	25 U
Iron	300[c]	ug/L	6010B	263	384	617	380	254	300	889	449	545	439	494	183	54.5 J	500	124	148
Lead	15[a]	ug/L	6010B	0.92 UJ	3 U	2 UJ	3 U	3 UJ	2.1 UJ	1 J	3 U	1.4 UJ	3 U	3 U	3 U	3 UJ	1.6 UJ	3 U	3 U
Magnesium	-	ug/L	6010B	42500	42400	53200	54400	57900	72200	42200	38700	62500	64000	70800	62900	67800	58900	71100	76300
Manganese	50[c]	ug/L	6010B	20.5	7.1	10.7	10.5	5.3 UJ	6	19	15.2 UJ	8.9	6.1	5.1 UJ	3.7 UJ	2.8 UJ	9.5	9.4	11 UJ
Mercury	2[b]	ug/L	7470A	0.05 J	0.2	0.21 J	0.046 J	0.15 J	0.55	0.21 J	1	0.038 J	0.19	0.013	0.03 J	0.16 J	0.73	0.29 J	0.77
Nickel	100[b]	ug/L	6010B	3.8 UJ	2	3.1 UJ	1.1 UJ	1 UJ	1.8	1.3 UJ	40 UJ	5.1 UJ	2.4	2.3 UJ	4.3	1.2 UJ	1	0.77 UJ	40 UJ
Potassium	-	ug/L	6010B	4190	3770 J	3820	3940	4190	3330	4090	3240	3520	3020 J	3050	2870	3190	4090	3140	3340
Selenium	50[b]	ug/L	6010B	13.3	14.6 UJ	17.5	21.6	29.9	7.1 UJ	11.6 UJ	11.6 UJ	7.5 J	7.9 UJ	5.4 UJ	5 UJ	8.1 UJ	30.3 UJ	5 U	6.1 UJ
Silver	100[c]	ug/L	6010B	10 U	10 U	0.81 UJ	10 UJ	1.2 UJ	0.98 J	10 U	10 U	10 U	10 U	1.6 UJ	10 UJ	10 U	18.1	0.93 UJ	10 U
Sodium	-	ug/L	6010B	329000	336000 J	380000	424000	404000	400000	334000	298000	413000	406000 J	371000	412000	394000	400000	421000	423000
Thallium	5[b]	ug/L	6010B	7.1 UJ	10 UJ	10 U	10 U	10 U	10 U	3.7 UJ	10 U	9.5 UJ	1.6 J	10 U	10 U	10 U	10 U	4.2 UJ	10 U
Vanadium	-	ug/L	6010B	33.9	32.9	26.9	27.4	28	13.8	40.5	29.9	15.4	14.7	14.9	13.1	13.5	26.8	13.1	12.4
Zinc	5000[c]	ug/L	6010B	10.3 UJ	9.3	16.8 J	3.1 UJ	4 J	11.3	6.9 J	2.7 UJ	11.4 UJ	8.9	17.7	3.7 UJ	2.8 J	14	5.4 J	4.7 UJ
Miscellaneous																			
pH	-	pH	9040	7.25	7.26	7.06	7	7.07	6.84	--	7.12	7.21	7.16	6.88	7	7.12	6.79	--	7.02
Chromium, hexavalent	50[c]	ug/L	7199	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

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Table 6-26: Summary of Detected Analytes - Round 1 through Round 8 Groundwater Sampling - RSE Investigation

PARAMETER	Regulatory Threshold Concentrations (µg/L)	Units	Method	AA3-MW10	AA3-MW10	AA3-MW10	AA3-MW10	AA3-MW10	AA3-MW10	AA3-MW10	AA3-MW10	AA3-MW10
			EPA ID:	LK252	LK253	LK301	LK350	LK373	LK402	LK436	LK478	LK512
			SAMPLE DATE:	12/2/2002	12/2/2002	3/20/2003	11/12/2003	3/30/2004	6/29/2004	10/5/2004	2/17/2005	4/27/2005
			SAMPLE TYPE:	Regular	Duplicate	Regular	Regular	Regular	Regular	Regular	Regular	Regular
			ROUND #:	Round 1		Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8
PETROLEUM HYDROCARBONS												
Motor Oil	-	mg/L	8015B DRO	0.096 U	0.096 U	0.13 U	0.13 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U
Diesel Fuel	-	mg/L	8015B DRO	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U
Gasoline	-	mg/L	8015B DRO	0.1 U	0.1 U	0.1 U	0.02 J	0.02 J	0.1 U	0.1 U	0.1 U	0.1 U
VOCs												
4-Methyl-2-Pentanone	-	ug/L	8260B	50 U	50 U	0.3 J	50 UJ	50 U	50 U	50 U	50 UJ	50 U
Chloroform	100[b]	ug/L	8260B	0.1 U	0.1 U	0.1 U	0.1 U	0.11 U	0.11 U	0.1 U	0.1 U	0.1 U
2-Butanone (MEK)	-	ug/L	8260B	100 U	100 U	100 UJ	100 UJ	100 U	100 UJ	100 U	100 U	100 U
Methylene Chloride	-	ug/L	8260B	3 U	3 U	3 U	3 U	3 UJ	3 U	3 U	3 U	3 U
SVOCs												
4-Methylphenol	180[d]	ug/L	8270C	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Acenaphthene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Anthracene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(a)anthracene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(a)pyrene	0.2[b]	ug/L	8270 SIM	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Benzo(b)fluoranthene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(g,h,i)perylene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Bis(2-Ethylhexyl)Phthalate	-	ug/L	8270C	9.6 UJ	9.6 U	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Bis(2-chloroethoxy)methane	-	ug/L	8270C	9.6 UJ	9.6 U	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Butyl Benzyl Phthalate	-	ug/L	8270C	9.6 U	9.6 UJ	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Chrysene	0.4[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Dibenz(a,h)anthracene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Diethyl Phthalate	29000[d]	ug/L	8270C	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Fluoranthene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Fluorene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Indeno(1,2,3-c,d)pyrene	0.04[e]	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Napthalene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Phenanthrene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Phenol	22000[d]	ug/L	8270C	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 UJ	10 UJ
Pyrene	-	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
METALS												
Aluminum	1000[b]	ug/L	6010B	23.7 J	25.2 J	14 UJ	5 UJ	31.1 J	8.2 J	17.9 J	22.2 J	18.1 UJ
Antimony	6[b]	ug/L	6010B	2.4 UJ	1.8 UJ	60 U	60 UJ	60 U	60 U	2.7	60 U	60 U
Arsenic	50[b]	ug/L	6010B	5.7 UJ	4.5 UJ	9.1 UJ	8.1 UJ	3.7 UJ	7	11.6 UJ	7.6 UJ	5.4
Barium	1000[b]	ug/L	6010B	40	41.1	38.3	29	31	34.2	30.9	32.8	30.5
Cadmium	-	ug/L	6010B	0.15 UJ	0.18 UJ	5 UJ	5 U	5 U	5 U	5 U	0.42 UJ	5 UJ
Calcium	-	ug/L	6010B	167000	179000	209000	178000	193000	203000	186000	162000	202000
Chromium	50[b]	ug/L	6010B	2.8 J	2.7 J	3.1 UJ	2.4 J	1.1 J	10 U	3.9	5.4 J	10 U
Cobalt	-	ug/L	6010B	0.75 UJ	0.56 UJ	50 UJ	50 U	50 U	50 U	50 U	50 U	50 UJ
Copper	1300[a]	ug/L	6010B	4.9 UJ	4.3 UJ	25 UJ	2.6 UJ	24.2	8.5 UJ	3.1 J	2.4 UJ	25 U
Iron	300[c]	ug/L	6010B	28.5 UJ	30 UJ	193	185	240 J	208	234	192 J	191
Lead	15[a]	ug/L	6010B	3.3 UJ	3.2 UJ	3 U	1.4 UJ	3 U	3 UJ	3.3 UJ	3 U	3 U
Magnesium	-	ug/L	6010B	87200	90800	99500	90800	90000	91000	90300	81800	101000
Manganese	50[c]	ug/L	6010B	35.5	38.1	14.7	10.5	13.2	14.1	13.6	11.4	17.3 UJ
Mercury	2[b]	ug/L	7470A	0.11 J	0.12 J	0.2	0.058 J	0.066 J	0.1 J	0.55 J	0.21 J	1.2 J
Nickel	100[b]	ug/L	6010B	3 UJ	3.3 UJ	1.6 UJ	1.6 UJ	1.2 J	40 U	1.7	0.71 UJ	40 UJ
Potassium	-	ug/L	6010B	5650	6010	6520 J	5960	6110	6460	5790	6340	6720
Selenium	50[b]	ug/L	6010B	5 UJ	5 UJ	3.4 UJ	5 UJ	5 U	5 U	7.7 UJ	5 U	5 U
Silver	100[c]	ug/L	6010B	1.2	0.85	10 UJ	2.1 UJ	0.96 UJ	1.5 UJ	2 J	10 U	10 U
Sodium	-	ug/L	6010B	421000	448000	507000	460000	494000	465000	437000	418000	500000
Thallium	5[b]	ug/L	6010B	10 U	10 U	3 J	10 U	10 U	10 U	10 U	6.8 UJ	10 U
Vanadium	-	ug/L	6010B	1.5 UJ	1.5 UJ	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Zinc	5000[c]	ug/L	6010B	201	209	3.6 UJ	12 J	8.1 J	3.2 J	24.4 J	8.3 J	2 UJ
Miscellaneous												
pH	-	pH	9040	7.07	7.01	6.83	6.71	6.85	6.86	6.64	--	6.88
Chromium, hexavalent	50[a]	ug/L	7199	--	--	--	--	--	--	--	--	--

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Table 6-26: Summary of Detected Analytes - Round 1 through Round 8 Groundwater Sampling - RSE Investigation

PARAMETER	Regulatory Threshold Concentrations (µg/L)	Units	Method	AA3-MW11	AA3-MW11	AA3-MW11	AA3-MW11	AA3-MW12	AA3-MW12	AA3-MW12	AA3-MW12	AA3-MW12	AA3-MW13	AA3-MW13	AA3-MW13	AA3-MW13	AA3-MW14	AA3-MW14	AA3-MW14	AA3-MW14
			EPA ID:	LK466	LK467	LK520	LK521	LK469	LK472	LK530	LK532	LK531	LK471	LK473	LK535	LK536	LK475	LK476	LK518	LK519
			SAMPLE DATE:	2/15/2005	2/15/2005	4/28/2005	4/28/2005	2/16/2005	2/16/2005	4/29/2005	4/29/2005	4/29/2005	2/16/2005	2/16/2005	4/29/2005	4/29/2005	2/17/2005	2/17/2005	4/28/2005	4/28/2005
			SAMPLE TYPE:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular
			ROUND #:	Round 7		Round 8		Round 7		Round 8			Round 7		Round 8		Round 7		Round 8	
PETROLEUM HYDROCARBONS																				
Motor Oil	-	mg/L	8015B DRO	0.096 U	–	0.04 J	–	0.06 J	–	0.24	0.2	–	0.096 U	–	0.096 U	–	0.096 U	–	0.09 J	–
Diesel Fuel	-	mg/L	8015B DRO	0.009 J	–	0.04 J	–	0.2	–	0.85	0.78	–	0.096 U	–	0.096 U	–	0.096 U	–	0.1	–
Gasoline	-	mg/L	8015B DRO	0.1 U	–	0.1 U	–	0.1 U	–	0.1 U	0.1 U	–	0.1 U	–	0.1 U	–	0.1 U	–	0.1 U	–
VOCs																				
4-Methyl-2-Pentanone	-	ug/L	8260B	50 UJ	–	50 U	–	50 UJ	–	50 U	50 U	–	50 UJ	–	50 U	–	50 UJ	–	50 U	–
Chloroform	100[b]	ug/L	8260B	0.1 U	–	0.1 U	–	0.1 U	–	0.1 U	0.1 U	–	0.1 U	–	0.1 U	–	0.1 U	–	0.1 U	–
2-Butanone (MEK)	-	ug/L	8260B	100 UJ	–	100 U	–	100 U	–	100 U	100 U	–	100 U	–	100 U	–	100 U	–	100 U	–
Methylene Chloride	-	ug/L	8260B	3 U	–	3 U	–	3 U	–	3 UJ	3 U	–	3 U	–	3 UJ	–	3 U	–	3 U	–
SVOCs																				
4-Methylphenol	180[d]	ug/L	8270C	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–
Acenaphthene	-	ug/L	8270 SIM	0.48 U	–	0.48 U	–	0.2 J	–	1.6	1.5	–	0.48 U	–	0.48 U	–	0.48 U	–	0.05 J	–
Anthracene	-	ug/L	8270 SIM	0.48 U	–	0.48 U	–	0.05 J	–	0.09 J	0.08 J	–	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	–
Benzo(a)anthracene	0.04[e]	ug/L	8270 SIM	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	–
Benzo(a)pyrene	0.2[a]	ug/L	8270 SIM	0.19 U	–	0.19 U	–	0.19 U	–	0.19 U	0.19 U	–	0.19 U	–	0.19 U	–	0.19 U	–	0.19 U	–
Benzo(b)fluoranthene	0.04[e]	ug/L	8270 SIM	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	–
Benzo(g,h,i)perylene	-	ug/L	8270 SIM	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	–
Bis(2-Ethylhexyl)Phthalate	-	ug/L	8270C	9.6 UJ	–	9.6 U	–	9.6 U	–	9.6 U	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–
Bis(2-chloroethoxy)methane	-	ug/L	8270C	9.6 UJ	–	9.6 U	–	9.6 U	–	2 J	2 J	–	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–
Butyl Benzyl Phthalate	-	ug/L	8270C	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–
Chrysene	0.4[e]	ug/L	8270 SIM	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	–
Dibenz(a,h)anthracene	-	ug/L	8270 SIM	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	–
Diethyl Phthalate	29000[d]	ug/L	8270C	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–
Fluoranthene	-	ug/L	8270 SIM	0.48 U	–	0.48 U	–	0.02 J	–	0.09 J	0.08 J	–	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	–
Fluorene	-	ug/L	8270 SIM	0.48 U	–	0.48 U	–	0.1 J	–	0.48 U	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	–
Indeno(1,2,3-c,d)pyrene	0.04[e]	ug/L	8270 SIM	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	–
Napthalene	-	ug/L	8270 SIM	0.48 U	–	0.48 U	–	0.48 U	–	0.04 J	0.03 J	–	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	–
Phenanthrene	-	ug/L	8270 SIM	0.48 U	–	0.48 U	–	0.48 U	–	0.05 J	0.05 J	–	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	–
Phenol	22000[d]	ug/L	8270C	9.6 U	–	9.6 U	–	9.6 UJ	–	9.6 U	9.6 U	–	9.6 UJ	–	9.6 U	–	9.6 UJ	–	9.6 U	–
Pyrene	-	ug/L	8270 SIM	0.48 U	–	0.48 U	–	0.48 U	–	0.06 J	0.06 J	–	0.48 U	–	0.48 U	–	0.48 U	–	0.48 U	–
METALS																				
Aluminum	1000[b]	ug/L	6010B	35.1 J	46.7 J	186 UJ	31 UJ	98.1 J	29.7 J	63.7 UJ	44 UJ	33 UJ	35.5 J	29.1 J	28.9 UJ	22.8 UJ	127 J	40.3 J	249	58.9 J
Antimony	6[b]	ug/L	6010B	60 U	60 U	60 U	60 U	60 U	60 U	60 U	**11.7**	60 U	60 U	60 U	**9.7**	**6.7**	60 U	60 U	60 U	60 U
Arsenic	50[b]	ug/L	6010B	7.3 UJ	7.5 UJ	31.7	24.5	7.7 UJ	10.6 UJ	**61.9**	**58.6**	**62.2**	8.1 UJ	9.5 UJ	4.7 UJ	10 U	7.3 UJ	6.7 UJ	22.5	23.8
Barium	1000[b]	ug/L	6010B	48.6	45.6	43	39	147	146	109 J	110 J	121 J	61.4	63	35.1 J	34.4 J	32.2	32.9	113	113 J
Cadmium	-	ug/L	6010B	5 U	0.16 UJ	5 U	5 U	0.42 UJ	0.3 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	0.36 UJ	0.4 UJ	5 U	5 U
Calcium	-	ug/L	6010B	147000	135000	164000	155000	243000	244000	266000	279000	299000	367000	379000	386000 J	374000	196000	198000	214000	211000
Chromium	50[b]	ug/L	6010B	1.8	1.4	2.7 UJ	3 UJ	2.9 J	2.8 J	10 U	3.8 J	10 UJ	17.5	18	3.4 J	3.3 J	2.8 J	4.1 J	3.2 UJ	3.3 J
Cobalt	-	ug/L	6010B	0.81 UJ	0.8 UJ	1.7 UJ	2 UJ	2 UJ	2.1 UJ	2.4 J	2.7 J	2.6 J	0.53 UJ	0.55 UJ	50 UJ	50 UJ	1.3 UJ	1.2 UJ	2 UJ	1.5 J
Copper	1300[a]	ug/L	6010B	15.5	3.1 UJ	5.4 J	3.1	7.6 UJ	5.6 UJ	2.5	5.4	1.9 J	2.6 UJ	3.7 UJ	6	5.8	3 UJ	16.7 UJ	8	2.3 J
Iron	300[c]	ug/L	6010B	46 J	26.9 J	402	202	124 J	31.9 UJ	4550	4640	4950	17.8 UJ	39.1 J	25 UJ	20.2 UJ	139 J	94.8 J	1890	2260
Lead	15[a]	ug/L	6010B	3 U	3 U	3 U	2.5	3 U	3 U	3 U	2	3 U	3 U	3 U	4.3	4.3	3 U	3 U	3.1	1.9 J
Magnesium	-	ug/L	6010B	79100	75800	134000	124000	137000	139000	101000	99500	114000	129000	135000	152000	147000	105000	105000	129000	127000
Manganese	50[c]	ug/L	6010B	69.5	57.9	685	635	358	362	1770	1760 J	2000	11.4	11.2	14 J	13.9 J	511	519	1450	1400
Mercury	2[b]	ug/L	7470A	0.51 J	0.54 J	0.13 J	0.23 J	0.039 J	0.032 J	0.1 J	0.032 J	0.062 J	0.082 J	0.092 J	0.43	0.27	0.2 J	0.18 J	0.19 J	0.45
Nickel	100[b]	ug/L	6010B	5.8	3.5 UJ	4.8	4.6	22	21.1	19.6	20.6	22.8	1.7 UJ	1.7 UJ	2.7 J	3.4 J	4.7	6.3	5.9	5 J
Potassium	-	ug/L	6010B	13600	13100	14800	13400	29400	29300	29100 J	29300 J	31000 J	12000	12500	3430 J	3330 J	6710	7260	20500	19700
Selenium	50[b]	ug/L	6010B	14.2 UJ	4.5 UJ	7.8	6.5	5 U	5 U	8.7 UJ	5.2 UJ	12.5 UJ	**97.9**	**97.2**	**91.8 J**	**87**	5 U	7.5 UJ	5 U	9.3
Silver	100[c]	ug/L	6010B	10 U	10 U	1.6	2.9	10 U	10 U	3.5 UJ	4.5 UJ	4.8 UJ	10 U	10 U	5.5 UJ	5.8 UJ	10 U	10 U	4.5	4.2 J
Sodium	-	ug/L	6010B	470000	437000	415000	397000	514000	531000	526000 J	451000 J	593000	441000	453000	412000 J	402000	433000	440000	390000	393000
Thallium	5[b]	ug/L	6010B	5.4 UJ	4.7 UJ	10 U	10 U	8.2 UJ	10 UJ	8.7 UJ	10 U	8 UJ	9.6 UJ	9.1 UJ	10 U	10 U	8.4 UJ	8.5 UJ	10 U	10 U
Vanadium	-	ug/L	6010B	9.5	9.2	4	2.7	15.4	14.9	1.7	3.1	1.6	14	14.6	27.5	26.4	15.7	15.5	2.4	1.9 J
Zinc	5000[c]	ug/L	6010B	17 J	6.1 J	8.5 J	1.2 J	6.4 J	10 J	20 UJ	20 UJ	20 UJ	5.4 J	4.7 J	20 UJ	20 UJ	12 J	18.5 J	3.5 J	20 U
Miscellaneous																				
pH	-	pH	9040	–	–	7.12	–	–	–	6.73	6.76	–	–	–	6.94	–	–	–	6.9	–
Chromium, hexavalent	50[c]	ug/L	7199	–	–	–	–	–	–	–	–	–	14	–	1.1	–	–	–	–	–

Notes:

[a] Value represents the AL for the analyte.

[b] Value represents the stringent concentration of Federal and California MCLs.

[c] Value represents the secondary MCL.

[d] Value represents the tap water PRGs.

[e] Public Health Goal for benoz(a)pyrene and OEHHA PEFs

AA3 = Anomaly Area 3

RSE = removal site evaluation

MCL = maximum contaminant level

AL = action level

PRGs = Preliminary Remediation Goals

U = indicates the analyte was not detected at or above the stated limit.

UJ = indicates the analyte was not detected at or above the stated limit. The sample detection limit is an estimated value.

J = indicates an estimated value.

- = Regulatory Threshold Concentrations not established for this particular analyte.

Values in bold indicate that the particular analyte had exceeded its regulatory threshold limit.

µg/L = micrograms per liter

mg/L = milligram per liter

TPH = total petroleum hydrocarbons

VOCs = volatile organic compounds

SVOCs = semivolatile organic compounds

pH = negative logarithm of hydrogen ion concentration

ID = identification

OEHHA = Office of Environmental Health Hazard Assessment

PEF = potency equivalency factor

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6.5.7 July 2004 Sampling Event – Round 5 RSE Investigation

Seventeen groundwater samples (including four duplicates) were analyzed for petroleum hydrocarbons, VOCs, SVOCs, and metals. Groundwater samples were collected from upgradient Well MW06and downgradient Wells MW01 and MW02 for dissolved metals (EPA Method 6010) and hexavalent chromium (EPA Method 7199) analysis. A complete data set for Round 5 groundwater sampling is presented in Appendix B.

The July 2004 groundwater samples were collected as part of the fifth RSE investigation sampling event. Detected analytes from this sampling event are presented in Table 6-26. The results are consistent with the previous two sampling events.

VOCs were not detected in any of the wells sampled. SVOCs were not detected in any of the wells sampled with the exception of low detection of bis(2-ethylhexyl)phthalate (3 J µg/L) in one well.

All groundwater samples reported metal concentrations that were lower than their respective MCL values, with the exception of aluminum (one well had detected concentration [1700 µg/L] exceeding the MCL of 1,000 µg/L). The dissolved metal concentrations reported from Wells MW01, MW02 and MW06 groundwater samples were comparable to their total metal concentrations. The chromium concentrations in Wells MW01 and MW02 were significantly below the MCL concentration of 50 µg/L. Downgradient well samples that were analyzed for hexavalent chromium (MW01 and MW02) reported no hexavalent chromium contribution. However, upgradient Well, MW06, reported hexavalent chromium at a concentration of 0.6 µg/L and its duplicate reported a hexavalent chromium value of 0.54 µg/L.

Motor oils (four wells reported concentrations ranging from 0.01 J mg/L to 0.03 J mg/L) and petroleum hydrocarbons as diesel fuel (five wells reported concentrations ranging from 0.01 J mg/L to 0.07 J mg/L) were detected. There were no detections of petroleum hydrocarbons as gasoline in any of the wells sampled.

6.5.8 October 2004 Sampling Event – Round 6 RSE Investigation

Sixteen groundwater samples (including three duplicates) were analyzed for petroleum hydrocarbons, VOCs, SVOCs, and metals. Groundwater samples were collected from upgradient Well MW06 and downgradient Wells MW01 and MW02 for dissolved metals (EPA Method 6010) and hexavalent chromium (EPA Method 7199) analysis. A complete data set for Round 6 groundwater sampling is presented in Appendix B.

The October 2004 groundwater samples were collected as part of the sixth RSE investigation sampling event. Detected analytes from this sampling event are presented in Table 6-26. The results are consistent with the previous sampling events.

VOCs were not detected in any of wells sampled with the exception of low detection of 2-Butanone (1 J µg/L) in one well and methylene chloride (0.5 J µg/L) in one well. SVOCs were not detected in any of the wells sampled.

All groundwater samples reported metal concentrations that were lower than their respective MCL values, with the exception of chromium. One downgradient well, MW01, had a detected concentration of 50.4 µg/L (MCL of 50 µg/L); the duplicate sample from the same well had a chromium concentration of 47.9 µg/L. The chromium concentrations in other wells were significantly below the MCL value. The dissolved metal concentrations reported from the MW01,

MW02, and MW06 groundwater samples were comparable to their total metal concentrations. Downgradient well samples that were analyzed for hexavalent chromium (MW01 and MW02) reported no hexavalent chromium contribution. However, upgradient Well MW06, reported hexavalent chromium at a concentration of 0.25 J µg/L and its duplicate reported a hexavalent chromium value of 0.24 µg/L.

Two wells reported petroleum hydrocarbons as diesel fuel with concentrations of 0.008 J mg/L and 0.01 J mg/L and five wells reported petroleum hydrocarbons as gasoline with concentrations ranging from 0.02 J mg/L to 0.05 J mg/L. There were no detections of motor oils in any of the wells sampled.

6.5.9 February 2005 Sampling Event – Round 7 RSE Investigation

Twenty-three groundwater samples (including two duplicates) were analyzed for petroleum hydrocarbons, VOCs, SVOCs, and metals (Appendix B). A complete data set for Round 7 groundwater sampling is presented in Appendix B.

The February 2005 groundwater samples were collected as part of the seventh RSE investigation sampling event. Detected analytes from this sampling event are presented in Table 6-26. With the exception of PAHs, the results are consistent with the previous sampling events.

VOCs were not detected in any of wells sampled with the exception of low detection of chloroform (0.95 µg/L in one well) and methylene chloride (four detections ranging from 1 J µg/L to 3 µg/L).

SVOCs were not detected in any of the wells sampled, except MW08 and MW12.

> The detected SVOCs at Well MW08 include benzo[a]anthracene (0.04 J µg/L; equal to the public health goal of 0.04 µg/L [total PAHs]); B[a]P (0.46 µg/L; exceeding MCL of 0.2 µg/L); benzo[b]fluoranthene (0.6 µg/L; exceeding the public health goal of 0.04 µg/L [total PAHs]); benzo[g,h,i]perylene (0.4 J µg/L); chrysene (0.04 J µg/L); dibenz[a,h]anthracene (0.1 J µg/L); and, indeno[1,2,3-c,d]pyrene (0.4 J µg/L; exceeding the public health goal of 0.04 µg/L [total PAHs]).
>
> The detected SVOCs at MW12 include acenaphthene (0.2 J µg/L), anthracene (0.05 J µg/L), fluoranthene (0.02 J µg/L), fluorene (0.1 J µg/L), and phenanthrene (0.1 J µg/L).

All groundwater samples reported metal concentrations that were lower than their respective MCL values, with the exception of selenium and thallium. Upgradient Well, MW13 reported a selenium concentration of 97.9 µg/L. Upgradient groundwater Monitoring Well MW06 reported thallium at a concentration of 5.3 J µg/L exceeding the MCL concentration of 5 µg/L. However, the dissolved thallium concentration at this well was reported at 2.8 and 3.4 µg/L. During Round 2 sampling, a sample collected from MW06 reported thallium at a concentration of 5.7 µg/L.

In Round 7, upgradient Well MW06 was sampled for hexavalent chromium sample. Hexavalent chromium was not detected in this well. Upgradient Well MW13 reported hexavalent chromium at a concentration of 14 µg/L. Note that during Round 4, 5, and 6 sampling events, Well MW06 reported hexavalent chromium at concentrations of 0.24 µg/L, 0.6 µg/L, and 0.25 J µg/L, respectively.

Detected petroleum hydrocarbons included: (1) motor oils (three wells reporting concentrations ranging from 0.02 J mg/L to 0.1 mg/L); (2) petroleum hydrocarbons as diesel fuel (three wells reporting concentrations ranging from 0.03 J mg/L to 0.2 mg/L); and, (3) petroleum hydrocarbons as gasoline (two wells reporting concentrations of 0.005 J mg/L to 0.03 J mg/L).

The groundwater is in close proximity (at some locations within the waste) with the waste at the site. January and February 2005 recorded 8.58 and 8.41 inches of rainfall locally at Irvine. The presence of SVOCs in this round of sampling may be attributed to the rise in groundwater levels as a result of unprecedented rainfall at the site. And, it must be noted that the wells that were installed within the waste placement area (MW12) and one periphery well, MW08, had observable SVOC concentrations slightly above reporting limits.

6.5.10 April 2005 Sampling Event – Round 8 RSE Investigation

Twenty-three groundwater samples (including two duplicates) were analyzed for petroleum hydrocarbons, VOCs, SVOCs, and metals. A complete data set for Round 8 groundwater sampling is presented in Appendix B.

The April 2005 groundwater samples were collected as part of the eighth RSE investigation sampling event. Detected analytes from this sampling event are presented in Table 6-26. The results are consistent with the previous sampling events.

VOCs were not detected in any of the wells samples.

SVOCs were not detected in any of the wells sampled with the exception of MW12 and MW14. The detected SVOCs at MW12 (duplicate sample also collected) include acenaphthene (1.6 and 1.5 µg/L), anthracene (0.09 J and 0.08 J µg/L), bis(2-chloroethoxy)methane (both 2 J µg/L), fluoranthene (0.09 J and 0.08 J µg/L), naphthalene (0.04 J and 0.03 J µg/L), phenanthrene (both 0.05 J), and pyrene (both 0.06 J µg/L). The detected SVOC at MW14 included acenaphthene (0.05 J µg/L).

During this sampling event, antimony was detected at concentration exceeding its MCL value in three wells. Upgradient Well MW06 reported antimony at a concentration of 9.7 µg/L; however, antimony was not detected in the dissolved metal sample. Another upgradient Well MW13 reported antimony concentration of 9.7 µg/L with dissolved metal result being 6.7 µg/L. A duplicate sample collected from Well MW12 reported antimony concentration at 11.7 µg/L; however, antimony was not reported in the regular sample.

Arsenic was reported above its MCL of 10 µg/L value at one well, MW12, at a concentration of 61.9 µg/L (duplicate – 58.6 µg/L). The same well reported arsenic at 62.2 µg/L (dissolved metal sample). Another metal that exceed its MCL value was selenium. Upgradient Well MW13 reported a selenium concentration of 91.8 µg/L and 81 µg/L (duplicate sample result). Thallium was reported above its MCL value in two wells, MW02 and MW08. Well MW02 reported thallium at 7.8 µg/L (7.2 µg/L in dissolved metal sample). A duplicate sample collected from Well MW08 reported thallium at 5.5 µg/L; however the regular sample reported thallium at only 3.1 µg/L (below MCL value of 5 µg/L).

In Round 8, the upgradient Well MW06 reported a hexavalent chromium concentration of 0.23 J µg/L and upgradient Well MW13 reported hexavalent chromium at a concentration of 1.1 µg/L. Note that during Round 4, 5, 6, and 7 sampling events, Well MW06, reported hexavalent chromium at concentrations of 0.24 µg/L, 0.6 µg/L, 0.25 J µg/L and non-detect, respectively. Note that during the Round 7 sampling event, Well MW13 reported hexavalent chromium at concentrations of 14 µg/L.

Detected petroleum hydrocarbons included: (1) motor oils (six wells reported concentrations ranging from 0.04 J mg/L to 0.24 mg/L); and (2) petroleum hydrocarbons as diesel fuel (five wells reported concentrations ranging from 0.04 J mg/L to 0.85 mg/L).

March and April 2005 recorded 0.59 and 1.3 inches of rainfall locally at Irvine. The higher groundwater elevations observed during January and February 2005, as result of heavy rains, were also measured during the March/April 2005 sampling round as well. The SVOCs were reported slightly above reporting limits only in Wells MW12 and MW14 (wells within the waste) and not in the periphery Well MW08.

6.5.11 Summary of Groundwater Sampling Results

Figures 5-8, 5-9, 5-10, and 5-11 are cross sections presenting the subsurface extent of debris placement at the site and water level gauging information from February 2005, which is considered to represent historic high groundwater elevations for the most recent water level gauging events (1999 -2005). As is indicated in these cross sections, the groundwater surface appears to be above or in close proximity to the pre-waste placement topographical elevation, which indicates that the groundwater is in contact with the debris placed at the site. Figure 6-12 presents groundwater hydrographs for AA 3 groundwater monitoring wells and also includes area rainfall data.

Figure 6-11 presents the results of November 1999, April 2000, December 2002, March 2003, November 2003, April 2004, July 2004, October 2004, February 2005 and April 2005 groundwater sampling events. Summary statistics on the groundwater sampling results are presented in Table 6-27.

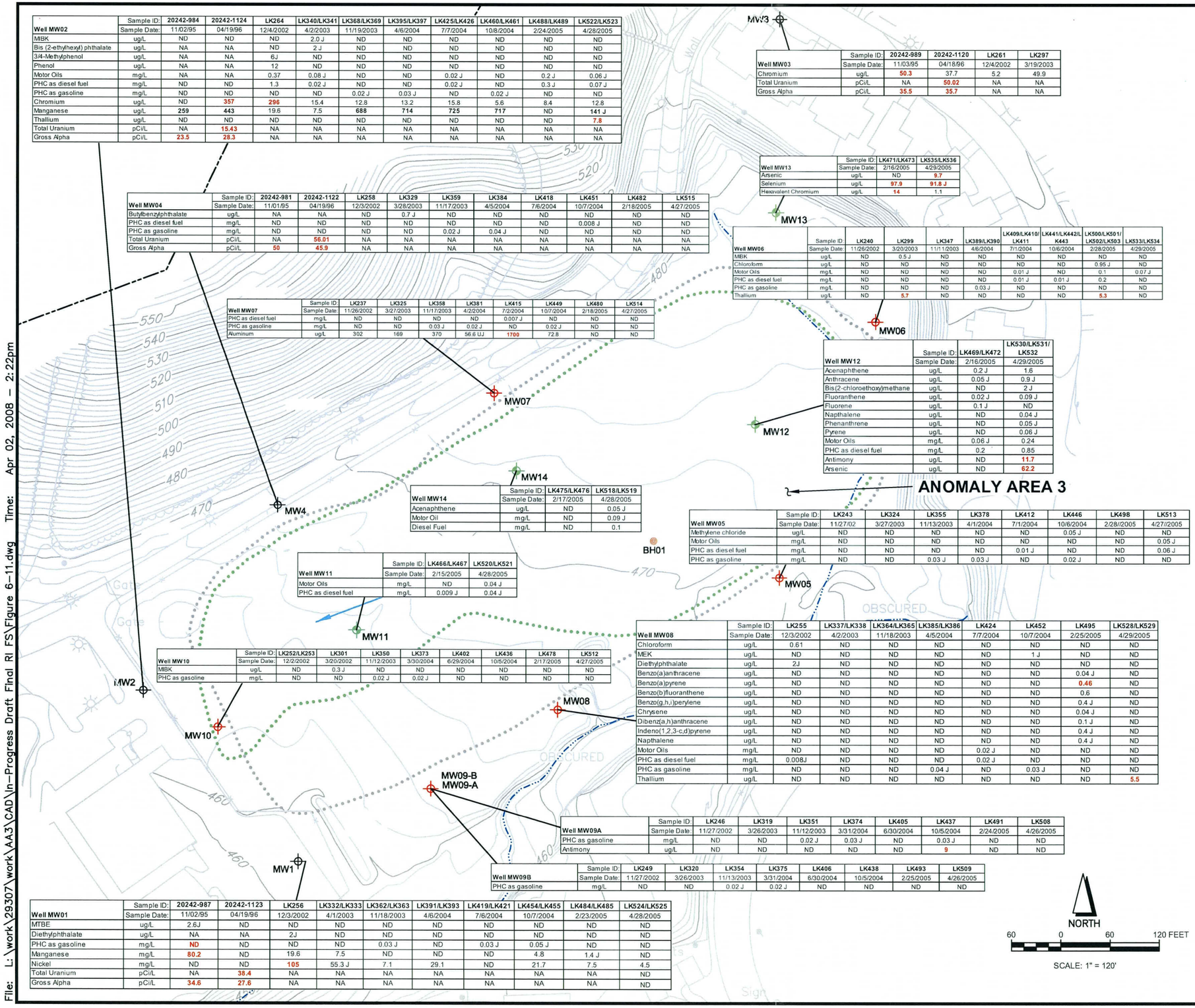
A total of 107 groundwater samples were collected and analyzed for VOCs. VOCs were not detected at concentrations exceeding their respective MCLs. The following VOCs were detected: MTBE (2 detections in 1999 at one well [including a duplicate] had concentrations less than its MCL); chloroform (1 detection less than their MCL); methyl isobutylketone (MIBK) (3 detections less than it's MCL); MEK (one detection less than it's MCL); and, methylene chloride (1 detection less than its MCL).

A total of 107 groundwater samples were collected and analyzed for SVOCs; the following SVOCs, were detected once at concentrations below their respective MCLs: m/p-cresol, 4-methylphenol, benzo(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)-perylene, butyl benzyl phthalate, chrysene, dibenz(a,h)anthracene, fluorene, indeno(1,2,3-c,d)pyrene, and phenol. Benzo(a)pyrene was also detected only once, at 0.46 µg/L which exceeded it's MCL of 0.2 µg/L.

The following SVOCs were detected twice at concentrations below their respective MCLs: bis(2-chloroethoxy)-methane, bis(2-ethylhexyl)phthalate, diethylphthalate, phenanthrene, and pyrene. Fluoranthene, acenaphthene, and anthracene were also detected five, four, and three times, respectively, at concentrations below their respective MCLs.

Out of the 107 groundwater samples analyzed for petroleum hydrocarbons, motor oil was detected in 17 samples, with diesel and gasoline petroleum hydrocarbons detected in 21 and 24 samples, respectively.

From all sampling events and out of 134 groundwater samples analyzed for metals, the following metals that were detected above their MCL values include: aluminum (1 detection above its MCL); antimony (5 detections above its MCL); arsenic (3 detections above its MCL); chromium



Well MW02	Sample ID:	20242-984	20242-1124	LK264	LK340/LK341	LK368/LK369	LK395/LK397	LK425/LK426	LK460/LK461	LK488/LK489	LK522/LK523
	Sample Date:	11/02/95	04/19/96	12/4/2002	4/2/2003	11/19/2003	4/6/2004	7/7/2004	10/8/2004	2/24/2005	4/28/2005
MIBK	ug/L	ND	ND	ND	2.0 J	ND	ND	ND	ND	ND	ND
Bis (2-ethylhexyl) phthalate	ug/L	NA	NA	ND	2 J	ND	ND	ND	ND	ND	ND
3/4-Methylphenol	ug/L	NA	NA	6J	ND	ND	ND	ND	ND	ND	ND
Phenol	ug/L	NA	NA	12	ND	ND	ND	ND	ND	ND	ND
Motor Oils	mg/L	NA	NA	0.37	0.08 J	ND	ND	0.02 J	ND	0.2 J	0.06 J
PHC as diesel fuel	mg/L	ND	ND	1.3	0.02 J	ND	ND	0.02 J	ND	0.3 J	0.07 J
PHC as gasoline	mg/L	ND	ND	ND	ND	0.02 J	0.03 J	ND	0.02 J	ND	ND
Chromium	ug/L	ND	**357**	**296**	15.4	12.8	13.2	15.8	5.6	8.4	12.8
Manganese	ug/L	**259**	**443**	19.6	7.5	**688**	**714**	**725**	**717**	ND	**141 J**
Thallium	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	**7.8**
Total Uranium	pCi/L	NA	**15.43**	NA	NA	NA	NA	NA	NA	NA	NA
Gross Alpha	pCi/L	**23.5**	**28.3**	NA	NA	NA	NA	NA	NA	NA	NA

Well MW03	Sample ID:	20242-989	20242-1120	LK261	LK297
	Sample Date:	11/03/95	04/18/96	12/4/2002	3/19/2003
Chromium	ug/L	**50.3**	37.7	5.2	49.9
Total Uranium	pCi/L	NA	**50.02**	NA	NA
Gross Alpha	pCi/L	**35.5**	**35.7**	NA	NA

Well MW13	Sample ID:	LK471/LK473	LK535/LK536
	Sample Date:	2/16/2005	4/29/2005
Arsenic	ug/L	ND	**9.7**
Selenium	ug/L	**97.9**	**91.8 J**
Hexavalent Chromium	ug/L	**14**	1.1

Well MW04	Sample ID:	20242-981	20242-1122	LK258	LK329	LK359	LK384	LK418	LK451	LK482	LK515
	Sample Date:	11/01/95	04/19/96	12/3/2002	3/28/2003	11/17/2003	4/5/2004	7/6/2004	10/7/2004	2/18/2005	4/27/2005
Butylbenzylphthalate	ug/L	NA	NA	ND	0.7 J	ND	ND	ND	ND	ND	ND
PHC as diesel fuel	mg/L	ND	ND	ND	ND	ND	ND	ND	0.008 J	ND	ND
PHC as gasoline	mg/L	ND	ND	ND	ND	0.02 J	0.04 J	ND	ND	ND	ND
Total Uranium	pCi/L	NA	**56.01**	NA	NA	NA	NA	NA	NA	NA	NA
Gross Alpha	pCi/L	**50**	**45.9**	NA	NA	NA	NA	NA	NA	NA	NA

Well MW06	Sample ID:	LK240	LK299	LK347	LK389/LK390	LK409/LK410/ LK411	LK441/LK442/L K443	LK500/LK501/ LK502/LK503	LK533/LK534
	Sample Date:	11/26/2002	3/20/2003	11/11/2003	4/6/2004	7/1/2004	10/6/2004	2/28/2005	4/29/2005
MBK	ug/L	ND	0.5 J	ND	ND	ND	ND	ND	ND
Chloroform	ug/L	ND	ND	ND	ND	ND	ND	0.95 J	ND
Motor Oils	mg/L	ND	ND	ND	ND	0.01 J	ND	0.1	0.07 J
PHC as diesel fuel	mg/L	ND	ND	ND	ND	0.01 J	0.01 J	0.2	ND
PHC as gasoline	mg/L	ND	ND	ND	0.03 J	ND	ND	ND	ND
Thallium	ug/L	ND	**5.7**	ND	ND	ND	ND	**5.3**	ND

Well MW07	Sample ID:	LK237	LK325	LK358	LK381	LK415	LK449	LK480	LK514
	Sample Date:	11/26/2002	3/27/2003	11/17/2003	4/2/2004	7/2/2004	10/7/2004	2/18/2005	4/27/2005
PHC as diesel fuel	mg/L	ND	ND	ND	ND	0.007 J	ND	ND	ND
PHC as gasoline	mg/L	ND	ND	0.03 J	0.02 J	ND	0.02 J	ND	ND
Aluminum	ug/L	302	169	370	56.6 UJ	**1700**	72.8	ND	ND

Well MW12	Sample ID:	LK469/LK472	LK530/LK531/ LK532
	Sample Date:	2/16/2005	4/29/2005
Acenaphthene	ug/L	0.2 J	1.6
Anthracene	ug/L	0.05 J	0.9 J
Bis(2-chloroethoxy)methane	ug/L	ND	2 J
Fluoranthene	ug/L	0.02 J	0.09 J
Fluorene	ug/L	0.1 J	ND
Napthalene	ug/L	ND	0.04 J
Phenanthrene	ug/L	ND	0.05 J
Pyrene	ug/L	ND	0.06 J
Motor Oils	mg/L	0.06 J	0.24
PHC as diesel fuel	mg/L	0.2	0.85
Antimony	ug/L	ND	**11.7**
Arsenic	ug/L	ND	**62.2**

Well MW14	Sample ID:	LK475/LK476	LK518/LK519
	Sample Date:	2/17/2005	4/28/2005
Acenaphthene	ug/L	ND	0.05 J
Motor Oil	mg/L	ND	0.09 J
Diesel Fuel	mg/L	ND	0.1

Well MW05	Sample ID:	LK243	LK324	LK355	LK378	LK412	LK446	LK498	LK513
	Sample Date:	11/27/02	3/27/2003	11/13/2003	4/1/2004	7/1/2004	10/6/2004	2/28/2005	4/27/2005
Methylene chloride	ug/L	ND	ND	ND	ND	ND	0.05 J	ND	ND
Motor Oils	mg/L	ND	ND	ND	ND	ND	ND	ND	0.05 J
PHC as diesel fuel	mg/L	ND	ND	ND	ND	0.01 J	ND	ND	0.06 J
PHC as gasoline	mg/L	ND	ND	0.03 J	0.03 J	ND	0.02 J	ND	ND

Well MW11	Sample ID:	LK466/LK467	LK520/LK521
	Sample Date:	2/15/2005	4/28/2005
Motor Oils	mg/L	ND	0.04 J
PHC as diesel fuel	mg/L	0.009 J	0.04 J

Well MW10	Sample ID:	LK252/LK253	LK301	LK350	LK373	LK402	LK436	LK478	LK512
	Sample Date:	12/2/2002	3/20/2002	11/12/2003	3/30/2004	6/29/2004	10/5/2004	2/17/2005	4/27/2005
MBK	ug/L	ND	0.3 J	ND	ND	ND	ND	ND	ND
PHC as gasoline	mg/L	ND	ND	0.02 J	0.02 J	ND	ND	ND	ND

Well MW08	Sample ID:	LK255	LK337/LK338	LK364/LK365	LK385/LK386	LK424	LK452	LK495	LK528/LK529
	Sample Date:	12/3/2002	4/2/2003	11/18/2003	4/5/2004	7/7/2004	10/7/2004	2/25/2005	4/29/2005
Chloroform	ug/L	0.61	ND	ND	ND	ND	ND	ND	ND
MEK	ug/L	ND	ND	ND	ND	ND	1 J	ND	ND
Diethylphthalate	ug/L	2J	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	ug/L	ND	ND	ND	ND	ND	ND	0.04 J	ND
Benzo(a)pyrene	ug/L	ND	ND	ND	ND	ND	ND	**0.46**	ND
Benzo(b)fluoranthene	ug/L	ND	ND	ND	ND	ND	ND	0.6	ND
Benzo(g,h,i)perylene	ug/L	ND	ND	ND	ND	ND	ND	0.4 J	ND
Chrysene	ug/L	ND	ND	ND	ND	ND	ND	0.04 J	ND
Dibenz(a,h)anthracene	ug/L	ND	ND	ND	ND	ND	ND	0.1 J	ND
Indeno(1,2,3-c,d)pyrene	ug/L	ND	ND	ND	ND	ND	ND	0.4 J	ND
Napthalene	ug/L	ND	ND	ND	ND	ND	ND	0.4 J	ND
Motor Oils	mg/L	ND	ND	ND	ND	0.02 J	ND	ND	ND
PHC as diesel fuel	mg/L	0.008J	ND	ND	ND	0.02 J	ND	ND	ND
PHC as gasoline	mg/L	ND	ND	ND	0.04 J	ND	0.03 J	ND	ND
Thallium	ug/L	ND	ND	ND	ND	ND	ND	ND	**5.5**

Well MW09A	Sample ID:	LK246	LK319	LK351	LK374	LK405	LK437	LK491	LK508
	Sample Date:	11/27/2002	3/26/2003	11/12/2003	3/31/2004	6/30/2004	10/5/2004	2/24/2005	4/26/2005
PHC as gasoline	mg/L	ND	ND	0.02 J	0.03 J	ND	0.03 J	ND	ND
Antimony	ug/L	ND	ND	ND	ND	ND	**9**	ND	ND

Well MW09B	Sample ID:	LK249	LK320	LK354	LK375	LK406	LK438	LK493	LK509
	Sample Date:	11/27/2002	3/26/2003	11/13/2003	3/31/2004	6/30/2004	10/5/2004	2/25/2005	4/26/2005
PHC as gasoline	mg/L	ND	ND	0.02 J	0.02 J	ND	ND	ND	ND

Well MW01	Sample ID:	20242-987	20242-1123	LK256	LK332/LK333	LK362/LK363	LK391/LK393	LK419/LK421	LK454/LK455	LK484/LK485	LK524/LK525
	Sample Date:	11/02/95	04/19/96	12/3/2002	4/1/2003	11/18/2003	4/6/2004	7/6/2004	10/7/2004	2/23/2005	4/28/2005
MTBE	ug/L	2.6J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diethylphthalate	ug/L	NA	NA	2J	ND	ND	ND	ND	ND	ND	ND
PHC as gasoline	mg/L	**ND**	ND	ND	ND	0.03 J	ND	0.03 J	0.05 J	ND	ND
Manganese	mg/L	**80.2**	ND	19.6	7.5	ND	ND	ND	4.8	1.4 J	ND
Nickel	mg/L	ND	ND	**105**	55.3 J	7.1	29.1	ND	21.7	7.5	4.5
Total Uranium	pCi/L	NA	**38.4**	NA	NA	NA	NA	NA	NA	NA	ND
Gross Alpha	pCi/L	**34.6**	**27.6**	NA	NA	NA	NA	NA	NA	NA	ND

LEGEND

- MINOR SURFACE ELEVATION: 2-FOOT INTERVALS
- 460 — MAJOR SURFACE ELEVATION: 10-FOOT INTERVALS
- MCAS EL TORO BOUNDARY
- EXISTING STREAM OR WASH
- PREVIOUSLY ESTIMATED EXTENT OF WASTE PLACEMENT BEFORE RSE INVESTIGATION (EARTH TECH 2001)
- REVISED EXTENT OF WASTE PLACEMENT BASED ON TRENCHING ACTIVITY (MARCH 2000 AND OCTOBER 2002)
- MW06 — RSE GROUNDWATER MONITORING WELL LOCATION
- MW4 — EXISTING GROUNDWATER MONITORING WELL LOCATION
- NA — NOT ANALYZED
- U — ANALYTE WAS NOT DETECTED AT OR ABOVE THE STATED LIMIT
- ND — NON DETECTED
- MEK — 2-BUTANONE
- UJ — ANALYTE WAS NOT DETECTED AT OR ABOVE THE STATED LIMIT. THE SAMPLE DETECTION LIMIT IS AN ESTIMATED VALUE
- MIBK — 4-METHYL-2-PENTANONE
- GROUNDWATER GRADIENT DIRECTION - APRIL 2005

NOTES

1. TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHOD FROM AERIAL PHOTOGRAPHY DATED DECEMBER 2001 BY SAN-LO AERIAL SURVEYS.
2. COORDINATES ARE IN CALIFORNIA STATE PLANE COORDINATE SYSTEM, NAD 83, ZONE 6.
3. ELEVATIONS IN FEET; BENCHMARK BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
4. CONCENTRATIONS IN RED >MCL VALUES.

NORTH

60 0 60 120 FEET

SCALE: 1" = 120'

RI/FS Report — Draft Final

Detected Groundwater Sampling Results - All Sampling Events

Anomaly Area 3

Date: 04-08 | Former MCAS El Toro | Figure 6-11

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Table 6-27: Statistics of Detected Analytes – Groundwater Sampling – RSE Investigation Round 1 through Round 8 Sampling Events

Analytes	Number of Samples Analyzed [a]	Number of Detections	Minimum and Maximum Detected Concentrations (µg/L)	Highest concentration at GW Monitoring Well	Frequency of Detection (%)	Detections Above MCLs
PETROLEUM HYDROCARBONS						
Motor Oil (mg/L)	107	17	0.01 J - 0.37	AA3-MW02	16	—
Diesel Fuel (mg/L)	107	21	0.007 J - 1.3	AA3-MW02	20	—
Gasoline (mg/L)	107	24	0.02 J - 0.24	AA3-MW01	22	—
VOCs						
4-Methyl-2-Pentanone	107	3	0.3 J - 2J	AA3-MW02	3	—
Chloroform	107	2	0.61 - 0.95 J	AA3-MW06	2	—
2-Butanone (MEK)	107	1	1 J	AA3-MW08	1	—
Methylene Chloride	107	1	0.5 J	AA3-MW01	1	—
SVOCs						
4-Methylphenol	107	1	6 J	AA3-MW02	1	—
Acenaphthene	107	4	0.05 J -1.6	AA3-MW12	4	—
Anthracene	107	3	0.05 J - 0.09 J	AA3-MW12	3	—
Benzo(a)anthracene	107	1	0.04 J	AA3-MW08	1	—
Benzo(a)pyrene	107	1	0.46	AA3-MW08	1	1
Benzo(b)fluoranthene	107	1	0.6	AA3-MW08	1	—
Benzo(g,h,i)perylene	107	1	0.4 J	AA3-MW08	1	—
Bis(2-Ethylhexyl)Phthalate	107	2	2 J and 3 J	AA3-MW02	2	—
Bis(2-chloroethoxy)methane	107	2	Both 2 J	AA3-MW12	2	—
Butyl Benzyl Phthalate	107	1	0.7 J	AA3-MW04	1	—
Chrysene	107	1	0.04 J	AA3-MW08	1	—
Dibenz(a,h)anthracene	107	1	0.1 J	AA3-MW08	1	—
Diethyl Phthalate	107	2	Both 2 J	AA3-MW01; AA3-MW08	2	—
Fluoranthene	107	3	0.02 J - 0.09 J	AA3-MW01	3	—
Fluorene	107	1	0.1 J	AA3-MW12	1	—
Indeno(1,2,3-c,d)pyrene	107	1	0.4 J	AA3-MW08	1	—
Napthalene	107	3	0.03 J - 0.4 J	AA3-MW08	3	—
Phenanthrene	107	2	Both 0.05 J	AA3-MW12	2	—
Phenol	107	1	12	AA3-MW02	1	—
Pyrene	107	2	Both 0.06 J	AA3- MW01	2	—
METALS						
Aluminum	134	93	6 J - 1700	AA3-MW07	69	1
Antimony	134	21	2.4 - 11.7 J	AA3-MW12	16	5
Arsenic	134	62	1.7 J - 62.2	AA3-MW12	46	3
Barium	134	131	3.4 - 230	AA3-MW07	98	0
Cadmium	134	4	0.31 J - 1.7	AA3-MW02	3	0
Calcium	134	133	116 - 386,000 J	AA3-MW13	99	0
Cobalt	134	18	0.45 - 8.8 J	AA3-MW01	13	0
Copper	134	62	1.7 - 47.2	AA3-MW02	46	0
Chromium	134	101	0.78 - 296	AA3-MW02	75	4
Iron	134	111	10.7 J - 4950	AA3-MW12	83	0
Lead	134	29	0.84 J - 12.3 J	AA3-MW02	22	0
Magnesium	134	133	56.5 - 152,000	AA3-MW13	99	0
Manganese	134	114	0.7 - 2000	AA3-MW12	85	0
Mercury	134	124	0.013 - 1.4 J	AA3-MW02	93	0
Nickel	134	85	1 - 105	AA3-MW01	63	1
Potassium	134	133	1,930 - 31,000 J	AA3-MW12	99	0
Selenium	134	91	3.8 - 97.9	AA3-MW13	68	4
Silver	134	36	0.4 - 53.8	AA3-MW02	27	0
Sodium	134	133	188,000- 593,000	AA3-MW12	99	0
Thallium	134	14	1.6 J - 7.8	AA3-MW02	10	5
Vanadium	134	113	1.6 - 57.5	AA3-MW04	84	0
Zinc	134	97	1.2 J - 209	AA3-MW10	72	0
Miscellaneous						
Chromium, hexavalent	17	8	0.23 J - 14	AA3-MW13	47	0

Notes:

[a] Number of samples analyzed for the specified analyte, including duplicates, if any.

For metals, the number of samples analyzed also includes samples analyzed for dissoved metals analysis.

% = percent
µg/L = micrograms per liter
GW = groundwater
J = indicates an estimated value.
MCL = maximum contaminant level
mg/L = milligram per liter
SVOCs = semivolatile organic compounds
VOCs = volatile organic compounds

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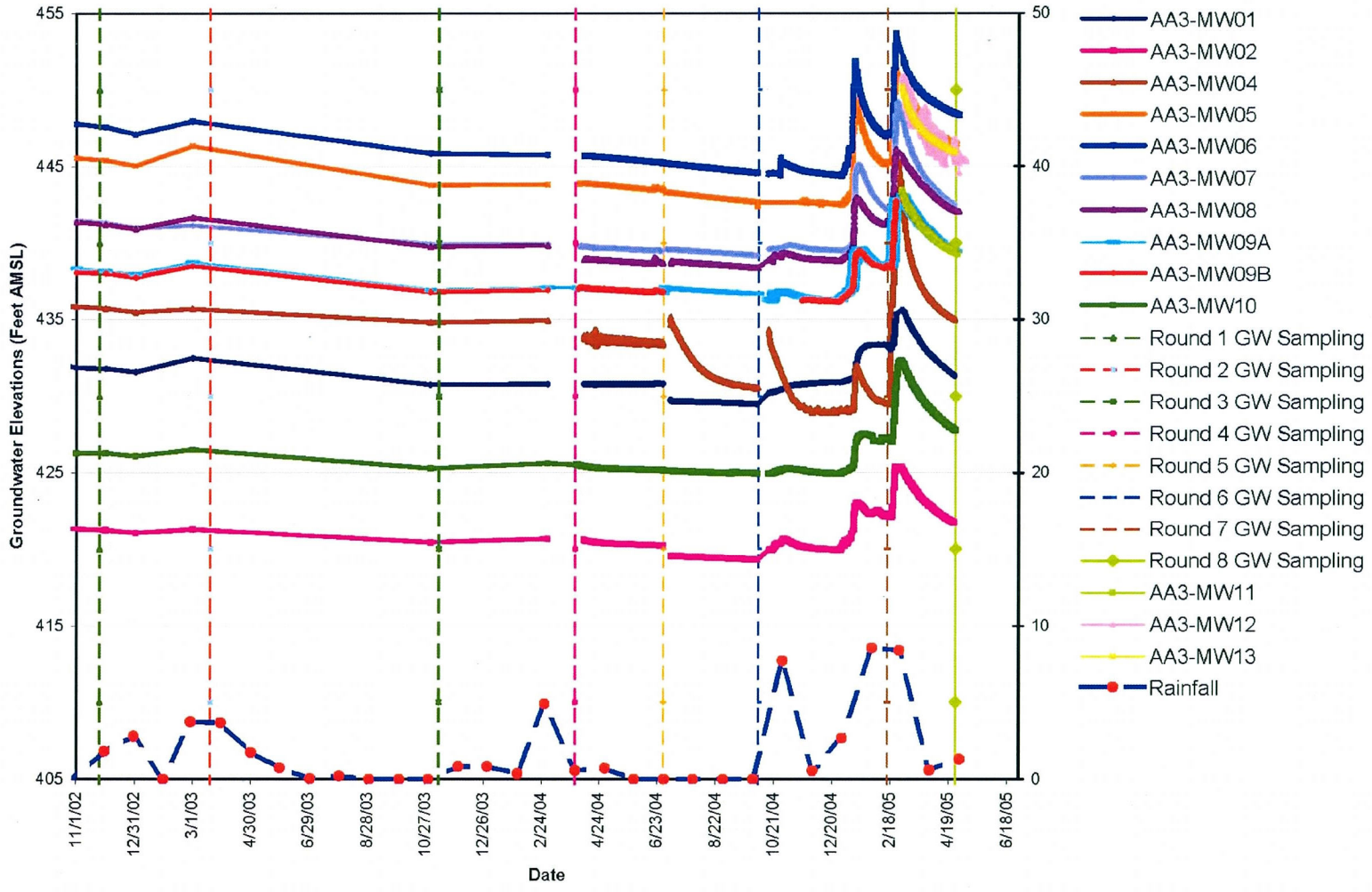

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Anomaly Area 3		
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(4 detections above its MCL); nickel (1 detection above its MCL); selenium (4 detections above its MCL); and, thallium (5 detections above its MCL). Groundwater samples from Wells MW11, MW12, and MW14 (installed within the waste) showed low concentrations of petroleum hydrocarbons (see Table 6-26). Very low detections of SVOCs (PAHs) at Well MW12 were likely attributable to asphalt placed within the AA 3 waste placement area.

As presented above, data collected indicates very low concentrations of CERCLA contaminants within and in the vicinity of AA 3. A review of the data indicates no clear trends can be established based on comparing individual well concentration trends or the spatial distribution of the detected constituents.

6.5.12 Statistical Evaluation of Groundwater Data

Further evaluation of groundwater data using statistical evaluation methods specified in landfill regulations was performed. One of the specified methods compares data from upgradient locations from a waste management unit with point of compliance wells at downgradient locations. Data collected at AA 3 was evaluated using DUMPSTAT, a statistical groundwater monitoring analyses system that is consistent with the EPA Subtitle C and D, all EPA guidance, and ASTM D6312-98 guidance. Two statistical evaluations were performed. The initial evaluation was presented in the Draft RI/FS and is summarized in section 6.5.12.1. The second statistical evaluation was performed subsequent to receipt of regulatory comments on the Draft RI/FS. In response to regulatory comments an additional round (Round 9) of groundwater monitoring was performed. This second statistical evaluation using DUMPSTAT incorporated the data collected from Round 9 as well as incorporating a station-wide data set. The results of this supplemental monitoring and statistical evaluation were presented in the Draft Technical Memorandum, Anomaly Area 3 Supplemental Groundwater Monitoring (Earth Tech (2007) and are summarized in section 6.5.12.2.

6.5.12.1 INITIAL STATISTICAL EVALUATION

DUMPSTAT performs upgradient and downgradient well comparison to determine whether there is a statistically significant evidence of release and provides results in both graphical and tabular formats showing intermediate calculations. DUMPSTAT also:

- Establishes a prediction interval that is constructed from the data on background wells.
- Uses the prediction interval to evaluate one or more future observations from the same population with a specified confidence.
- Compares concentrations detected in compliance wells with a prediction interval.
- Identifies compliance well concentrations that do not fall within the prediction interval, thereby indicating a statistically significant evidence of release.

Using the point of compliance concept in DUMPSTAT for evaluating whether releases at AA3 have occurred, the following upgradient (background) compliance wells were selected MW03, MW06, and MW13. Downgradient point of compliance wells selected included MW01, MW02, MW04 and MW10. This initial evaluation did not incorporate Station-wide data into the upgradient/background data set.

The DUMPSTAT statistical evaluation concluded that there were no indications of releases for VOCs, SVOCs and/or TPH constituents. For metals, the evaluation concluded there was a statistically significant difference between upgradient and downgradient data for the following seven metals: arsenic, copper, manganese, mercury, nickel, potassium, and sodium. Tables 6-28, 6-29 and 6-30 present summary statistics for these metals from the upgradient and downgradient wells and for data compiled for a Station-wide metals evaluation and presented in the *Draft Technical Memorandum – Evaluation of Metal Concentrations in Groundwater* (BNI 1999). As the summary data indicate, a statistically significant difference between the upgradient and downgradient point of compliance wells was noted. However, upon further review, the downgradient/point of compliance data set (Table 6-29) is consistent with the Station-wide data set (Table 6-30) indicating that the downgradient point of compliance wells may not be statistically different from Station-wide background. To confirm that metals detected in the point of compliance wells are not representative of a release, the Station-wide data set for the metals will be used in an updated DUMPSTAT evaluation to establish more representative background concentrations.

In summary, even though there is a complete groundwater pathway for contaminant migration due to the close proximity of groundwater to the waste, this initial DUMPSTAT statistical evaluation concluded that there were no indications of releases for VOCs, SVOCs and/or TPH constituents at the point of compliance. Data from all wells (at the periphery of and within wastes remaining at the site) show a low frequency of detection, with no clear trends noted in the spatial distribution of groundwater constituents. In addition, the statistical evaluation of the metals in groundwater shows no conclusive evidence of a release at the point of compliance.

Table 6-28: Background (Upgradient) Well Statistics –Anomaly Area 3

Metal	Total Number of Samples Analyzed	Number of Detections	Frequency of Detection (%)	Range of Detected Concentrations (µg/L)	Highest Concentration at Upgradient GW Monitoring Well
Arsenic	13	3	23	2.4 – 5.5	AA3-MW06
Copper	13	6	46	2 - 17.7	AA3-MW06
Manganese	13	12	92	0.88 J – 284	AA3-MW06
Mercury	13	12	92	0.035 J – 0.43	AA3-MW13
Nickel	13	5	38	2.4 – 14.2	AA3-MW03
Potassium	13	13	100	3060 J – 12000	AA3-MW13
Sodium	13	13	100	188000 J - 441000	AA3-MW13

Note:
1. Monitoring wells considered as background (upgradient) wells in DUMPSTAT evaluation are: MW03, MW06, and MW13.
2. Concentrations reported here are from RSE Investigation Round 1 (Dec 2002) through Round 8 (Apr 2005) Sampling Events.

% = percent
µg/L = micrograms per liter
J = indicates an estimated value
GW = groundwater
RSE = removal site evaluation

Table 6-29: Point of Compliance (Downgradient) Well Statistics – Anomaly Area 3

Metal	Total Number of Samples Analyzed	Number of Detections	Frequency of Detection (%)	Range of Detected Concentrations (µg/L)	Highest Concentration at Downgradient GW Monitoring Well
Arsenic	33	15	44	1.7 J – 26	AA3-MW04
Copper	33	21	64	3.1 J – 47.2	AA3-MW02
Manganese	33	26	79	1.4 J – 829	AA3-MW02
Mercury	33	29	88	0.02 J – 1.4 J	AA3-MW02
Nickel	33	23	70	1.2 J – 105	AA3-MW01
Potassium	33	32	97	2270 – 15300	AA3-MW02
Sodium	33	33	100	348000 – 507000	AA3-MW10

Notes:
1. Monitoring wells considered along the point of compliance surface (downgradient) wells in DUMPSTAT statistical evaluation are: MW01, MW02, MW04, and MW13.
2. Concentrations reported here are from RSE Investigation Round 1 (Dec 2002) through Round 8 (Apr 2005) Sampling Events.
3. Metals chosen are the ones that DUMPSTAT evaluation showed a statistically significant difference.

% = percent
µg/L = micrograms per liter
J = indicates an estimated value
GW = groundwater

Table 6-30: Summary of Selected Metal Concentrations in Groundwater - Station-wide MCAS El Toro

Metal	Total Number of Samples Analyzed	Number of Detections	Frequency of Detection (%)	Range of Reported Concentrations (ug/L)
Arsenic	1247	496	40%	0.6 - 122
Copper	1267	544	43%	0.5 - 177
Manganese	1343	1132	84%	0.2 - 2300
Mercury	1243	48	4%	0.8 - 1.3
Nickel	1019	665	65%	1 - 7180

Note:
1. Reproduced from Appendix F of the Draft Final CERCLA Groundwater Monitoring Plan (BNI 1999) presented the Draft Technical Memorandum – Evaluation of Metal Concentrations in Groundwater (BNI 1999). This table is a subset of the original table presented in the report.

% = percent
µg/L = micrograms per liter
MCAS = Marine Corps Air Station

6.5.12.2 SUPPLEMENTAL GROUNDWATER MONITORING AND STATISTICAL EVALUATION

Based on regulatory agency comments regarding the adequacy of the groundwater characterization, a supplemental monitoring event was conducted. The supplemental monitoring was conducted in accordance with Sampling and Analysis Plan (SAP) Addendum # 1 (Earth Tech 2007a). In addition to collecting general minerals in groundwater, consistent with the recommendations from the initial statistical evaluation, the SAP Addendum #1 proposed the incorporation of groundwater data from selected stationwide groundwater monitoring wells into the dataset for the statistical evaluation. The regulatory agencies concurred with SAP Addendum #1 and a ninth round of groundwater sampling was conducted in February 2007.

Data from the February 2007, the previous eight monitoring events and from the selected stationwide monitoring well results were incorporated into the statistical evaluation. The following statistical evaluations were performed.

- Inter-well evaluation comparing data from upgradient wells with downgradient well data at AA 3
- Inter-well evaluation comparing data from AA3 upgradient wells with data from the stationwide dataset.
- Inter-well evaluation comparing data from upgradient wells with downgradient well data at AA 3
- Intra-well evaluation to identify data trends from monitoring wells AA 3 MW04 and AA 3 MW10

The results of the supplemental groundwater monitoring and statistical evaluation were documented in a *Draft Technical Memorandum, Anomaly Anomaly 3 Supplemental Groundwater Monitoring* (Earth Tech 2007b). This document was submitted to regulatory agencies in July 2007, the report concluded that the groundwater data collected during the Round 9 was consistent with previous monitoring rounds. In addition, the statistical evaluation concluded that debris place at AA 3 was not impacting groundwater at the point-of-compliance wells. This finding was consistent with previous conclusions that there was no statistically significant of groundwater at the point of compliance wells and that the existing soil cover at AA 3 has effectively controlled the amount of infiltration into the landfill and is protective of groundwater quality. The report recommended no additional assessment was required and that a groundwater specific response action was not required. Lastly the report recommended the findings be incorporated into the Draft Final RI/FS.

Regulatory agencies reviewed the draft technical memorandum and concurred with the report conclusions and recommendations. No changes to the draft technical memorandum were required, therefore, the draft became final in January 2008. A copy of the final technical memorandum is provided in Appendix M.

6.6 SEDIMENT

Sediment sampling was proposed at AA 3 in response to Decision Question #4 and in accordance to Decision Rule #5 of the RSE investigation. Four sediment samples were collected from the upstream and downstream locations to assess the impact of debris on the sediment of the Agua Chinon Wash.

Four sediment samples (at upstream, mid, and downstream locations) were collected on 23 February 2003 (Appendix B). Any impact to the Agua Chinon Wash sediments was determined by comparing the upstream sediment analyte concentrations with the downstream analyte concentrations, as well as by comparing the sediment analyte concentrations with the analyte concentrations detected from surface soil samples collected from within the debris placement boundaries. A complete data set for the sediment samples is presented in Appendix B.

Table 6-31 presents the detected results of the sediment samples. Sediment sampling locations are presented on Figure 4-1.

Out of the complete suite of analyses, only two metals, arsenic (three samples out of four) and vanadium (all four samples) exceeded the residential PRGs; however, the detected concentrations were within the background soil concentrations. Of the organics only motor oil was detected in one of the four samples collected and analyzed in the laboratory (at a low concentration of 20 mg/kg). The highest concentration of arsenic, vanadium, and motor oils was detected from the upstream Sediment Sample SD1. Surface soil samples (see Section 6.4.1) did not have arsenic and vanadium

concentrations exceeding their respective residential PRG concentrations. Even though the surface soil collected from AA 3 had detected concentrations of motor oils, it is unlikely that AA 3 is the source, since the upstream sediment sample had the only detected motor oil concentration compared to the other samples, which were non-detect. Based on these results of the sediment sampling, AA 3 does not impact sediments of the Aqua Chinon Wash.

6.7 SURFACE WATER SAMPLING

Surface water sampling was proposed at AA 3 in response to Decision Question #4 and in accordance to Decision Rule #5 of the RSE investigation. Two surface water samples were collected from the upstream and downstream locations to assess the impact of debris on the surface water of the Agua Chinon Wash (Appendix B).

The proposed sampling locations for surface water runoff were designed to evaluate analyte concentrations in surface water at the upstream and at a downstream location within the Agua Chinon Wash. Samples were analyzed for the full suite of analyses (petroleum hydrocarbons, VOCs, SVOCs, metals, and perchlorate) similar to groundwater samples. These surface water sample results were evaluated based on comparison with the groundwater quality criteria. A complete data set is presented in Appendix B. Table 6-32 presents the detected results of the surface water samples. The sampling locations are presented on Figure 4-1.

Of the complete suite of analyses conducted on these surface water samples, only two metals, aluminum and chromium, were detected at concentrations exceeding their respective MCL concentrations. However, as can be noted in Table 6-32, the upstream and downstream concentrations of these constituents are closely similar, indicating that AA 3 does not impact surface water in the Agua Chinon Wash.

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Table 6-31: Summary of Detected Analytes – Sediment – RSE Investigation

Analyte	PRGs Residential	PRGs Industrial	Background (95 percentile)	Sample ID:	LK289	LK290	LK291	LK292
				Location ID:	AA 3-SD1	AA 3-SD2	AA 3-SD3	AA 3-SD4
				Sample Date:	2/23/2003	2/23/2003	2/23/2003	2/23/2003
				Sample Type:	Regular	Regular	Regular	Regular
Metals (EPA Method 6010B)				Units				
Aluminum	76,000	100,000	14,800	mg/kg	3,050	2,420	2,120	1,750
Arsenic	0.39	1.6	6.86	mg/kg	**1.8**	**1.4**	0.94UJ	**1.4**
Barium	5,400	67,000	173	mg/kg	85.7	39.6	25.6	110
Cadmium	1.7	7.4	2.35	mg/kg	0.26	0.17UJ	0.16UJ	0.23
Calcium	—	—	46,000	mg/kg	4,570	3250	2,620	3,020
Chromium	211	448	26.9	mg/kg	4.4	2.8	2.7	2.5
Cobalt	903	1,921	6.98	mg/kg	2	1.6	1.2	1.4
Copper	3,129	40,877	10.5	mg/kg	2.5	1.8	1.5	1.3
Iron	23,463	100,000	18,400	mg/kg	5,050	3,830	2,700	2,890
Lead	150	750	15.1	mg/kg	1.9	1.2	1	1.5
Magnesium	—	—	8,370	mg/kg	1,610	1,330	1,030	898
Manganese	1,762	19,458	291	mg/kg	120	82.8	54.6	130
Mercury (EPA Method 7471A)	23.5	307	0.22	mg/kg	0.24U	0.22U	0.22U	0.006
Nickel	1,564	20,439	15.3	mg/kg	2.8	1.8	2.1	1.6
Potassium	—	—	4,890	mg/kg	821	699	418	422
Selenium	391	5,110	0.32	mg/kg	0.36U	0.34U	0.33U	0.17
Sodium	76,000	100,000	14,800	mg/kg	120U	23.1	47.7	110U
Vanadium	0.39	1.6	71.8	mg/kg	**13.9**	**9.4**	**7.5**	**7.9**
Zinc	5,400	67,000	173	mg/kg	13.5	9.9	7.6	7.3
Petroleum Hydrocarbons (EPA Method 8015B DRO)								
Motor Oils	—	—	—	mg/kg	20	11U	11U	11U

Notes:
For metals, values in **bold** indicate that the particular analyte has concentrations exceeding both the residential and industrial PRGs; however, their values are below the former MCAS El Toro background concentrations (BNI 1996).
AA3 = anomaly area 3
EPA = Environmental Protection Agency
ID = identification

J = indicates an estimated value.
MCAS = Marine Corps Air Station
mg/kg = milligrams per kilogram
PRG = preliminary remediation goal
RSE = removal site evaluation
U = indicates the analyte was not detected at or above the stated limit.
UJ = indicates the analyte was not detected at or above the stated limit. The sample detection limit is an estimated value.

Table 6-32: Summary of Detected Analytes – Surface Water – RSE Investigation

Analyte	Regulatory Threshold Concentrations (µg/L)	Sample ID:	LK286	LK287
		Location ID:	AA 3-UGSW	AA 3-DGSW
		Sample Date:	2/25/2003	2/25/2003
		Sample Type:	Regular	Regular
Metals (EPA Method 6010B)		Units		
Aluminum	1,000 [b]	µg/L	**87,500**	**86,400**
Arsenic	50 [b]	µg/L	33.8	34.2
Barium	1,000 [b]	µg/L	867	871
Beryllium	4 [b]	µg/L	2.7	2.7
Cadmium	10 [b]	µg/L	6	6.4
Calcium	-	µg/L	109,000	115,000
Chromium	50 [b]	µg/L	**80.2**	**83.5**
Cobalt	-	µg/L	30.8	31.5
Iron	300 [c]	µg/L	70,300	71,900
Lead	15 [a]	µg/L	26.7	28.2
Magnesium	-	µg/L	49,300	50,400
Manganese	50 [c]	µg/L	1,070	1,070
Nickel	100 [b]	µg/L	75.5	78.5
Potassium	-	µg/L	18,000	19,300
Sodium	-	µg/L	79,700	79,000
Vanadium	-	µg/L	222	227
Zinc	5,000 [c]	µg/L	242	286

NOTES:
[a] Value represents the AL for the analyte.
[b] Value represents the stringent concentration of Federal and California MCLs.
[c] Value represents the secondary MCL.
- = Regulatory Threshold Concentrations not established for this particular analyte.
Values in **bold** indicate that the particular analyte had exceeded its MCL regulatory threshold limit.
µg/L = micrograms per liter
AA3 = anomaly area 3
AL = action level
EPA = Environmental Protection Agency
ID = identification
J = indicates an estimated value.
MCAS = Marine Corps Air Station
MCL = maximum contaminant level
mg/kg = milligrams per kilogram
PRG = preliminary remediation goal
RSE = removal site evaluation

7. FATE AND TRANSPORT

This section presents the fate and transport evaluation for AA 3. The contaminant fate and transport analysis is used to assess the physical and chemical changes that may occur to the contaminants and to analyze site-specific transport mechanisms that may act upon them. Estimates of future contaminant locations, concentrations, and the resulting exposure rates provide necessary input for a response action decision. This analysis will consider the fate and transport of potential sources of contamination that could be released to the environment, including contaminated wastes disposed at the site during the period of the operation and waste by-products generated within the site.

The fate and transport analysis presented in this section, in conjunction with the information and analyses presented in Section 6, address the following DQOs:

1. Are adequate data available to characterize if the existing soil cover is sufficient to either protect human health and environment, or if not, to serve as a foundation layer for a soil cover system?
2. Has the impact to groundwater, surface water, and sediments been adequately characterized, or are additional data required?
3. Is soil vapor being produced within the waste, and if yes, does it exceed threshold levels listed as decision inputs and require a waste placement gas collection system?
4. Does soil vapor migrate from the site to impact adjacent property?
5. Has the nature of the waste present been adequately characterized using soil vapor, soil, groundwater, surface water, and sediment data, or is further evaluation required to characterize risk and evaluate response actions?
6. Have potential human and ecological receptors been identified, and are they likely to be at risk for adverse health effects at this site?

The analyses presented in this section were used as a basis for the preparation of the human health risk assessments. The fate and transport analysis will also assist in the evaluation of potential response actions.

Section 7.1 presents the site conceptual model developed for AA 3. This model incorporates site-specific physical characteristics, COPCs, migration pathways, and intermedia transport mechanisms. The site conceptual model is used to identify pathways that pose the greatest potential impact to the environment.

Section 7.2 presents a discussion of the fate of COPCs at the site. Fate, in the context of this discussion, refers to the physical and chemical properties of each group of contaminants (e.g., VOCs, SVOCs, inorganics) that affect contaminant transport and persistence in the environment. The discussion of fate includes general characteristics for organic and inorganic compounds, as well as specific characteristics for actual COPCs identified at the site.

Section 7.3 presents a discussion of transport and intermedia transfer mechanisms.

7.1 CONCEPTUAL MODEL

This section summarizes the pertinent geologic/hydrologic, surface drainage, and climatic factors that influence the fate and transport of COPCs detected at AA 3. It also summarizes the COPCs

reported above the thresholds and their distribution in soil, soil gas, and groundwater. These summaries form the basis for a potential contaminant migration pathway discussion, which completes the conceptual model. The conceptual model is the starting point for the discussion of contaminant migration.

7.1.1 Physical Characteristics

Physical characteristics of AA 3 are discussed in detail in Section 6. The following subsections highlight those factors that have significant impact on fate and transport of contaminants.

7.1.1.1 Surface Water

The Agua Chinon Wash is adjacent to the site as shown on Figure 4-1. The Agua Chinon Wash in the vicinity of AA 3 is shallow in some areas and relatively deep in other areas. The Wash in the vicinity of the site is normally dry but may contain surface water flow as a result of infrequent storm runoff. During heavy rainfall, surface water flows through the Wash. If the surface water flows in the Wash are substantial then there is a potential for stream bank erosion adjacent to the waste placement area. Thus, surface water flow is a potential transport mechanism for wastes as well as any contaminant associated with these materials if erosion occurs.

7.1.1.2 Geology/Hydrogeology

Surface deposits in the vicinity of the site are predominantly young alluvial fan deposits of Holocene/late Pliestocene Age, consisting primarily of unconsolidated gravels, sand, and silt. Surface deposits to the immediate north of the site consist of interbedded marine sandstone, conglomerate sandstone, and siltstone from the Niguel Formation of Pliocene Age. Most of the surface is covered with vegetation and loose soil, but bedrock crops out near the summit on the south side of a hill adjacent to the site. This bedrock is identified as the Niguel Formation, consisting of interbedded marine sandstone, conglomeratic sandstone, and conglomerate of Pliocene Age. The strata strike and dip in the vicinity of the Site are N5E and 22NW, respectively. The bedrock appears indurated and competent, although highly weathered at the surface. Fractures were not observed.

The Niguel Formation is underlain by the Monterey Formation, consisting of marine siltstone and sandstone of Miocene Age. The Niguel Formation has a maximum thickness of 350 feet. Deposits to the southwest of the site, across the Agua Chinon Wash, consist of very old alluvial fan deposits of Mid- to Early-Pleistocene Age. The lithology is sandy, well indurated, and well dissected by erosion.

However, a housing tract is currently located at that location and no outcrop was readily visible. A local geologic map (see Figure 5-1) was created using the U.S. Geographical Survey digital geologic map database of the Santa Ana 30° by 60° quadrangle as the map source for former MCAS El Toro region showing the geologic formations, contact, fault, strike and dip information in standard notation. The topography in the immediate vicinity of AA 3 has a relief of 400 feet to 600 feet above msl generally dipping to the south and southwest. The site is located at an elevation of approximately 460 feet above msl.

The April 2005 depth to water readings in Wells MW01, MW02, and MW04 through MW14, ranged from 26.56 feet below the TOC in Well MW01 to 40.58 feet below the TOC in Well MW02. Groundwater elevations were calculated based on well casing elevations and ranged from 423.16 feet above msl in Well MW02 to 447.84 feet above msl in Well MW06 (April 2005 gauging event). Figure 5-6 shows the groundwater elevation contours from April 2005 gauging event and its corresponding flow direction.

The hydrostatic equipotential gradient for the April 2005 event (see Figure 5-6) indicates a more or less westerly flow direction in two regimes. A gradient of 0.01 was calculated between the eastern parts of the study area to the vicinity of Well MW11. The groundwater gradient steepens to 0.06 from Wells MW11 to MW02 but essentially maintains a westerly flow direction. The wash empties into the Irvine Management Zone (IMZ) just beyond (west of) Well MW02. The increase in hydraulic gradient is probably associated with flow over the Basin Boundary Fault, which defines the northern limit of the IMZ in this part of the basin.

At IRP Site 3, the water level elevation in well 03DGMW64A was 195.33 feet above MSL during March 2005, a drop of over 200 feet in elevation across (west of) this fault. Similarly at IRP Site 2, the water level elevation in well 02NEW02 (east of the fault), was 432.23 feet above MSL in March 2005, with much lower water level elevations in wells 02NEW07 (366.92) and 05DGM67A (263.23) located west of the fault (CDM 2005).

7.1.1.3 Climate

The local climate is characterized as temperate semiarid. Yearly rainfall averages 10 inches to 12 inches. Atmospheric humidity is usually low. Consistent light-to-moderate coastal onshore winds preclude stagnant air conditions over the area. These conditions result in minimal net infiltration during precipitation events as the result of rapid runoff and high evapotranspiration rates.

7.1.1.4 Biota

Refer to Section 5.5 for details regarding the botanical, wildlife and, wetlands and waters of the U.S. evaluation for the site. The site is covered with biota that have root systems that stabilize the soil covering the waste, thereby preventing erosion.

7.1.2 Distribution of Contaminants

A detailed discussion of the nature and extent of contamination was presented in Section 6. The following summary is presented for completeness of the conceptual model.

7.1.2.1 Summary of Air Sampling Results

The results presented in Tables 6-2 and 6-3 for ambient air samples indicate that both the upwind and downwind locations had similar detections and range of concentrations. This indicates that the site does not currently alter air quality.

Integrated air sampling results presented in Tables 6-4 and 6-5 indicate that with the exception of low levels of 2-propanol (6 ppbv), benzene (3.7 to 43 ppbv), and m,p-xylene (1.5 to 2.7 ppbv), the same detected constituents of integrated air samples were also detected in ambient air samples, including methane.

The integrated air sample results are relatively consistent with the ambient (background) air samples. And a comparison of the integrated air sampling data published by the CARB for State-wide landfills indicated that benzene, methylene chloride, and methane exceeded the median concentrations in 100 percent, 78 percent, and 63 percent of the integrated air samples analyzed, respectively; detected chemicals did not exceed the CARB maximum concentrations.

7.1.2.2 Summary of Subsurface Soil Gas Sampling Results – Shallow, Subsurface and Perimeter

None of the 33 shallow soil gas samples collected from within the debris placement boundary, as part of the soil gas survey, had detected concentrations of 51 VOC analytes and methane. Similarly, none of the 43 subsurface soil gas samples (also collected from within the debris placement boundary as part of the soil gas survey) had any detection of 51 VOC analytes. Field screening results for the subsurface soil gas samples showed non-detect methane concentrations at 25 of 33 sampling locations, with detected concentrations (at 8 locations) ranging from 6,000 ppm_v to 230,000 ppm_v (Table 6-7). The 8 locations with detectable methane concentrations were confined to the central portion of the site. Methane, exceeding the Title 27 CCR stipulated threshold for methane of 50,000 ppm_v, was not detected in any of the perimeter soil gas wells during sampling (Tables 6-9 through 6-12 and field screening results from Tables 6-13 through 6-19). The detection of several VOCs in the perimeter soil vapor wells was inconsistent with the non-detect VOC results in all of the shallow and subsurface soil gas samples collected from within the debris placement boundary.

These results support the initial premise that only construction-related debris was placed at AA 3. The results indicate that subsurface methane occurs at depths deeper than 5 feet and is confined to the central portion of the debris placement boundary, and is not migrating. There were no VOCs detected in samples collected from the 76 soil gas sampling locations within the debris placement area; therefore, the site is not the source of low level detections in the perimeter soil gas wells.

7.1.2.3 Summary of Soil Sampling Results – Surface and Subsurface

The results of two trenching activities (pre-RSE and RSE investigations) and subsurface exploration during the soil gas survey confirmed that there is an average of 4.5 feet of soil cover with isolated areas having 2 feet of soil cover over the construction debris. The purpose of the surface soil sampling was to quantify the risk due to chemical contamination in surface soil (existing soil cover) to human and ecological receptors at the site. The purpose of subsurface soil sampling was to help adequately characterize the nature of the debris and evaluate the risk of adverse human health and ecological effects at this site.

In surface soils (0-foot to 1-foot bgs), VOCs were not detected in any of the surface soil samples (37 samples at 33 locations). Petroleum hydrocarbons were detected at very low concentrations ranging from 0.02 J mg/kg to 160 mg/kg. Only 5 SVOCs (benzo[a]anthracene, benzo(b)-fluoranthene, benzo[k]fluoranthene, B[a]P and dibenz[a,h]anthracene) at only 1 location (HA15) out of 33 surface soil sampling locations exceeded residential PRGs. 2,3,7,8-TCDD exceeded its residential PRG at only 1 out of 9 surface soil sampling locations (HA26) analyzed for dioxins and furans. All metals that were analyzed were either less than PRGs or within the background concentrations at all 33 surface soil sampling locations. It can be concluded that metals are detected in the surface soils at a frequency that reflects their natural variation in the soils. For surface soil results, refer to Tables 6-20, 6-21, and 6-22.

In subsurface soil samples, with the exception of common laboratory contaminants such as acetone, 2-butanone and methylene chloride, the frequency of detection of the VOCs and SVOCs is less than 4 percent and 8 percent, respectively. None of the detected VOCs exceeded residential or industrial PRGs. Only 1 SVOC (B[a]P) in only 1 sample (20242-1111) out of 24 samples exceeded its residential PRG. Asbestos and perchlorate were not detected in any of the subsurface soil samples. Of 24 samples analyzed, only 19 samples had detected concentrations of diesel range petroleum hydrocarbons. Of these 19 detections, only 2 had concentrations of 1,100 mg/kg and 5,600 mg/kg; all others ranged from 12 mg/kg to 370 mg/kg. The maximum concentrations of all the metals that were

detected above background levels and residential PRGs (antimony, arsenic, cadmium, lead, and molybdenum) and the maximum number of metals that exceeded the background are reported from one sample (20242-1096) collected from Trench 1E at 16 feet bgs. Thallium was detected in this subsurface soil sample at a concentration of 3.4 mg/kg and this concentration exceeds the background value of 0.42 mg/kg. However, the soil sample collected at 22 feet bgs from the same trench (20242-1099) did not report metals at a concentration exceeding their respective PRGs (with the exception of arsenic whose concentration was within the background concentration but exceeded the PRG value). Only 2 in 24 samples for arsenic and only 1 in 24 samples for antimony, cadmium, lead, and molybdenum exceeded both background concentrations and PRGs. For subsurface soil results, refer to Tables 6-23 and 6-24.

Analytical results indicate that with the exception of a few analytes the frequency of detection and distribution of metals within the waste placement areas is consistent with ambient/background variations. In addition, characterization of the near-surface soil does not show that significant levels of contamination exist. These data, coupled with the human health and ecological risk assessments, can be used to develop a response action that is protective of human and ecological receptors.

7.1.2.4 Summary of Groundwater Sampling Results

Figures 5-8, 5-9, 5-10, and 5-11 present the cross sections showing the width and depth of debris placement at the site. The water level gauging from February 2005, considered to be a historic high for the most recent gauging events, is also shown on these cross sections. In these cross sections, the groundwater surface appears to be above or within close proximity to the pre-waste placement topographical elevation, which indicates that the groundwater is in contact with the debris placed at the site.

Figure 6-11 presents the results of November 1999 through April 2005 groundwater sampling events. Summary statistics on the groundwater sampling results are presented in Table 6-27. Figure 6-12 presents groundwater hydrographs for AA 3 groundwater monitoring wells and also includes the area rainfall data. Figure 6-12 also shows the groundwater sampling events for the time period of the hydrograph.

Out of 107 groundwater samples collected and analyzed the following VOCs were detected: MTBE (2 detections in 1999 at 1 well [including a duplicate] had concentrations less than it's MCL); chloroform (1 detection less than it's MCL); MIBK (3 detections less than it's MCL); MEK (1 detection less than it's MCL); and methylene chloride (1 detection less than it's MCL).

Out of 107 groundwater samples the following SVOCs, were detected once at concentrations below their MCL values: m/p-cresol, 4-methylphenol, benzo[a]anthracene, benzo[b]fluoranthene, benzo[g,h,i]-perylene, butyl benzyl phthalate, chrysene, dibenz[a,h]anthracene, fluorene, indeno[1,2,3-c,d]pyrene, and phenol. B[a]P was also detected only once, at 0.46 μg/L which exceeded the MCL value of 0.2 μg/L.

The following SVOCs were detected twice at concentrations below their MCL values: bis(2-chloroethoxy)-methane, bis(2-ethylhexyl)phthalate, diethylphthalate, phenanthrene, and pyrene. Fluoranthene, acenaphthene, and anthracene were also detected five, four, and three times, respectively, at concentrations below their MCL values.

Out of 107 groundwater samples analyzed for motor oils, diesel fuel and gasoline petroleum hydrocarbons during Rounds 1 through 8, they were detected in 17, 21 and 24 samples, respectively.

From all sampling events and out of 134 groundwater samples analyzed for metals, the following metals that were detected above their MCL values include: aluminum (1 detection above it's MCL); antimony (5 detections above it's MCL); arsenic (3 detections above it's MCL); chromium (4 detections above its MCL); nickel (1 detection above it's MCL); selenium (4 detections above it's MCL); and thallium (5 detections above it's MCL).

The groundwater samples from Wells MW11, MW12, and MW14 (installed within the waste) showed low concentrations of petroleum hydrocarbons (see Table 6-26). Very low detections of SVOCs (PAHs) at Well MW12 were likely attributable to asphalt placed within the AA 3 waste placement area.

As presented above, data collected indicates very low concentrations of CERCLA contaminants within and in the vicinity of AA 3. A DUMPSTAT statistical evaluation was also performed as outlined in section 6.5.12 using upgradient background wells , downgradient compliance wells and selected stationwide monitoring wells. This evaluation concluded that there was no statistically significant indication that the point-of-compliance wells have been impacted by debris placement at AA3.

7.1.2.5 Summary of Sediment Sampling Results

Out of the complete suite of analysis, only two metals, arsenic (three samples out of four) and vanadium (all four samples) exceeded the residential PRGs; however, the detected concentrations were within the background concentrations (Table 6-31). Of the organics only motor oil was detected in one of the four samples at a low concentration of 20 mg/kg. The highest concentration of arsenic, vanadium, and motor oil was detected in the upstream Sediment Sample SD1. Based on the surface soil sampling results, it is unlikely that AA 3 is the source of the constituents detected in the upstream sediment sample.

7.1.2.6 Summary of Surface Water Sampling Results

Of the complete suite of analyses conducted on these surface water samples, only two metals, aluminum and chromium, were detected at concentrations exceeding their respective MCL concentrations. However, as shown in Table 6-32, the upstream and downstream concentrations of these constituents are consistent, indicating that AA 3 does not impact surface water in the Agua Chinon Wash.

7.2 Contaminant Persistence

Contaminant persistence refers to the propensity for contaminants to remain in place without chemical change. Persistence is a function of site-specific characteristics, and the physical and chemical properties of the contaminants. Such properties include solubility, tendency to transform or degrade (usually described by a half-life or an environmental half-life in a given medium), and chemical affinity for solids or organic matter (usually described by a partitioning coefficient).

In order to facilitate the discussion of contaminant persistence, detected compounds at AA 3 have been presented in Tables 6-2, 6-4, 6-8, 6-13, 6-20, 6-21, 6-23, 6-25, 6-26, 6-28, and 6-29. As described below, each chemical group has similar physicochemical properties that influence contaminant persistence or mobility in the environment.

7.2.1 Organics

The persistence or mobility of organic compounds is governed by their physicochemical properties and the transformation mechanisms that act on them.

7.2.1.1 PHYSICOCHEMICAL PARAMETERS

The solubility of a contaminant in water is a critical property since most transport via the water medium. Highly soluble substances can be rapidly leached from wastes and contaminated soils and are generally mobile in groundwater. Solubilities of organic chemicals generally range from less than 0.001 mg/L to greater than 100,000 mg/L.

Volatilization is the process whereby liquids and solids vaporize and escape to the atmosphere. Volatilization of a constituent is dependent upon its vapor pressure, water solubility (if present in water), and molecular weight. Vapor pressure is the tendency of the substance to evaporate (in other words, solubility of a contaminant in the gas phase at a given temperature). Vapor pressure typically ranges from $1x10^{-7}$ to 760 millimeters of Mercury (mm Hg) at 25 degree Celsius (^{0}C) for liquids, with the higher values indicating greater tendency to volatilize, or enter the gas phase.

Henry's law constant is based on the equilibrium relationship between the solubility of a gas in water and the partial pressure of the gas in the atmosphere above the water. Henry's law constant represents the transfer of a gas in liquid to the atmosphere and differs from volatilization, in which the chemical changes phase from liquid to gas. Henry's law constant is important if the contaminant exists as a gas in groundwater or surface water. The greater the value of Henry's law constant, the greater the tendency of the gas to be released into the air and transported in the atmosphere. The lower the constant, the greater the tendency of the gas to remain dissolved in the liquid phase and has the potential to be transported by groundwater.

Adsorption is one of several phenomena that affect the transport of contaminants through solid media. Cation exchange, absorption, precipitation, and complexation have an effect on the mobility of contaminants through soil matrix. In the case of organic compounds, the effect of adsorption is the most significant contributor to the retardation effects of the soil.

Generally, organics with higher solubilities (VOCs, SVOCs) tend to have greater volatility and lower adsorption potential; the lower-solubility organics (PAHs) have lower volatility and higher potential to remain adsorbed to the solid phase. There are no clear trends with respect to the origin and distribution of organic compounds at AA 3. Some of the physicochemical properties of selected organic compounds (PAHs and dioxins) are presented in Tables 7-1 and 7-2 below.

Table 7-1: Physicochemical Properties of Selected PAH compounds

PAH Molecular	Boiling Point (°C)	Vapor Pressure (kPa at 25°C)	Water Solubility (mol L^{-1})	Log K_{ow}
Naphthalene	218	1.04 x 10-2	2.48 x 10-4	3.36
Pyrene	393	6.0 x 10-7	6.68 x 10-7	4.88
Benzo[a]pyrene (B[a]P)	496	7.3 x 10-10	1.51 x 10-8	5.97
Indeno (1,2,3-cd) pyrene	525	1.3 x 10-11 (20°C)	7.25 x 10-10	7.44

NOTES:
PAH = polynuclear aromatic hydrocarbons
kPa = kilo pascal
°C = degree centigrade
mol L^{-1} = mole per liter

Log K_{ow} = logarithm of octanol-water partitioning coefficient

Table 7-2: Physicochemical Properties of Selected Dioxins and Furans

Dioxins and Furans	Melting Point (°C)	Solubility (25°C; ng/L)	Log K_{ow}	Vapor pressure (Pa)(solid)	H (25°C) ($Pa.m^3.mol^{-1}$)
2,3,7,8-TCDD	305-306	7.9-200	6.8	$9.8x10^{-8}$-4.5x10-6	1.63-10.34
2,3,7,8-TCDF	-	419 (23°C)	5.8	-	-
1,2,3,4,7,8-HCDD	275	4.4 (20°C)	7.8	$5.1x10^{-9}$	4.5
1,2,3,4,7,8-HCDF	-	8.2 (23°C)	-	-	-
1,2,3,4,6,7,8-HCDD	-	2.4 (20°C)	8	$8x10^{-10}$	0.13
OCDD	330	0.4 (20°C)	8.1	$1x10^{-10}$-$8.7x10^{-6}$	0.68
OCDF	-	1.2	11	-	-
2,3,4,7,8-PCDF	-	236 (23°C)	-	-	-
1,2,3,6,7,8-HCDF	-	18 (23°C)	-	-	-

NOTES:
°C = degree centigrade
Log K_{ow} = logarithm of octanol-water partitioning coefficient
ng/L = nanogram per liter
Pa = pascal
$Pa.m^3.mol^{-1}$ = Pascals cubic meter per mole

7.2.1.2 *Transformation Mechanisms*

The major transformations of organic chemicals occurring in the natural environment include biodegradation, hydrolysis, oxidation-reduction (redox), and photodecomposition.

Biodegradation involves the conversion of organic compounds to lower-energy forms as organisms utilize the compound for energy. Biodegradation can occur either aerobically (with oxygen as the electron acceptor) or anaerobically (another element/compound is used as the electron acceptor). Biodegradation is influenced by a number of factors such as availability of electron acceptors, pH, temperature, water content, organic carbon concentration, and biological factors (i.e., microbial species and population density). Methane in air over the waste placement area and degraded petroleum hydrocarbons in the soil are evidence that biodegradation is occurring in the waste placement area.

Hydrolysis reactions occur either biologically or chemically when a hydroxide ion dehalogenates an organic contaminant. Chemical hydrolysis reactions are a function of parameters such as pH, dissolved organic matter, and dissolved metal ions. These reactions generally occur at a much slower rate than biologic hydrolysis reactions.

Oxidation-reduction reactions involve the transfer of an electron donor to an electron acceptor, and may serve to mediate other reactions (e.g., biological) with contaminants that are present. Currently, the relative importance of redox reactions for organic compounds is not understood quantitatively.

Photodecomposition involves the oxidation of organic chemicals when sunlight, atmospheric oxygen, and photosensitizing agents are present. Typically, photo-oxidation occurs only in the upper 0.5 centimeter (cm) of the soil.

7.2.1.3 VOCs

The VOCs can volatilize and disperse to the atmosphere from shallow soil and surface water. However, at AA 3, VOCs were not detected in the surface soils and very low, random detection of a very few VOCs were observed in the subsurface soils and groundwater. Biodegradation can have significant impact in the degradation and destruction of VOCs in the natural environment, and is usually much more rapid than the abiotic processes. Natural attenuation of contamination can occur both in aerobic and anaerobic conditions. Certain naturally occurring microbial populations can consume many of the petroleum-based VOCs, breaking them down into carbon dioxide, methane, and water. Biodegradation is controlled by biologic population; availability of nutrients, oxygen, and water; redox potential (Eh)/pH of the environment; and temperature. The presence of methane in soil gas data indicates some biodegradable waste is present at AA 3.

7.2.1.4 SVOCs

Very few SVOCs were detected in surface, subsurface soil and groundwater; most of them were very low detections of PAHs compounds.

In the environment, PAHs are found adsorbed to particulate matter in the atmosphere. The two mechanisms by which they are transformed are ozone-induced oxidation and hydroxylation. A mixture of PAHs released in the water would be expected to sorb to particulate matter and dissolved organic matter. The degree of sorption depends on the mechanism, which is determined by the identity of the sorbate.

Volatilization, biodegradation, and adsorption to particulate matter and sediment are all processes, which affect the fate of naphthalene in the water compartment. When a petroleum product enters into the water column, the lighter hydrocarbons spread out along the surface of the water and then evaporate. The volatilization half-life of naphthalene is .4 hours to 3.2 hours. The naphthalene that does not evaporate sorbs to the particulate matter or is transformed into water/oil emulsion. Volatilization also plays an important role in the fate of naphthalene in the soil. Degradation through microbial activity also occurs but the extent is dependent upon the temperature, the soil type, and the presence of the proper organisms. The low molecular weight PAHs, like naphthalene are expected to volatize or biodegrade within 3 to 4 months.

B[a]P released to the atmosphere would likely be associated with particulate matter and may be subject to moderately long distance transport. The degree of transport depends on the particle size distribution and climactic conditions, which determines the rate of wet and dry deposition. B[a]P released to soil would absorb very strongly to the soil and would not leach to the groundwater. It would not hydrolyze, and evaporation from soils and surfaces may not be significant due to its higher molecular weight. B[a]P released to water, also would absorb very strongly to sediments and particular matter. It would not hydrolyze, but would be expected to bio-concentrate in aquatic organisms without metabolism. B[a]P would undergo significant photo-degradation near the surface of waters. Adsorption to sediments and particulates may significantly retard biodegradation, photo-degradation, and evaporation.

7.2.1.5 DIOXINS AND FURANS

Dioxins and furans are ubiquitous contaminants of food, water, air, soil, vegetation and commercial products. Concentrations of dioxins and furans from urban or industrialized sites are generally higher than those from rural or non-industrialized zones.

Fate in Air - More highly chlorinated dioxins and furans congeners (i.e., those with 6, 7 or 8 chlorines) are expected to exist largely associated with small particles in the atmosphere, and will have atmospheric lifetimes of roughly one week. Significant fractions of the more toxic tetra- and pentachloro dioxin congeners are expected to exist in both the vapor and particle phases in the atmosphere. Their atmospheric lifetimes are expected to be on the order of a few days to a week. Over such periods, dioxins and furans can be transported in the atmosphere over regional and continental scales.

Fate in Soil - Two of the 10 surface soil sample locations analyzed for dioxins and furans reported total 2,3,7,8-TCDD concentrations exceeding the PRG value. Dioxins and furans do not move readily through soil and sediments because they generally attach to the particles. Soils and sediments represent the most significant "sink" for dioxins and furans. Once dioxins, particularly 2,3,7,8-TCDD, enter the soil and sediments, they are very slow to degrade. 2,3,7,8-TCDD has a degradation half-life of 10 years or longer.

Fate in Water - Photolysis is the key transformation process affecting the persistence of dioxins and furans in water. The photolysis rates of dioxins and furans in natural water are enhanced by direct photosensitization or by indirect photoreactions of chemicals naturally occurring in water. Biological degradation of dioxins and furans is a slower process.

Bioaccumulation - The high water-octanol partition coefficients of dioxins and furans indicate a potential for considerable accumulation in biological tissues. The compounds which are substituted in the 2, 3, 7, 8 positions are not only accumulated but are also metabolized slowly and therefore persist in the body tissues for considerable lengths of time. Dioxins and furans enter crops largely from the air; they are not generally taken up by plants from soil or groundwater. Dry deposition of vapor-phase material may be the dominant mechanism by which they enter vegetation.

7.2.2 Metals

The common naturally occurring metals were detected in soil, sediments, groundwater, and surface water. As discussed in Section 6, none of the metals detected in the surface soil had concentrations exceeding their PRG values. In subsurface soil, the maximum concentrations of all the metals that were detected above background levels and residential PRGs (antimony, arsenic, cadmium, lead, and molybdenum), and the maximum number of metals that exceeded the background are reported from 1 sample (20242-1096) collected from Trench 1E at 16 feet bgs. Thallium was detected in this subsurface soil sample at a concentration of 3.4 mg/kg and this concentration exceeds the background value of 0.42 mg/kg. However, the 22 feet soil sample collected from the same trench (20242-1099) did not report metals at a concentration exceeding their respective PRGs (with exception of arsenic whose concentration was within the background concentration but exceeded the PRG value). Only 2 in 24 samples for arsenic and only 1 in 24 samples for antimony, cadmium, lead, and molybdenum exceeded both background concentrations and PRGs.

Out of 110 groundwater samples analyzed for metals from all sampling events, the only metals that were detected above their MCL values were aluminum (one detection above MCL), antimony (five detections above MCL), arsenic (three detections above MCL), chromium (four detections above its MCL), nickel (one detection above its MCL), selenium (four detections above its MCL) and thallium (five detections above its MCL).

There is no clear transport and concentration trends reported from the groundwater monitoring wells at the site. Some of the groundwater samples were analyzed for dissolved metal analysis. The dissolved metal results were consistent with their corresponding total metal concentrations.

Metals are naturally persistent in the environment. However, changes in chemical composition of the water may render metal contaminants insoluble (thereby reducing their transport from the site), or it may increase solubility and transport off-site.

Like organics, the transport of metals through the environment is strongly influenced by partitioning between soil and water. Metals may also react with soil or other solid surfaces by ion exchange, adsorption, precipitation, or complexation. Adsorption is a function of soil type, organic content, pH, oxidation-reduction potential, the concentration in water, and the presence of competing ions. The effect of these reactions on the mobility of the metal within the soil is referred to as the distribution coefficient. The greater the distribution coefficient, the more likely it is that the metal will remain adsorbed to soil and not be transported by water phase.

Precipitation and dissolution reactions are also important in determining the concentration of metals in solution. Dissolution of minerals is the prime factor in determining the chemical composition of natural waters. Anthropogenic contaminants entering the groundwater may alter the chemical equilibrium, and their own chemical (valence) state may be altered. Dissolved metal contaminants may then become supersaturated and precipitate out of solution, forming sediments. Factors influencing the solubility and possible transport of metals include turbidity, pH, Eh, temperature, total dissolved solids (TDS), and the presence of competing ions.

A possible mechanism to cause the migration of some of these metals is the dissolution of their oxides in soil. This typically occurs when microorganism biodegrading organics (SVOCs, PAHs, etc.,) use some of these heavy metal ions as electro acceptors, which causes them to dissolve. This in turn would release the heavy metals into solution.

7.2.3 Potential Routes of Contaminant Migration

Potential contaminant transport at AA 3 can happen through several routes or pathways. These potential migration pathways are shown schematically in Figure 7-1 and are summarized below. A better description of potential exposure pathways is presented in Section 8.4.3 (human receptors) and Section 9.2.5 (ecological receptors).

1. VOCs, methane and fugitive dust may potentially be transported off-site in air.
2. Waste debris contaminants may potentially leach into subsurface soil and, eventually, into groundwater.
3. Contaminants may potentially be transported off-site by groundwater.
4. Soil and waste debris may potentially be carried downstream off-site by surface water.

A conceptual site model was developed to show these routes of migration and is presented in the figures pertaining to Section 8.4.2 (human health) and 9.2.6 (ecological).

7.2.3.1 Migration in Air

Off-gassing of VOCs and methane and entrainment of fugitive dust are mechanisms by which waste area contaminants can be released to the atmosphere. In the case of off-gassing, the amount of soil gas constituents released depends on the extent of contamination in the area, proximity of contaminants to the surface, barometric pressure, vapor pressure of the contaminant, and in the case of methane the stage of biodegradation of the waste materials. Entrainment of contaminated dust in the air above the site and off-site is facilitated by exposed contaminated surface soil and moderate-

to-high winds across the waste surface. The amount of material that can be suspended depends on wind speed, soil moisture, particle size, and cover.

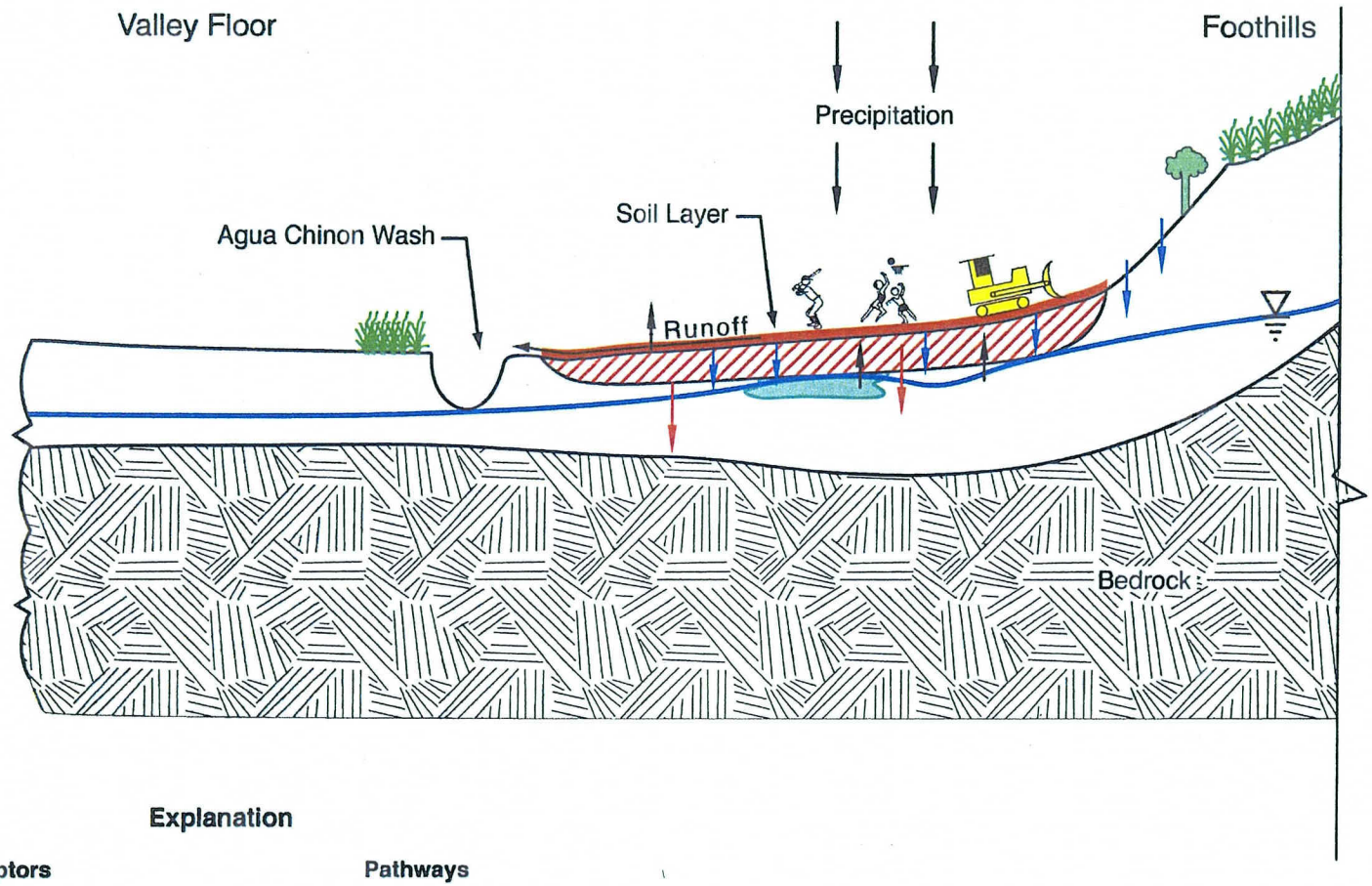
Shallow and subsurface soil and soil gas samples were collected and analyzed for metals, VOCs and fixed gases. None of the shallow and subsurface soil and soil gas samples had detected concentrations of VOCs. Metals in the soil were consistent with ambient levels. However, the field screening for methane indicated detected concentrations (in 12 samples at 8 locations) ranging from 6,000 ppm_v (HA26 and HA29) to 230,000 ppm_v (HA18) and non-detect methane concentrations at 25 of 33 sampling locations. Ambient air and integrated air samples were also collected from the surface of AA 3 to evaluate if the waste placed at the site is impacting the air quality. The air results indicated that the waste placed at the site is not impacting the air quality at the site. The integrated air sample results were relatively consistent with the background ambient air samples. And, none of the detected VOCs in the integrated air sample exceeded the maximum concentrations of the VOCs detected during the CARB Study (251 landfills Statewide).

The sampling results from the air samples (ambient and integrated samples) and shallow soil gas samples do not indicate that air transport is a significant transport pathway at the site. In addition, transport of metals via fugitive dust is not a significant transport pathway due to the existing groundcover that limits the amount of dust generated. In addition, metal concentrations are consistent with ambient/background levels. Therefore, any risk associated with metals in fugitive dust is not attributable to site activities.

7.2.3.2 Migration to Groundwater

Transport of contaminants from the waste material in the vadose zone to groundwater is facilitated by infiltrating rainwater percolating through the waste and potentially contaminated soil to the underlying aquifer. Generally, the major intermedia transfer mechanisms to the groundwater migration pathway are: (1) the leaching of contaminants from the soil matrix into the dissolved phase; (2) the percolation of the contaminated leachate to the underlying aquifer; and, (3) the suspension of particulates mobilized in the infiltrating water. The contaminant concentrations in leachate depend on the solubility of the contaminants, the soil texture, net infiltration volume and rate, and the concentration of contaminants in the waste materials. In the local climate, net infiltration volumes are low, transport mechanism could contribute to groundwater contamination as long as infiltration continues.

Figure 6-12 presents the groundwater hydrographs for the site. To-date, eight rounds of groundwater sampling have been conducted at the site as part of the RSE investigation (from December 2002 through April 2005). Few of these sampling events coincided with the heavy rainfall events which generally accelerates the intermedia transfer mechanisms.



Explanation

Receptors

- Workers
- Recreation Users
- Habitats
- Tree

Pathways

- Infiltration
- Groundwater
- Wastes
- Leaching
- Dissolved-Phase Contaminants

Not to Scale

RI/FS Report

Draft Final

Conceptual Site Model

Anomaly Area 3

Date 02/08	MCAS El Toro	Figure 7-1
Project No. 29307	EarthTech A tyco International Ltd. Company	

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In order to assess groundwater dynamics at AA 3, a detailed comparison of precipitation data was conducted with head data recorded within AA 3 during the winter of 2004-2005. Head data was collected from dedicated pressure transducers placed in AA 3 wells which provided a fairly good record with readings collected every two hours. Four wells, in two sets of two wells, were chosen to assess the way in which recharge is occurring at AA 3. The well pairs were MW06 and MW10, corresponding to either end of AA 3, and Wells MW05 and MW01, corresponding to roughly the same distance but within the alluvium only. Some data was not available for three of the four selected wells corresponding to the period of approximately 24 to 28 February 2005. Hourly precipitation data was obtained from the National Weather Service for the period spanning November 2004 through April 2005 (see Appendix B5).

During the selected period, two major precipitation events were used for the analysis. The first event began on 8 January 2005 and continued through 11 January 2005 peaking at 5:00 pm on 9 January 2005. The second event began on 18 February 2005 and continued through 24 February 2005, peaking at 3:00 pm on 28 February 2005.

For the first rain event, when precipitation peaked at 5:00pm on 9 January 2005, hydrographic data showed that MW06 (upgradient end of AA 3) reached its maximum head three days later with a rise of 6.7 feet in the aquifer surface gauged from 1 November 2004. For the same precipitation event, Monitoring Well MW10, located at the downgradient extent of AA 3, reached its maximum head 11 days after the precipitation maximum of 9 January 2005. The rise in MW10 was 2.3 feet above the reference head on 1 November 2004.

Significantly, Well MW06 reached maximum head from this precipitation event some eight days earlier than MW10 located at the downgradient end of AA 3, and achieved only 2.3 feet of head rise, some 4.5 feet less than Well MW06. Both factors, differential delay of eight days in aquifer response, and head differential of over 4 feet, strongly suggest that aquifer recharge takes place due to the much greater surface area of the total watershed feeding into the alluvial aquifer system as opposed to vertical percolation of the much less surface area of AA 3. If direct surface recharge from just the surface of AA 3 was the dominant mechanism it is unlikely that we would see either of the differentials that were seen during the precipitation events that are documented in detail in Appendix B5.

When compared, the results from groundwater samples collected after the heavy and normal rainfall events are relatively consistent (with the exception of SVOCs [PAHs]), and do not indicate that there is significant degradation of water quality after the rainfall events. Even though there are reportable, low detections of a few petroleum hydrocarbons, VOCs, and SVOCs, and metals that exceed the MCL values, the data does not conclusively indicate that the contaminants are leaching from the wastes at the site and are impacting the groundwater quality at the downgradient end of AA 3. The migration to groundwater does not seem to be a significant transport pathway at AA 3.

In addition to the major intermedia transfer mechanism, the submersion of waste materials in groundwater can also contribute contaminants to the groundwater transport pathway and such a condition exists at AA 3. The waste is in very close proximity to the groundwater at the site and in certain locations waste is in contact with the groundwater. New groundwater Monitoring Wells MW11, MW12 and MW14 were installed within the waste placement area. Wells MW11 and MW12 were installed at areas represented as topographic lows for the site. And, Well MW14 was drilled and installed at a location where the waste is in contact (or is submerged) with the groundwater.

In summary after considering all the details, there is a complete groundwater pathway for contaminant migration due to the close proximity of groundwater to the waste. However, analytical results of groundwater samples collected from all wells (at the periphery and within the debris placement boundary) show a low frequency of detection and spatial distribution of groundwater constituents and that there is no conclusive evidence of a release at the point of compliance.

Direct discharge of contaminant liquids to the groundwater from the landfill is also a potential mechanism for contamination transport. However, sampling results indicate groundwater has not been significantly impacted due to this transport mechanism.

7.2.3.3 Migration in Groundwater

Contaminant migration in groundwater is controlled by the concentration of the contaminant, flow velocity, dispersion, dilution, diffusion, and the retardation coefficient of the solid media to the transported contaminant. As described in Section 6 (Table 6-27), very low detections of motor oils and petroleum hydrocarbons (both diesel fuel and gasoline range) were reported from groundwater wells at a frequency ranging from 16 percent to 22 percent. Very low detections of common laboratory VOC contaminants like methylene chloride, 2-butanone, chloroform, and 4-methyl-2-pentanone were reported from groundwater wells at a frequency ranging from 1 percent to 3 percent. Very low detections of SVOCs and PAHs were reported from groundwater wells at a frequency ranging from 1 percent to 5 percent. The inorganics that were of concern (exceeded their respective MCLs) in groundwater are aluminum, antimony, arsenic, chromium, nickel, selenium, and thallium were detected at 69 percent (1 sample above MCL), 16 percent (5 samples above MCL), 46 percent (3 samples above MCL), 75 percent (4 samples above MCL), 63 percent (1 sample above MCL), 68 percent (4 samples above MCL), and 10 percent (5 samples above MCL), respectively. For the inorganics, low frequency of detection along with no discernable trends suggests the lack of significant impact to groundwater.

In addition, the statistical evaluation groundwater quality at the downgradient and upgradient monitoring wells indicates that even though this is a viable transport mechanism, a statistically significant impact to groundwater quality has not been detected. Therefore, the likelihood of contaminants migrating in the groundwater from AA 3 will be low.

7.2.3.4 Migration in Surface Water and Sediment

During heavy rainfall, soil particles can be dislodged from the landfill surface and carried by runoff to surface drainages. The amount of soil erosion depends on rainfall intensity, slope length, slope steepness, vegetative cover, and erosion control practices.

The overall ground surface at AA 3 is generally flat and, grasses and shrubs cover the surface of the site. Surface drainages occur at and adjacent to the site. The soil cover averages 4.5 feet with isolated areas having 2 feet of soil cover. The Agua Chinon Wash carries most of the surface water that collects water from the catchment area and a box culvert outlet at the northwest corner of the site regulates the surface water flow adjacent to the site.

Sediment and surface water sampling results indicate that the upgradient sample results are consistent with the downgradient sample results. The surface soil sample results indicate that site activities did not result in any significant release of contaminants. The detected organics in surface soil include SVOCs, dioxins and petroleum hydrocarbons. Metals were detected in the surface soil at a frequency that reflects their natural variation in the soil.

A minimal amount of erosion is occurring at AA 3, and sampling results indicate no release of contamination to surface water and sediment. For this reason, this transport pathway will not significantly mobilize waste materials and contaminants under the current conditions.

8. SCREENING RISK ASSESSMENT - HUMAN HEALTH

8.1 INTRODUCTION

This risk assessment is part of the RI for AA 3 at former MCAS El Toro, California. Detailed information regarding the RI (e.g., nature and extent of contamination, contaminant transport and fate) is contained in Sections 3 through 7, and the approved Work Plan, wherein the risk assessment objectives have been outlined (Earth Tech 2002a). However, where appropriate, information that is relevant to the interpretation of the risk evaluation has been summarized and included herein to provide the facts that were considered prior to completing the risk evaluation.

A Tier 1 SRA was conducted for AA 3 to help risk managers determine if further action at the site is warranted. The decision for further action will be based on the potential for adverse human health effects as a result of exposure to chemicals detected at the site. These chemicals, termed COPCs, were identified and the risk was evaluated for receptors that exist now (current conditions) or those that may exist in the future (future conditions). Analytical results from surface soil, subsurface soil, and groundwater analyses were used to identify the human health COPCs for each exposure medium evaluated in the SRA.

8.1.1 Human Health Screening Risk Assessment

This human health SRA quantitatively focused on the potential for human exposure to surface and subsurface soil and to groundwater that may have been impacted by contamination from past operations (i.e., excavation of soils for use as borrow material and/or placement of construction debris resulting from nonhazardous operations). As noted in the approved Work Plan (Earth Tech 2002a), a preliminary determination was made documenting that the potable use of groundwater in the area was negligible, despite its classification as a potential drinking water source. However, the groundwater is used in agricultural irrigation operations, so the SRA evaluates potential exposure to, and risk from, this medium under both residential and agricultural exposure scenarios.

8.1.2 Guidance Documents

The human health SRA is based on a standard approach developed in accordance with guidelines from the following documents and communications:

- DON Risk Policy 5090 Ser N453E/1U5951 (DON 2001)
- DON Background Chemical Levels Policy 5090 Ser N45C/N4U732212 (DON 2004b)
- Risk Assessment Guidance for Superfund (RAGS), Volume 1, Human Health Evaluation Manual (Parts A, B and E) (EPA 1989a, 1991b, and 2004a)
- Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual Supplemental Guidance, Standard Default Exposure Factors (EPA 1991d)
- Exposure Factors Handbook (EPA 1997a),
- Child-Specific Exposure Factors Handbook (EPA 2002a)

Additional guidance was derived from correspondence and discussion with the principal investigators and is referenced where deemed of key relevance to the SRA.

Risk assessments are key components of the Environmental Restoration Program employed by the DON. Pursuant to the DON policy 5090 Ser N453E/1U5951 (DON 2001), the determination of human health risk at a site of concern is clearly prescribed to ensure sufficient resources are allocated for the protection of human health. The U.S. Navy policy for conducting HHRAs identifies a three-tiered approach that may be implemented in its entirety depending on the level and nature of incremental lifetime cancer risk (ICLR) or hazard that is determined in prior tiers. The tiers discussed in the DON policy are listed below.

Tier 1 - SRA

Tier 2 - Baseline Human Health Risk Assessment (BHHRA)

Tier 3 - Evaluation of Remedial Alternatives

The evaluation contained herein is Tier 1, the SRA. As defined by Navy Policy SER N453E/U595168 (DON 2001), the purpose of the Tier 1 SRA is to identify COPCs that may pose unacceptable risks to human health. This SRA incorporates all elements the Navy has identified as necessary for a screening assessment (DON 2001); additionally, this SRA also includes elements typically included in the Tier 2 assessment to satisfy screening requirements of EPA Region 9. Examples of additional elements traditionally included in the Tier 2 assessment include the evaluation of cumulative risks and the evaluation of risks under both a high-end level of exposure (reasonable maximum exposure [RME]) and an average level of exposure (central tendency exposure [CTE]), as well as a detailed qualitative evaluation of the uncertainty associated with this evaluation.

This Tier 1 SRA consists of two parts: Tier 1A, the RBS, which satisfies the EPA Region 9 requirements of a screening preliminary risk evaluation (PRE), and Tier 1B, a site-specific risk-based evaluation (SSRBE), which satisfies the EPA Region 9 requirements for the site-specific PRE.

In certain instances, a SRA is not required, such as when negligible contamination is detected at a site. The SRA is, however, conducted if analytical data from the site investigation indicate that contamination is, or may be, of sufficient magnitude and distribution to warrant continuance of the risk assessment process.

The Tier 1A RBS methodology is consistent with RAGS (EPA 1989a, and 1991b) and is conducted using the EPA Region 9 PRGs (EPA 2004b) for residential and industrial exposure scenarios. Based on recommendations from EPA Region 9 (EPA 2004c), the use of the EPA Region 9 PRGs in a Tier 1A RBS (or screening PRE) is performed when:

1. The complete or potentially complete exposure pathways of concern at a site are the same as those used to develop EPA Region 9 PRGs (EPA 2004b), and
2. Pathway-specific exposure factors are expected to be similar to those used by the EPA for calculation of EPA Region 9 residential and/or industrial PRGs.

If complete, or potentially, complete exposure pathways for the site are not addressed in the use of the EPA Region 9 PRG tables (e.g., construction/excavation worker and visitors), or if site conditions warrant the use of exposure factors that differ from those used to develop EPA Region 9 PRGs, a Tier 1B SSRBE is performed. Additionally, if the Tier 1A results indicate potentially significant health risks, the analysis proceeds to Tier 1B to estimate more realistic, site-specific levels of risk.

8.2 DATA EVALUATION AND REDUCTION

8.2.1 Data Quality Assessment

Section 4.11 presents the details and results of the data quality assessment process. The following text summarizes the methods used to perform a data quality assessment for application of the SRA.

A data quality assessment was conducted, which included a review of analytical methods; reporting limits; laboratory, field, and method blanks; and quality assurance and quality control (QA/QC) procedures. This section presents the results of the data quality assessment for each element most pertinent to the SRA.

Soil and groundwater data were reviewed in the following manner:

- A minimum of 20 percent of the analytical data were validated according to Navy "Level D" data validation criteria.
- A minimum of 80 percent of the data were validated according to Navy "Level C" (NFESC 1999).
- One hundred percent of the data in the database were checked against data sheets received from the data validation personnel.

None of the data collected for the purpose of conducting the HHRA at AA 3 were "R" qualified as rejected. In accordance with the conceptual site model (CSM) presented in the Work Plan (Earth Tech 2002a), soil data were segregated into surface and subsurface soil data. As noted previously, surface soil is defined as soil in the depth interval of 0-foot to 1-foot bgs and subsurface soil samples were defined as 0-foot to 10 feet bgs.

Laboratory Contaminants. All data have been validated and the third-party validators determined that there was no objective evidence to qualify acetone and methylene chloride data based on their association with field or laboratory blanks. The measurements were retained for risk assessment purposes.

8.2.2 Sample Reporting Limit Evaluation

The magnitude of the sample reporting limits may have a substantial effect on the results of the risk assessment. Reporting limits may be set at levels determined by the analytical method or may become elevated due to sample preparation procedures or during sample analysis. Potential causes of elevated reporting limits include percent soil moisture, limited sample volume, and matrix interferences where high levels of non-target compounds limit the ability to detect target chemicals, or dilutions required to detect certain target compounds mask the detection of other chemicals. The potential presence of chemicals in environmental media at concentrations below the highest sample reporting limit could result in a potential underestimation of cancer risk or adverse noncarcinogenic health effects if the concentration were deemed to be negligible and exposure were to occur. However, it is also possible that these chemicals are in fact not present, and therefore, when unaccounted for, do not contribute to additional risk for human receptors. The assumption that the chemical is present when if in fact it is not, would potentially result in an overestimation of adverse health effects. For these reasons, a detailed evaluation of the sample reporting limits was performed before cancer risk or noncarcinogenic health effects were assessed to ensure that the risk estimate was as accurate and unbiased as possible.

Table 8-1 presents data for those non-detected chemicals with reporting limits that exceed a designated screening criterion. These screening criteria were selected as follows:

- For soil samples, with the exception of petroleum hydrocarbons, the screening criteria were the EPA Region 9 residential soil PRG (EPA 2004b). To address petroleum hydrocarbons, the CRWQCB recommends the use of the ASTM (1995) standard for Risk Based Corrective Action (RBCA), ASTM E-1739-95 to evaluate potential health risks (CRWQCB 1996). However, because the ASTM standard provides Tier 1 screening levels for indicator chemicals (i.e., benzene, ethylbenzene, toluene, xylene, and PAHs), potential risk from petroleum hydrocarbons was evaluated based on concentrations of indicator chemicals in soil.

- For groundwater, the screening criteria were the EPA Region 9 residential tap water PRG (EPA 2004b). To address petroleum hydrocarbons, only indicator chemicals (and not hydrocarbon mixtures) were quantitatively evaluated in groundwater.

The reporting limits for soil and groundwater were evaluated for direct exposures to these media; they were not evaluated through modeling for their appropriateness for assessing indoor air risks. However, no VOCs were detected above reporting limits in soil gas samples, suggesting that the VOCs detected in soil and groundwater are likely adequate in providing conservative estimates of risk for exposures to indoor air.

Table 8-1 illustrates the frequency that reporting limits for non-detected chemicals exceed the screening criteria. For the surface soil samples, the following non-detected chemicals had reporting limits that exceeded the screening criterion for that chemical. Only one chemical, hexachlorobenzene, had a range of reporting limits that was greater than the screening criterion for 100 percent of the samples.

- 3,3'-dichlorobenzidine
- bis(2-chloroethyl)ether
- hexachlorobenzene
- pentachlorophenol

For the subsurface soil, the following non-detected chemicals had reporting limits that exceeded the screening criterion for that chemical:

- 1,4-dichlorobenzene
- 2-methyl-4,6-dinitrophenol
- 3,3'dichlorobenzidine
- 3-nitroaniline
- 4-nitroaniline
- bis(2-chloroisopropyl)ether
- bis(2-chloroethyl)ether
- hexachlorobutadiene
- nitrobenzene
- n-nitrosodi-n-propylamine
- pentachlorophenol

The percentage of reporting limits that exceeded screening criteria ranged between 2 percent and 41 percent (for 3,3'-dichlorobenzidine). For groundwater, the following non-detected chemicals had reporting limits that exceeded the screening criterion for that chemical. The percentage of reporting limits that were greater than the screening criterion ranged from almost 7 to 100 percent.

Table 8-1: Nondetect Chemicals with Reporting Limits Above Human Health Screening Criteria

Chemical	Screening Criteria[a]	Range of Reporting Limits	Frequency of Exceedence
Surface Soil (0-foot to 2 feet bgs)(ug/kg)			
3,3'-Dichlorobenzidine	1100	1000 - 2400	41%
bis(2-Chloroethyl) Ether	220	170 - 380	11%
Hexachlorbenzene	300	510 - 1200	100%
Pentachlorophenol	3000	1700 - 4000	11%
Subsurface Soil (0-foot to 10 feet bgs) (ug/kg)			
1,4-Dichlorobenzene	3400	350 - 21000	2%
2-Methyl-4,6-Dinitrophenol	6100	880 - 52000	2%
3,3'-Dichlorobenzidine	1100	350 - 21000	41%
3-Nitroaniline	18000	880 - 52000	2%
4-Nitroaniline	23000	880 - 52000	2%
bis(2-Chloroisopropyl)ether	2900	350 - 21000	11%
bis(2-Chloroethyl)ether	220	35 - 21000	22%
Hexachlorobutadiene	6200	350 - 21000	2%
Nitrobenzene	20000	25 - 21000	2%
n-Nitrosodi-n-Propylamine	69	29 - 16000	15%
Pentachlorophenol	3000	180 - 21000	14%
Groundwater (ug/l)			
1,1,1,2-Tetrachloroethane	4.3E-01	0.2 - 0.5	59%
1,1,2,2-Tetrachloroethane	5.5E-02	1 - 5	100%
1,1,2-Trichloroethane	2.0E-01	1 - 5	100%
1,2,3-Trichloropropane	5.6E-03	0.5 - 0.5	100%
1,2,4-Trichlorobenzene	7.2E+00	9.6 - 11	100%
1,2-Dichloroethane	1.2E-01	0.2 - 5	100%
1,2-Dichloropropane	1.6E-01	1 - 5	100%
1,4-Dichlorobenzene	5.0E-01	4.8 - 5.2	100%
2,4,6-Trichlorophenol	3.6E+00	4.8 - 11	100%
3,3'-Dichlorobenzidine	1.5E-01	9.6 - 11	100%
3-Nitroaniline	3.2E+00	48 - 52	100%
4,6-Dinitro-2-Methylphenol	3.6E+00	48 - 52	100%
4-Nitroaniline	3.2E+00	48 - 52	100%
Benzene	3.5E-01	0.2 - 5	89%
bis(2-Chloroethyl)ether	1.0E-02	1 - 11	100%
Bromodichloromethane	1.8E-01	0.1 - 5	7%
Carbazole	3.4E+00	10 - 50	100%
Carbon Tetrachloride	1.7E-01	0.2 - 5	100%
Chloroethane	4.6E+00	1 - 5	7%
cis-1,3-Dichloropropene	4.0E-01	0.2 - 5	89%
Dibromochloromethane	1.3E-01	5 - 5	100%
Hexachlorobenzene	4.2E-02	0.96 - 1.5	100%
Hexachlorobutadiene	8.6E-01	9.6 - 11	100%
Hexachloroethane	4.8E+00	5 - 10	100%
Nitrobenzene	3.4E+00	4.8 - 11	100%
n-Nitrosodi-N-Propylamine	9.6E-03	1 - 11	100%
Pentachlorophenol	5.6E-01	10 - 15	100%
Perchlorate	3.6E+00	3 - 6	29%
Tetrachloroethene	1.0E-01	1 - 5	100%
trans-1,3-Dichloropropene	4.0E-01	0.2 - 5	89%
Trichloroethene	2.8E-02	1 - 5	100%
Vinyl Chloride	2.0E-02	0.2 - 5	100%

Notes:

[a] The screening criteria are equivalent to EPA Region 9 (2004) preliminary remediation goals (PRGs) for residential soil and tap water.

% = percent

bgs = below ground surface

EPA = Environmental Protection Agency

ug/kg = microgram per kilogram

ug/l = microgram per liter

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- 1,1,1,2-tetrachloroethane
- 1,1,2,2-tetrachloroethane
- 1,1,2-trichloroethane
- 1,2,3-trichloropropane
- 1,2,4-trichlorobenzene
- 1,2-dichloroethane
- 1,2-dichloropropane
- 1,4-dichlorobenzene
- 2,4,6-trichlorophenol
- 3,3'-dichlorobenzidine
- 3-nitroaniline
- 4-nitroaniline
- 4,6-dinitro-2-methylphenol
- benzene
- bis(2-chloroethyl)ether
- bromodichloromethane
- carbazole
- carbon tetrachloride
- chloroethane
- cis-1,3-dichloropropene
- trans-1,3-dichloropropene
- dibromochloromethane
- hexachlorobenzene
- hexachlorobutadiene
- hexachloroethane
- Nitrobenzene
- N-nitrosodo-N-propylamine
- pentachlorophenol
- perchlorate
- tetrachloroethene
- trichloroethene
- vinyl chloride

If any of these non-detected chemicals are truly present in the given medium at the reporting limits, then these chemicals would be overlooked as potential COPCs and risks would be potentially underestimated. It is also possible that these chemicals are not present in the medium. Further discussion of the potential presence of non-detected chemicals and their effect on risk estimates is presented in Section 8.7.1, Uncertainties in Data Assessment.

When sample reporting limits for non-detected chemicals exceed the screening criteria, additional uncertainty may be introduced into final risk estimates. Where sample reporting limits appeared to be inordinately high relative to other samples evaluated, an additional evaluation of the data was performed in the data reduction step (Section 8.2.3). The influence of elevated reporting limits on the SRA results is qualitatively discussed in Section 8.7.

8.2.3 Data Reduction

The SRA focuses on data from the impacted area(s) within the study site. Chemicals that have been detected at least once are considered COPCs for the Tier 1A RBS (or screening PRE under the EPA Region 9 terminology). Relevant data sets are identified to facilitate the estimation of chemical exposure point concentrations (EPCs) to which receptors may reasonably be exposed.

Conclusions and recommendations of the risk assessment are often based on the RME that a receptor may encounter. Key in determining the RME is a statistical evaluation of the data set, which provides summary statistics such as maximum detected concentration, minimum detected concentration, number of detects, and upper confidence levels (UCLs) on the mean value. Prior to making this summary, the data set was evaluated for further use in the risk assessment. Thus, the data set was "reduced" by: (a) averaging original and field duplicate samples to yield one data point per sampling locus; and (b) eliminating elevated or inordinately high non-detect values. Each of these steps is discussed below.

8.2.3.1 FIELD DUPLICATE SAMPLES

For soil samples, field duplicates were treated in the following manner:

Case 1: The original sample and field duplicate results for the COPC were above the reporting limit for the COPC.

Both values were averaged to obtain an average concentration for the sample pair before the statistical summary was performed.

Case 2: One sample of the duplicate pair had a concentration that was non-detect for the COPC, while the other exceeded the reporting limit.

The non-detect value was assigned a value of one-half its reporting limit and was then averaged with the detected concentration. If a qualifier existed on the detected concentration, that qualifier remained with the "averaged" value.

Case 3: Both samples had COPC concentrations that were non-detect.

The two values (i.e., reporting limit) were averaged to obtain an average reporting limit for the sample pair. Prior to summarizing the data statistically for EPC determination (i.e., calculation of the 95th UCL), the average reporting limit of the sample pair was then assigned a value of one-half of that average reporting limit. In so doing, the underestimation of risk due to use of a "biased low" data set (resulting from assigning the surrogate concentration twice during the process) was minimized.

8.2.3.2 ELEVATED REPORTING LIMITS FOR NONDETECT VALUES

One or more sample-specific factors may result in reporting limits for a particular chemical that, in some samples, may be unusually high. As noted above, potential causes of elevated reporting limits include percent soil moisture, limited sample volume, and matrix interferences (i.e., high levels of non-target compounds that limit the ability to detect target chemicals, or dilutions required to detect certain target compounds mask the detection of other chemicals). Sometimes these elevated reporting limits greatly exceed the detected concentrations for the same chemical in other samples, suggesting that the elevated reporting limit is not representative of the data set as a whole or site conditions. Inclusion of these data when determining the EPCs (e.g., calculating the 95 percent UCL) could correspondingly result in poorly characterized risk (EPA 1989a). Therefore, when a chemical was detected in some samples but not in others, those samples that were reported as non-detections with reporting limits that exceeded twice the maximum detected concentration for that chemical were not included in the statistical analysis. Chemicals reported as non-detections for certain samples that have reporting limits (for a specific chemical) that exceeded twice the maximum detection are summarized below in Table 8-2, according to the medium evaluated.

Four soil sampling locations listed below had matrix interferences that lead to elevated reporting limits and the exclusion of results for one or more of the following chemicals: anthracene, benzo[a]anthracene, benzo(a)pyrene, benzo[b]fluoranthene, chrysene, fluoranthene, indeno(1,2,3-c,d)pyrene, phenanthrene, phenol and pyrene. Petroleum hydrocarbons (specifically diesel) were detected in each of these subsurface locations at concentrations ranging between 42 mg/kg and 5,600 mg/kg.

Table 8-2: Summary of Chemicals Having Reporting Limits Exceeding Twice the Maximum Detected Concentration

Chemical	Surface Soil[a]	Subsurface Soil[a]	Groundwater[a]
Anthracene	--	9	101
Antimony	29	38	67
Benzene	--	40	--
Benz[a]anthracene	--	4	102
Benzo(a)pyrene	--	3	--
Benzo[b]fluoranthene	--	4	--
Benzo[g,h,i]perylene	--	--	102
Bis(2-Chloroethoxy)Methane	--	--	102
Bis(2-Ethylhexyl)Phthalate	30	30	89
butyl Benzyl phthalate	--	--	102
Cadmium	--	--	58
Chloroform	--	--	8
Chrysene	--	8	102
Cobalt			60
Dibenz[a,h]anthracene	--	--	102
Diethyl Phthalate	32	30	101
Fluoranthene	--	5	101
Fluorene	--	--	102
Gasoline	7	16	12
Hexachlorobenzene	--	38	--
Indeno(1,2,3-cd)pyrene	--	6	12
Methyl ethyl ketone	--	--	89
4-Methyl-2-Pentanone	--	--	108
Methyl Tert-Butyl Ether	--	--	7
Methylene chloride	--	--	109
Motor Oil	--	--	3
Naphthalene	--	--	102
Phenanthrene	--	13	101
PHC as diesel fuel	1	--	--
Phenol	--	1	--
Pyrene	--	6	102
Silver	--	--	8
Thallium	--	--	8

Notes:
[a] = number of nondetect analyses exceeding twice the maximum detected concentration.

- Borehole 1097
- Borehole 1102
- Borehole 1109
- Borehole 1112

Additionally, the presence of motor oil (at a maximum detected concentration of 160 mg/kg) at Borehole Location LK026 resulted in the exclusion of one diesel fuel result in the surface soil.

In other instances, sample results were excluded even though the reporting limits were not elevated. This occurs when the maximum detected concentration is a low estimated value that is closer to the method detection limit than the reporting limit. Non-elevated reporting limits were excluded for antimony, bis(2-ethylhexyl) phthalate, diethyl phthalate, gasoline (each in surface and subsurface soil), and anthracene, benzene, hexachlorobenzene (in subsurface soil only).

Numerous groundwater results were removed from the data set because reporting limits exceeded twice the maximum detected concentrations. Results were generally omitted because either earlier groundwater analyses (November 1995 and April 1996) had higher reporting limits than subsequent analyses, and/or low detections were closer to the method detection limits than the reporting limit. Chemicals for which earlier analyses had higher reporting limits include antimony, methyl tert-butyl ether, chloroform, cadmium, silver, and thallium. Contrarily, the reporting limits for gasoline and indeno(1,2,3-cd)pyrene) during the last round of sampling in February 2007 were higher than those of earlier sampling events and had to be removed. Chemicals with low detections that required omitted results include anthracene, benz(a)anthracene, benzo(g,h,i)perylene, bis(2-chloroethoxy)methane, bis(2-ethylhexyl) phthalate, butyl benzyl phthalate, cadmium, chrysene, cobalt, dibenz(a,h)anthracene, diethyl phthalate, fluoranthene, fluorene, methylene chloride, methyl ethyl ketone, 4-methyl-2-pentanone, naphthalene, phenanthrene and pyrene. Three results for motor oil were removed due to elevated reporting limits during the November-December 2002 sampling event. The uncertainty associated with the omission of these sample results is presented in Section 8.7.1.

8.2.4 Summary Statistics for Sample Data

Summary statistics (e.g., frequency of detection, maximum values) for the detected chemicals in surface soil, all of which were evaluated in this RBS, appear in Table 8-3; summary statistics for the detected chemicals in subsurface soil appear in Table 8-4. Summary statistics for the groundwater data are presented in Table 8-5. In addition, a 95 percent UCL is provided based on the method(s) described in Section 8.4.4. One-half the sample reporting limit (U or UJ-qualified) was used as a proxy value for non-detects in all statistical evaluations. Nondetect data with elevated sample reporting limits were not used to calculate statistics or conduct statistical comparisons.

Non-detected chemicals (i.e., chemicals that were not detected in any applicable medium) were not included in the risk assessment. The uncertainty associated with this practice is further discussed in Section 8.7.1.

8.3 SELECTION OF CHEMICALS OF POTENTIAL CONCERN

The Work Plan proposed a comprehensive list of chemicals for testing (Earth Tech 2002a). As such, the chemical groups consisted of metals, VOCs, SVOCs, dioxins/furans, and petroleum hydrocarbons. From all data derived from the analyses, all chemicals detected at least once in an environmental medium (i.e., soil or groundwater) were considered COPCs for the RBS. The selection of COPCs followed a tiered approach as outlined in DON (2001).

To determine whether the COPCs should be further evaluated in the Tier 1B SSRBE, maximum detected concentrations are compared to EPA Region 9 residential PRGs. COPCs having maximum detected concentrations greater than the residential screening criteria are retained for further evaluation in the SSRBE to determine the magnitude of exposure associated with incremental cancer risk or noncancer hazard based on hypothetical or planned reuse.

8.3.1 Essential Nutrients

Chemicals such as calcium, magnesium, potassium, and sodium are referred to as essential nutrients. These chemicals do not have toxicity criteria or PRGs, and are generally considered to be of minor, if any, concern in risk assessments performed for hazardous waste site investigations. While these essential nutrients were not quantitatively evaluated in this Report, they have been summarized and presented for information purposes in subsequent risk summary tables.

8.3.2 Summary of Chemical Types by Medium

All chemicals detected in surface soil (0-foot to 1-foot bgs), subsurface soil (0-foot to 10 feet bgs) and groundwater were retained as COPCs for the human health RBS evaluation. A summary of the chemical classes that were evaluated for each medium is provided below.

8.3.2.1 Surface and Subsurface Soil

TPH, dioxins, PAHs, several SVOCs, and inorganic chemicals were detected in surface soil samples collected at the site. All of the above chemical classes were detected in subsurface soil with the addition of three VOCs at relatively low concentrations.

8.3.2.2 Groundwater

Chemicals detected in groundwater were dominated by inorganic elements. Some organic chemicals (VOCs, PAHs, and SVOCs) were detected in 1 to 3 samples while TPH was detected in 15 to 22 samples.

8.3.3 Chemicals without Toxicity Values

Several chemicals detected in the various environmental media do not have toxicity values with which to derive PRGs and evaluate chemical-specific risks. The omission of these chemicals from the risk evaluation is addressed qualitatively in Section 8.7.3, Uncertainties in the Toxicity Assessment.

8.4 Exposure Assessment

The exposure assessment section identifies land use and receptors that currently, or in the future, are likely to use the property and, as a result, may contact COPCs identified in the previous sections.

8.4.1 Land Use and Receptors

8.4.1.1 Current Land Use and Receptors

Previous land use at the site was industrial. The Wherry Housing Area is located to the northeast and south of AA 3 and consists of single-family residences. However, since the operational closing of former MCAS El Toro, the Wherry Housing Area is no longer used. The site is currently fenced along the northwest and southwest sides, with vegetation surrounding the remainder of the site. Authorized visitors and escorts are the only current human receptors on the site.

According to the Santa Ana Region Basin Plan (CRWQCB 1995), the groundwater beneath former MCAS El Toro has potential beneficial uses for a municipal water supply, agricultural and industrial supplies, and industrial process supply. Groundwater in the vicinity of former MCAS El Toro is mostly used for irrigation of agricultural and greenbelt areas (i.e., parkways and parks). Potable water in the area is imported from various sources, and the remainder comes from local resources, including groundwater. The nearest municipal wells used as drinking water sources are associated with the recently installed Irvine Desalter project and are located within approximately 5 miles from AA 3, near the intersection of Irvine Center Drive and Culver Drive. Human receptors are shown in Figure 8-1 and summarized below.

- Current on-site escorted visitors
- Current off-site residents
- Current off-site agricultural workers

8.4.1.2 Future Land Use and Receptors

Even though the reuse for the site is not finalized, the preliminary reuse scenario proposed for AA 3 and surrounding areas is residential use. Therefore, potential future human receptors at AA 3, identified below, include residents, industrial workers, construction/utility workers, escorted visitors and recreational users (Figure 8-1). Additionally, future on-site agricultural use of AA 3 is possible.

- Future on-site residents (adult/child)
- Future on-site industrial workers
- Future on-site construction/utility workers
- Future on-site escorted visitors (adult/juvenile)
- Future on-site and off-site agricultural workers
- Future on-site recreational users (adult/juvenile)

8.4.2 Conceptual Site Model

The CSM is a schematic representation of the chemical source areas, chemical release mechanisms, environmental transport media, potential exposure routes, and potential receptors. It is used to guide the evaluation of potential exposures so that relevant pathways, exposure routes, and ultimately risk can be evaluated in the SRA. The primary purpose of the CSM in this risk evaluation is to represent chemical sources and exposure pathways that may result in human health risks. Only potentially complete exposure pathways are evaluated quantitatively in the risk assessment, consistent with EPA guidance (EPA 1989a).

Table 8-3: Summary Statistics for Analytical Data from Surface Soil (0-foot to 1-foot bgs) Samples at Anomaly Area 3

EPA Method	Analyte[a]	Units	Number of Detects	Number of Samples	Frequency of Detection	Maximum Concentration	95% UCL Concentrations[b]	Distribution[b]	Method[b]	EPC Concentration[c]
6010B	Aluminum	mg/kg	33	33	100%	1.58E+04	9.98E+03	Normal	Student's-t UCL	9.98E+03
6010B	Antimony	mg/kg	1	33	3%	2.10E+00	–	–	–	2.10E+00
6010B	Arsenic	mg/kg	33	33	100%	4.60E+00	3.16E+00	Normal	Student's-t UCL	3.16E+00
6010B	Barium	mg/kg	33	33	100%	1.87E+02	1.07E+02	Normal	Student's-t UCL	1.07E+02
6010B	Beryllium	mg/kg	10	33	30%	3.10E-01	–	–	–	3.10E-01
6010B	Cadmium	mg/kg	33	33	100%	1.00E+00	6.71E-01	Normal	Student's-t UCL	6.71E-01
6010B	Calcium	mg/kg	33	33	100%	2.52E+04	8.55E+03	Non-parametric	95%Chebyshev (Mean, Sd) UCL	8.55E+03
6010B	Chromium	mg/kg	33	33	100%	1.58E+01	1.09E+01	Normal	Student's-t UCL	1.09E+01
6010B	Cobalt	mg/kg	33	33	100%	7.60E+00	5.06E+00	Normal	Student's-t UCL	5.06E+00
6010B	Copper	mg/kg	33	33	100%	1.08E+01	6.71E+00	Normal	Student's-t UCL	6.71E+00
6010B	Iron	mg/kg	33	33	100%	1.94E+04	1.25E+04	Normal	Student's-t UCL	1.25E+04
6010B	Lead	mg/kg	33	33	100%	2.07E+01	8.50E+00	Gamma	Approximate Gamma UCL	8.50E+00
6010B	Magnesium	mg/kg	33	33	100%	6.90E+03	4.37E+03	Normal	Student's-t UCL	4.37E+03
6010B	Manganese	mg/kg	33	33	100%	2.89E+02	1.97E+02	Normal	Student's-t UCL	1.97E+02
6010B	Nickel	mg/kg	33	33	100%	1.21E+01	7.72E+00	Normal	Student's-t UCL	7.72E+00
6010B	Potassium	mg/kg	33	33	100%	3.31E+03	2.64E+03	Normal	Student's-t UCL	2.64E+03
6010B	Selenium	mg/kg	20	33	61%	1.10E+00	6.62E-01	Normal	Student's-t UCL	6.62E-01
6010B	Silver	mg/kg	1	33	3%	2.00E+00	–	–	–	2.00E+00
6010B	Vanadium	mg/kg	33	33	100%	4.41E+01	2.81E+01	Normal	Student's-t UCL	2.81E+01
6010B	Zinc	mg/kg	33	33	100%	5.71E+01	3.74E+01	Normal	Student's-t UCL	3.74E+01
7471A	Mercury	mg/kg	33	33	100%	6.90E-02	3.06E-02	Gamma	Approximate Gamma UCL	3.06E-02
8015B DRO	PHC as Diesel Fuel	mg/kg	14	33	42%	1.50E+01	3.95E+01	Non-parametric	99%Chebyshev (Mean, Sd) UCL	1.50E+01
8015B DRO	PHC as Motor Oil	mg/kg	20	33	61%	1.60E+02	4.39E+01	Non-parametric	95%Chebyshev (Mean, Sd) UCL	4.39E+01
8015B GRO	PHC as Gasoline	mg/kg	26	33	79%	2.77E+00	9.99E+00	Non-parametric	99%Chebyshev (Mean, Sd) UCL	2.77E+00
8270C	bis(2-Ethylhexyl) Phthalate	ug/kg	3	33	9%	7.00E+01	–	–	–	7.00E+01
8270C	Diethylphthalate	ug/kg	1	33	3%	2.25E+02	–	–	–	2.25E+02
8270C	Phenol	ug/kg	12	33	36%	9.36E+02	7.16E+02	Non-parametric	95%Chebyshev (Mean, Sd) UCL	7.16E+02
PAH-SIM	Anthracene	ug/kg	1	33	3%	4.40E+01	–	–	–	4.40E+01
PAH-SIM	Benzo(a)Anthracene	ug/kg	7	33	21%	7.30E+02	–	–	–	7.30E+02
PAH-SIM	Benzo(a)pyrene	ug/kg	4	33	12%	1.03E+03	–	–	–	1.03E+03
PAH-SIM	Benzo(b)Fluoranthene	ug/kg	5	33	15%	1.79E+03	–	–	–	1.79E+03
PAH-SIM	Benzo(g,h,i)Perylene	ug/kg	4	33	12%	4.40E+02	–	–	–	4.40E+02
PAH-SIM	Benzo(k)Fluoranthene	ug/kg	4	33	12%	5.10E+02	–	–	–	5.10E+02
PAH-SIM	Chrysene	ug/kg	4	33	12%	8.70E+02	–	–	–	8.70E+02
PAH-SIM	Dibenz(a,h)Anthracene	ug/kg	1	33	3%	9.70E+01	–	–	–	9.70E+01
PAH-SIM	Fluoranthene	ug/kg	5	33	15%	1.00E+03	–	–	–	1.00E+03
PAH-SIM	indeno(1,2,3-c,d)Pyrene	ug/kg	2	33	6%	4.60E+02	–	–	–	4.60E+02
PAH-SIM	Phenanthrene	ug/kg	2	33	6%	2.90E+02	–	–	–	2.90E+02
PAH-SIM	Pyrene	ug/kg	5	33	15%	9.60E+02	–	–	–	9.60E+02
8290	Total 2,3,7,8-TCDD equivalent[d]	pg/g	9	9	100%	1.25E+01	–	–	–	1.25E+01

Notes:

[a]Only detected chemicals are shown in this table.

[b] The 95% UCL, distribution, and method were taken from the ProUCL output when statistics were generated for the 95% UCL.

[c] The EPC is the lower value between the maximum detected concentration and the 95% UCL.

[d] Total 2,3,7,8-TCDD contribution was calculated using the toxicity equivalency procedure (EPA 2003g) as illustrated in Table 8-6.

– = Not applicable. 95% UCL, distribution, and method were not calculated for data sets with fewer than 11 detections.

% = percent

ug/kg = microgram per kilogram

EPA = Environmental Protection Agency

EPC = exposure point concentration

mg/kg = milligrams per kilogram

pg/g = picogram per gram

UCL = upper confidence limit

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Table 8-4: Summary Statistics for Analytical Data from Subsurface Soil (0 - 10 ft bgs) Samples at Anomaly Area 3

EPA Method	Analyte[a]	Unit	Number of Detects	Number of Samples	Frequency of Detection	Maximum Concentration	95% UCL Concentrations[b]	Distribution[b]	Method[b]	EPC Concentration[c]
6010B	Aluminum	mg/kg	33	33	100%	15800	9.98E+03	Normal	Student's-t UCL	9.98E+03
6010B	Antimony	mg/kg	1	42	2%	2.1	--	--	--	2.10E+00
6010B	Arsenic	mg/kg	42	42	100%	4.63	3.20E+00	Normal	Student's-t UCL	3.20E+00
6010B	Barium	mg/kg	42	42	100%	187	1.04E+02	Gamma	Approximate Gamma UCL	1.04E+02
6010B	Beryllium	mg/kg	10	42	24%	0.31	--	--	--	3.10E-01
6010B	Cadmium	mg/kg	33	42	79%	1	7.74E-01	Normal	Student's-t UCL	7.74E-01
6010B	Calcium	mg/kg	33	33	100%	25200	8.55E+03	Non-parametric	95% Chebyshev (Mean, Sd) UCL	8.55E+03
6010B	Chromium	mg/kg	42	42	100%	16.4	1.09E+01	Normal	Student's-t UCL	1.09E+01
6010B	Cobalt	mg/kg	42	42	100%	7.6	4.88E+00	Normal	Student's-t UCL	4.88E+00
6010B	Copper	mg/kg	42	42	100%	12.7	7.02E+00	Normal	Student's-t UCL	7.02E+00
6010B	Iron	mg/kg	33	33	100%	19400	1.25E+04	Normal	Student's-t UCL	1.25E+04
6010B	Lead	mg/kg	42	42	100%	20.7	8.40E+00	Gamma	Approximate Gamma UCL	8.40E+00
6010B	Magnesium	mg/kg	33	33	100%	6900	4.37E+03	Normal	Student's-t UCL	4.37E+03
6010B	Manganese	mg/kg	42	42	100%	289	1.96E+02	Normal	Student's-t UCL	1.96E+02
6010B	Nickel	mg/kg	41	42	98%	13.7	7.86E+00	Normal	Student's-t UCL	7.86E+00
6010B	Potassium	mg/kg	33	33	100%	3970	2.64E+03	Normal	Student's-t UCL	2.64E+03
6010B	Selenium	mg/kg	20	42	48%	1.1	7.77E-01	Gamma	Approximate Gamma UCL	7.77E-01
6010B	Silver	mg/kg	1	42	2%	2	--	--	--	2.00E+00
6010B	Vanadium	mg/kg	42	42	100%	44.1	2.79E+01	Normal	Student's-t UCL	2.79E+01
6010B	Zinc	mg/kg	42	42	100%	57.1	3.77E+01	Normal	Student's-t UCL	3.77E+01
7471A	Mercury	mg/kg	33	42	79%	0.069	6.67E-02	Non-parametric	95% Chebyshev (Mean, Sd) UCL	6.67E-02
8015B DRO	PHC as Diesel Fuel	mg/kg	19	42	45%	5600	1.48E+03	Non-parametric	99% Chebyshev (Mean, Sd) UCL	1.48E+03
8015B DRO	PHC as Motor Oil	mg/kg	20	33	61%	160	4.39E+01	Non-parametric	95% Chebyshev (Mean, Sd) UCL	4.39E+01
8015B GRO	PHC as Gasoline	mg/kg	26	42	62%	2.78	1.84E+01	Non-parametric	99% Chebyshev (Mean, Sd) UCL	2.78E+00
8260B	Acetone	ug/kg	5	42	12%	100	--	--	--	1.00E+02
8260B	Benzene	ug/kg	1	42	2%	2.4	--	--	--	2.40E+00
8260B	Methylene Chloride	ug/kg	1	42	2%	9.2	--	--	--	9.20E+00
8270C	Bis(2-Ethylhexyl)Phthalate	ug/kg	3	33	9%	70	--	--	--	7.00E+01
8270C	Diethyl Phthalate	ug/kg	3	42	7%	260	--	--	--	2.60E+02
8270C	Hexachlorobenzene	ug/kg	1	42	2%	150	--	--	--	1.50E+02
8270C	Phenol	ug/kg	12	42	29%	936	3.29E+03	Non-parametric	95% Chebyshev (Mean, Sd) UCL	9.36E+02
8270C	Benzo[a]anthracene	ug/kg	1	9	11%	270	--	--	--	2.70E+02
8270C	Benzo[a]pyrene	ug/kg	1	9	11%	230	--	--	--	2.30E+02
8270C	Benzo[b]fluoranthene	ug/kg	1	9	11%	440	--	--	--	4.40E+02
8270C	Chrysene	ug/kg	1	9	11%	250	--	--	--	2.50E+02
8270C	Fluoranthene	ug/kg	1	9	11%	600	--	--	--	6.00E+02
8270C	Indeno[1,2,3-cd]pyrene	ug/kg	1	9	11%	81	--	--	--	8.10E+01
8270C	Phenanthrene	ug/kg	1	9	11%	140	--	--	--	1.40E+02
8270C	Pyrene	ug/kg	1	9	11%	460	--	--	--	4.60E+02
PAH-SIM	Anthracene	ug/kg	1	33	3%	44	--	--	--	4.40E+01
PAH-SIM	Benz(A)Anthracene	ug/kg	7	33	21%	730	--	--	--	7.30E+02
PAH-SIM	Benzo(A)Pyrene	ug/kg	4	33	12%	1030	--	--	--	1.03E+03
PAH-SIM	Benzo(B)Fluoranthene	ug/kg	5	33	15%	1790	--	--	--	1.79E+03
PAH-SIM	Benzo(G,H,I)Perylene	ug/kg	4	33	12%	440	--	--	--	4.40E+02
PAH-SIM	Benzo(K)Fluoranthene	ug/kg	4	33	12%	510	--	--	--	5.10E+02
PAH-SIM	Chrysene	ug/kg	4	33	12%	870	--	--	--	8.70E+02
PAH-SIM	Dibenz(A,H)Anthracene	ug/kg	1	33	3%	97	--	--	--	9.70E+01
PAH-SIM	Fluoranthene	ug/kg	5	33	15%	1000	--	--	--	1.00E+03
PAH-SIM	Indeno(1,2,3-Cd)Pyrene	ug/kg	2	33	6%	460	--	--	--	4.60E+02
PAH-SIM	Phenanthrene	ug/kg	2	33	6%	290	--	--	--	2.90E+02
PAH-SIM	Pyrene	ug/kg	5	33	15%	960	--	--	--	9.60E+02
8290	Total 2,3,7,8-TCDD equivalent[d]	pg/g	11	11	100%	1.29E+01	--	--	--	1.29E+01

Notes:
[a]Only detected chemicals are shown in this table.
[b] The 95UCL, distribution, and method were taken from the ProUCL output when statistics were generated for the 95UCL.
[c] The EPC is the lower value between the maximum detected concentration and the 95UCL.
[d] Total 2,3,7,8-TCDD contribution was calculated using the toxicity equivalency procedure (EPA 2003) as illustrated in Table 8-6.
-- = Not applicable. 95UCL, distribution, and method were not calculated for data sets with fewer than 11 detections.
% = percent
ug/kg = microgram per kilogram
bgs = below ground surface
EPC = exposure point concentration
mg/kg = milligrams per kilogram
pg/g = picogram per gram
UCL = upper confidence limit

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Table 8-5: Summary Statistics for Analytical Data from Groundwater Samples at Anomaly Area 3

Method	CAS ID	Analyte[a]	Units	Number of Samples	Number of Detects	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Number of Non-Detect Results Exceeding Twice the Maximum Detected Concentration	Sample with Maximum Detected Concentration	Location with Maximum Detected Concentration	95% UCL Concentration[b]	Distribution[b]	Method[b]	Exposure Point Concentration[c]
6010B	7429-90-5	Aluminum	ug/L	106	63	59%	6	1700	0	LK415	AA3-MW07	2.16E+02	Non-Parametric	95% Chebyshev (Mean, Sd) UCL	2.16E+02
6010B	7440-36-0	Antimony	ug/L	114	17	15%	0.764	20.85	86	LK530LK532	AA3-MW12	1.24E+01	Non-Parametric	95% Chebyshev (Mean, Sd) UCL	1.24E+01
6010B	7440-38-2	Arsenic	ug/L	114	46	40%	2.4	60.25	0	LK530LK532	AA3-MW12	1.10E+01	Non-Parametric	95% Chebyshev (Mean, Sd) UCL	1.10E+01
6010B	7440-39-3	Barium	ug/L	114	104	91%	16.3	332.5	0	LK552LK553	AA3-MW12	6.17E+01	Non-Parametric	95% Chebyshev (Mean, Sd) UCL	6.17E+01
6010B	7440-43-9	Cadmium	ug/L	114	4	4%	0.31	2.1	98	LK460LK461	AA3-MW02	--	--	--	2.10E+00
6010B	7440-70-2	Calcium	ug/L	106	106	100%	89450	386000	0	LK535	AA3-MW13	1.82E+05	Gamma	95% Approximate Gamma UCL	1.82E+05
6010B	7440-47-3	Chromium	ug/L	114	73	64%	0.595	357	0	20242-1124	AA3-MW-02	4.04E+01	Non-Parametric	97.5% Chebyshev (Mean, Sd) UCL	4.04E+01
6010B	7440-48-4	Cobalt	ug/L	114	8	7%	0.465	12.91	98	LK528LK529	AA3-MW08	--	--	--	1.29E+01
6010B	7440-50-8	Copper	ug/L	114	64	56%	0.54	47.2	0	LK264	AA3-MW02	1.28E+01	Non-Parametric	95% Chebyshev (Mean, Sd) UCL	1.28E+01
6010B	7439-89-6	Iron	ug/L	106	80	75%	20	6950	0	LK552LK553	AA3-MW12	1.06E+03	Non-Parametric	97.5% Chebyshev (Mean, Sd) UCL	1.06E+03
6010B	7439-92-1	Lead	ug/L	114	16	14%	0.84	7.75	0	LK460LK461	AA3-MW02	2.18E+00	Non-Parametric	95% Modified-t UCL	2.18E+00
6010B	7439-95-4	Magnesium	ug/L	106	106	100%	38700	152000	0	LK535	AA3-MW13	8.87E+04	Normal	95% Student's-t UCL	8.87E+04
6010B	7439-96-5	Manganese	ug/L	114	96	84%	0.88	1950	0	LK545	AA3-MW14	3.72E+02	Non-Parametric	97.5% Chebyshev (Mean, Sd) UCL	3.72E+02
6010B	7440-02-0	Nickel	ug/L	114	65	57%	0.561	105	0	LK256	AA3-MW01	3.24E+01	Non-Parametric	97.5% Chebyshev (Mean, Sd) UCL	3.24E+01
6010B	7440-09-7	Potassium	ug/L	106	106	100%	1930	29400	0	LK469	AA3-MW12	7.33E+03	Non-Parametric	95% Chebyshev (Mean, Sd) UCL	7.33E+03
6010B	7782-49-2	Selenium	ug/L	114	67	59%	0.9705	165	0	LK556	AA3-MW13	2.90E+01	Non-Parametric	97.5% Chebyshev (Mean, Sd) UCL	2.90E+01
6010B	7440-22-4	Silver	ug/L	114	17	15%	0.4	18.1	8	LK438	AA3-MW09B	5.41E+00	Non-Parametric	95% Chebyshev (Mean, Sd) UCL	5.41E+00
6010B	7440-23-5	Sodium	ug/L	106	106	100%	188000	514000	0	LK469	AA3-MW12	4.14E+05	Normal	95% Student's-t UCL	4.14E+05
6010B	7440-28-0	Thallium	ug/L	114	9	8%	1.6	7.8	8	LK522	AA3-MW02	--	--	--	7.80E+00
6010B	7440-62-2	Vanadium	ug/L	114	92	81%	1.06	57.5	0	LK515	AA3-MW04	2.81E+01	Non-Parametric	95% Chebyshev (Mean, Sd) UCL	2.81E+01
6010B	7440-66-6	Zinc	ug/L	114	72	63%	2.45	205	0	LK252LK253	AA3-MW10	2.33E+01	Non-Parametric	95% Chebyshev (Mean, Sd) UCL	2.33E+01
7199	1333-82-0	Chromium, hexavalent	ug/L	13	6	46%	0.23	14	0	LK471	AA3-MW13	--	--	--	1.40E+01
7470A	7439-97-6	Mercury	ug/L	114	90	79%	0.013	1.2	0	LK460LK461	AA3-MW02	2.90E-01	Lognormal	95% H-UCL	2.90E-01
8015B DRO	ADR-02-001	Motor Oil	mg/L	91	15	16%	0.01	0.37	3	LK264	AA3-MW02	6.41E-02	Non-Parametric	95% Modified-t UCL	6.41E-02
8015B DRO	68334-30-5	PHC as Diesel Fuel	mg/L	111	20	18%	0.007	1.3	0	LK264	AA3-MW02	1.95E-01	Non-Parametric	95% Chebyshev (Mean, Sd) UCL	1.95E-01
8015B GRO	8006-61-9	Gasoline	mg/L	111	22	20%	0.02	0.05	12	LK454LK455	AA3-MW01	1.53E-01	Non-Parametric	95% Chebyshev (Mean, Sd) UCL	5.00E-02
8260B	78-93-3	2-Butanone (MEK)	ug/L	111	1	1%	1	1	110	LK452	AA3-MW08	--	--	--	1.00E+00
8260B	108-10-1	4-Methyl-2-Pentanone	ug/L	111	3	3%	0.3	13.5	108	LK340LK341	AA3-MW02	--	--	--	1.35E+01
8260B	67-66-3	Chloroform	ug/L	111	2	2%	0.61	0.95	8	LK500	AA3-MW06	--	--	--	9.50E-01
8260B	1634-04-4	Methyl tert-butyl ether	ug/L	111	1	1%	2.55	2.55	7	20242-98720242-990	AA3-MW-01	--	--	--	2.55E+00
8260B	75-09-2	Methylene Chloride	ug/L	111	2	2%	0.5	0.66	109	LK541	AA3-MW09B	--	--	--	6.60E-01
8270C	106-44-5	4-Methylphenol	ug/L	103	1	1%	6	6	1	LK264	AA3-MW02	--	--	--	6.00E+00
8270C	111-91-1	Bis(2-chloroethoxy)Methane	ug/L	103	1	1%	2	2	102	LK530LK532	AA3-MW12	--	--	--	2.00E+00
8270C	117-81-7	Bis(2-Ethylhexyl)Phthalate	ug/L	103	4	4%	1.15	3.9	89	LK425LK426	AA3-MW02	--	--	--	3.90E+00
8270C	85-68-7	Butyl Benzyl Phthalate	ug/L	103	1	1%	0.7	0.7	102	LK329	AA3-MW04	--	--	--	7.00E-01
8270C	84-66-2	Diethyl Phthalate	ug/L	103	2	2%	2	2	101	LK255	AA3-MW08	--	--	--	2.00E+00
8270C	108-95-2	Phenol	ug/L	103	1	1%	12	12	0	LK264	AA3-MW02	--	--	--	1.20E+01
EPA 300.0	14797-55-8	Nitrate (NO_3)	mg/L	16	15	94%	0.207	9.91	0	LK540	AA3-MW09A	4.71E+00	Normal	95% Student's-t UCL	4.71E+00
PAH-SIM	83-32-9	Acenaphthene	ug/L	103	3	3%	0.05	1.55	0	LK530LK532	AA3-MW12	--	--	--	1.55E+00
PAH-SIM	120-12-7	Anthracene	ug/L	103	2	2%	0.05	0.085	101	LK530LK532	AA3-MW12	--	--	--	8.50E-02
PAH-SIM	56-55-3	Benz(a)anthracene	ug/L	103	1	1%	0.04	0.04	102	LK495	AA3-MW08	--	--	--	4.00E-02
PAH-SIM	50-32-8	Benzo(a)pyrene	ug/L	103	1	1%	0.46	0.46	0	LK495	AA3-MW08	--	--	--	4.60E-01
PAH-SIM	205-99-2	Benzo(b)fluoranthene	ug/L	103	1	1%	0.6	0.6	0	LK495	AA3-MW08	--	--	--	6.00E-01
PAH-SIM	191-24-2	Benzo(g,h,i)perylene	ug/L	103	1	1%	0.4	0.4	12	LK495	AA3-MW08	--	--	--	4.00E-01
PAH-SIM	218-01-9	Chrysene	ug/L	103	1	1%	0.04	0.04	102	LK495	AA3-MW08	--	--	--	4.00E-02
PAH-SIM	53-70-3	Dibenz(a,h)anthracene	ug/L	103	1	1%	0.1	0.1	102	LK495	AA3-MW08	--	--	--	1.00E-01
PAH-SIM	206-44-0	Fluoranthene	ug/L	103	2	2%	0.02	0.085	101	LK530LK532	AA3-MW12	--	--	--	8.50E-02
PAH-SIM	86-73-7	Fluorene	ug/L	103	1	1%	0.1	0.1	102	LK469	AA3-MW12	--	--	--	1.00E-01
PAH-SIM	193-39-5	Indeno(1,2,3-Cd)Pyrene	ug/L	103	1	1%	0.4	0.4	12	LK495	AA3-MW08	--	--	--	4.00E-01
PAH-SIM	91-20-3	Naphthalene	ug/L	103	1	1%	0.035	0.035	102	LK530LK532	AA3-MW12	--	--	--	3.50E-02
PAH-SIM	85-01-8	Phenanthrene	ug/L	103	2	2%	0.05	0.1	101	LK469	AA3-MW12	--	--	--	1.00E-01
PAH-SIM	129-00-0	Pyrene	ug/L	103	1	1%	0.06	0.06	102	LK530LK532	AA3-MW12	--	--	--	6.00E-02

Notes:
[a] Only detected chemicals are shown in this table.
[b] The 95% UCL, distribution, and method were taken from the ProUCL output when statistics were generated for the 95% UCL.
[c] The Exposure Point Concentration (EPC) is the minimum of the 95% UCL Concentration and the Maximum Detected Concentration.
-- = Not applicable. Mean, standard deviaion , distribution and UCL were not calculated for data sets with fewer than 11 detections.
% = percent
ug/L = microgram per liter
EPA = Environmental Protection Agency
UCL = upper confidence limit

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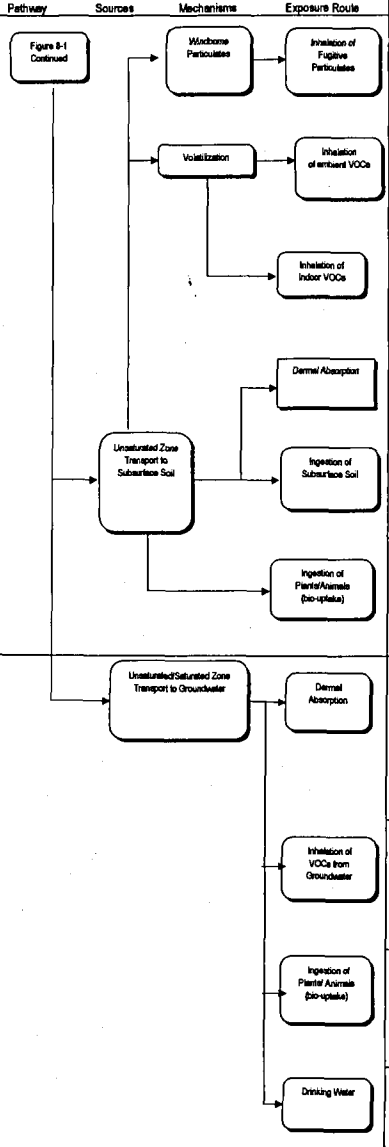
FIGURE 8-1: *Conceptual Site Model for Anomaly Area 3*



Pathway	Contributing Sources	Transport Mechanisms	Exposure Route	Receptors: Current Land Use: On-site Escorted Visitors (Adult/Juvenile)	Current Land Use: Off-site Residents and Agricultural Workers	Future Land Use: *Off-site Residents and Workers*	Future Land Use: *On-Site Residents (Adult/Child)*	Future Land Use: On-site Industrial Workers	Future Land Use: On-site Construction Workers	Future Land Use: On-site Escorted Visitors (Adult/Juvenile)	Future Land Use: On-site Agricultural Worker	Future Land Use: On-site Recreational User (Adult/Juvenile)	Rationale
Figure 8-1 Continued		Windborne Particulates	Inhalation of Fugitive Particulates	Incomplete	Incomplete	Insignificant	Potentially Complete	Potentially Complete	Potentially Complete	Incomplete	Potentially Complete	Incomplete	Inhalation of contaminated particulates is incomplete for current receptors and future escorted visitors and future recreational visitors since these receptors are not (or would not be) exposed to subsurface soil. Exposure pathway is potentially complete for future on-site residents, industrial workers and construction workers. Due to the expected degree of dispersion, exposure for future off-site receptors is insignificant.
		Volatilization	Inhalation of ambient VOCs	Potentially Complete	Insignificant	Insignificant	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Inhalation of VOCs is insignificant for current off-site receptors due to dispersion of airborne contaminants. Exposure is potentially complete for current visitors and all future on-site receptors due to soil vapor migration.
			Inhalation of Indoor VOCs	Incomplete	Incomplete	Insignificant	Potentially Complete	Potentially Complete	Incomplete	Incomplete	Incomplete	Incomplete	Exposure to VOCs in indoor air is limited to those receptors who spend time indoors, namely future on-site residents and future on-site industrial workers. off-site migration of VOCs in soil vapor and subsequent exposure for off-site receptors is likely insignificant.
	Unsaturated Zone Transport to Subsurface Soil		Dermal Absorption	Incomplete	Incomplete	Incomplete	Potentially Complete	Potentially Complete	Potentially Complete	Incomplete	Potentially Complete	Incomplete	Direct contact with subsurface soil is potentially complete for future construction workers, residents, industrial workers and agricultural workers as excavation or digging activities below 2 feet is possible. Pathway is considered incomplete for current and future escorted visitors and future recreational users since these receptors cannot directly interface subsurface soil.
			Ingestion of Subsurface Soil	Incomplete	Incomplete	Incomplete	Potentially Complete	Potentially Complete	Potentially Complete	Incomplete	Potentially Complete	Incomplete	
			Ingestion of Plants/Animals (bio-uptake)	Incomplete	Incomplete	Incomplete	Insignificant	Incomplete	Incomplete	Incomplete	Insignificant	Incomplete	There are no current agricultural activities on-site. Exposure is insignificant relative to other pathways for future residents and agricultural workers but incomplete for future visitors, industrial workers, construction workers and recreational users as they are not expected to engage in gardening or other agricultural activities.
	Unsaturated/Saturated Zone Transport to Groundwater		Dermal Absorption	Incomplete	Incomplete	Incomplete	Potentially Complete	Potentially Complete	Incomplete	Incomplete	Potentially Complete	Incomplete	Current and future escorted visitor and future recreational user are not *expected to contact groundwater such that exposure pathway is incomplete.* Future construction workers are also not expected to contact groundwater since the depth to groundwater is over 25 feet. Impacted groundwater on-site has not migrated to current off-site receptors. Future exposure to groundwater is potentially complete for future on-site residents, future on-site industrial *workers and future on-site agricultural workers; however, groundwater* is only evaluated for its most beneficial (residential) use.
			Inhalation of VOCs from Groundwater	Insignificant	Insignificant	Insignificant	Potentially Complete	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Inhalation of VOCs in ambient air that have migrated from groundwater is insignificant relative to other pathways for all current and future receptors except future on-site residents. Future exposure to groundwater may lead to significant inhalation of VOCs in ambient air by future on-site residents during showering events.
			Ingestion of Plants/ Animals (bio-uptake)	Incomplete	Incomplete	Incomplete	Insignificant	Incomplete	Incomplete	Incomplete	Insignificant	Incomplete	Groundwater may potentially be used for irrigation purposes. While exposure is possible for future on-site agricultural worker and future on-site residents, the pathway is considered insignificant relative to other exposure pathways. off-site receptors are not potentially exposed via this exposure pathway since impacted groundwater has not migrated to offsite wells. No other receptor is expected to engage in gardening or other agricultural activity.
			Drinking Water	Incomplete	Incomplete	Incomplete	Potentially Complete	Potentially Complete	Incomplete	Incomplete	Potentially Complete	Incomplete	Ingestion is currently incomplete for off-site residents and agricultural workers since impacted groundwater from the site has not migrated to off-site wells. Pathway is potentially complete for future on-site residents, industrial workers and on-site agricultural workers, however, groundwater is only evaluated for its most beneficial (residential) use. Current and future escorted visitors, future construction workers and future recreational users are not expected to contact groundwater or use groundwater as a source for drinking water.

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FIGURE 8-1: Conceptual Site Model for Anomaly Area 3

Pathway	Contributing Sources	Transport Mechanisms	Exposure Route	Receptors: Current Land Use: On-site Escorted Visitors (Adult/Juvenile)	Current Land Use: Off-site Residents and Agricultural Workers	Future Land Use: Off-site Residents and Workers	Future Land Use: On-Site Residents (Adult/Child)	Future Land Use: On-site Industrial Workers	Future Land Use: On-site Construction Workers	Future Land Use: On-site Escorted Visitors (Adult/Juvenile)	Future Land Use: On-site Agricultural Worker	Future Land Use: On-site Recreational User (Adult/Juvenile)	Rationale
Air		Windborne Particulates	Inhalation of Fugitive Particulates	Potentially Complete	Insignificant	Insignificant	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Inhalation of contaminated dust and VOCs is potentially complete for all on-site receptors, but is insignificant for off-site receptors because of dispersion.
		Volatilization	Inhalation of VOCs	Potentially Complete	Insignificant	Insignificant	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	
Surface Soil	Surface Soil	Direct Contact	Dermal Contact with Soil	Potentially Complete	Incomplete	Incomplete	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Direct contact with surface soil is potentially complete for on-site receptors including current and future escorted visitors, future industrial workers, construction workers, residents, agricultural workers and recreational users. Pathway is incomplete for any off-site receptor.
			Incidental Ingestion of Soil	Potentially Complete	Incomplete	Incomplete	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	Potentially Complete	
			Ingestion of Plants/Animals (bio-uptake)	Incomplete	Incomplete	Incomplete	Insignificant	Incomplete	Incomplete	Incomplete	Insignificant	Incomplete	There are no current agricultural activities on-site. Exposure is insignificant relative to other pathways for future residents and agricultural workers but incomplete for future visitors, industrial workers, construction workers and recreational users as they are not expected to engage in gardening or other agricultural activities.
		Surface Water Runoff	Dermal Absorption	Incomplete	Incomplete	Insignificant	Insignificant	Insignificant	Insignificant	Incomplete	Insignificant	Insignificant	Direct contact with surface water is incomplete for escorted visitors and off-site receptors as they are not expected to directly contact surface water. This exposure pathway is insignificant relative to other exposure pathways for all other receptors. The inhalation of VOCs from surface water is insignificant relative to other pathways for all receptors. The consumption of food irrigated with surface water is insignificant relative to other exposure pathways for off-site receptors, future on-site residents and agricultural workers and incomplete for all other receptors who are not expected to engage in gardening or other agricultural activities.
			Incidental Ingestion	Incomplete	Incomplete	Insignificant	Insignificant	Insignificant	Insignificant	Incomplete	Insignificant	Insignificant	
			Inhalation of VOCs	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	
	Continued on Next Page		Ingestion of Plants/Animals (bio-uptake)	Incomplete	Insignificant	Insignificant	Insignificant	Incomplete	Incomplete	Incomplete	Insignificant	Incomplete	

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A complete exposure pathway must have all of the following elements:

- Sources and type of chemicals present,
- Affected media,
- Chemical release and transport mechanisms (e.g., spillage and advection, vaporization),
- Known and potential routes of exposure (e.g., ingestion, dermal contact, inhalation),
- Known or potential human and environmental receptors (e.g., residents, workers).

The absence of any one of these elements results in an incomplete exposure pathway. Thus, for an incomplete pathway with no potential human exposure, the potential for adverse health effects would be deemed negligible and does not warrant further evaluation. Figure 8-1 is the CSM for current and anticipated future receptors potentially exposed to COPCs in surface soil, subsurface soil, and groundwater, as well as surface water and sediment (ephemeral stream) associated with AA 3. The exposure pathways for each scenario and each receptor shown in the CSM are described in Section 8.4.3.

8.4.3 Exposure Pathways

Exposure pathways are specifically associated with the environmental medium that is being evaluated. In a generic context, soil, water, and air pathways may facilitate exposure; each of these might result in intake by applicable exposure routes, such as ingestion, dermal absorption, or inhalation. In most settings, exposure pathways may be incomplete or complete, as discussed in Section 8.4.2.

Although receptors may be exposed through various pathways, the degree of exposure from each pathway is not equal, such that some exposure pathways contribute more significantly (i.e., provide a higher relative contribution to the overall chemical intake or dose) while other pathways contribute so little to the overall chemical intake that they can be considered insignificant. Factors that determine whether an exposure pathway is insignificant include:

- the likelihood that the exposure is expected to occur;
- frequency with which the exposure is expected to occur; and
- the level or degree of exposure anticipated.

Each of these factors is weighed for all potentially complete exposure pathways to determine those which are most likely to contribute significantly to the overall risk and those exposure pathways which, though may be potentially complete, would contribute so little to the overall risk that they can be omitted from the quantitation of risks. Any exposure pathway identified as insignificant relative to other pathways is due the low probability of occurrence, a low frequency of occurrence, or a low anticipated level of exposure. The rationale for making this determination is presented below.

8.4.3.1 Incomplete Exposure Pathways

Of those exposure pathways that are presented in Figure 8-1, several have been deemed to be incomplete, insignificant, or not applicable to the SRA. Thus, these pathways do not warrant quantitative assessment. The following pathways were excluded from the assessment.

- Dermal contact with chemicals in on-site surface soil by current and future off-site workers and future off-site residents is incomplete since off-site receptors are not expected to directly contact on-site surface soils.

- Incidental ingestion of chemicals in on-site surface soil by current and future off-site workers and future off-site residents is incomplete since off-site receptors are not expected to directly contact on-site surface soils.

- Inhalation of VOCs in ambient air from impacted on-site surface soil by current and future off-site workers and future off-site residents is insignificant due to the expected degree of chemical dispersion to off-site locations.

- Inhalation of fugitive particles in contaminated on-site surface soil by current and future off-site workers and future off-site residents is insignificant due to expected degree of particulate dispersion to off-site locations.

- Dermal contact with chemicals in subsurface soil is incomplete for current and future escorted visitors, current and future off-site receptors and future on-site recreational users since direct contact is unlikely.

- Incidental ingestion of chemicals in subsurface soil is incomplete for current and future escorted visitors, current and future off-site receptors and future on-site recreational users since direct contact is unlikely.

- Inhalation of VOCs in ambient air from impacted on-site subsurface soil by current and future off-site workers and future off-site residents is insignificant due to the expected degree of chemical dispersion to off-site locations.

- Inhalation of VOCs in indoor air from impacted on-site subsurface soil is incomplete for all outdoor receptors including current and future escorted visitors, future construction workers, current off-site and future on-site agricultural workers and future on-site recreational users. Off-site migration of VOCs in soil vapor and subsequent indoor exposure for off-site residents and workers is likely insignificant.

- Inhalation of fugitive dust particles from contaminated on-site subsurface soil is incomplete for current receptors since subsurface soil is not currently exposed. This exposure pathway is also incomplete for future escorted visitors and future on-site recreational workers who would not be exposed to subsurface soil. Exposure for future off-site workers and future off-site residents is insignificant due to expected degree of particulate dispersion to off-site locations.

- Bioaccumulation and consumption of food contaminated from surface soil and subsurface soil and associated leachate is an insignificant secondary pathway for future on-site residents (adults/children) and future on-site agricultural workers relative to other, more direct exposure pathways such as soil ingestion and dermal contact.

- Bioaccumulation and consumption of food contaminated from surface soil and subsurface soil and associated leachate is incomplete for future recreational users as well as for future industrial workers, future construction workers, current and future off-site agricultural

workers, and current and future escorted visitors since these receptors are not expected to be engaged in gardening or other agricultural activities at on-site locations.

- Incidental ingestion of chemicals in groundwater is incomplete for current and future escorted visitors and future on-site recreational users since these receptors are not expected to directly contact groundwater. With the depth to groundwater over 25 feet, future construction workers are also not expected to contact groundwater. Additionally, this exposure pathway is incomplete for off-site receptors since impacted groundwater from the site has not migrated to off-site wells.

- Dermal contact with chemicals in groundwater is incomplete for current and future escorted visitors and future on-site recreational users since these receptors are not expected to directly contact groundwater.

- Bioaccumulation and consumption of food contaminated from groundwater is insignificant relative to other exposure pathways for future on-site residents and future on-site agricultural workers. The exposure pathway is incomplete for future recreational users, future industrial workers, future construction workers, and current and future escorted visitors since these receptors are not expected to be engaged in gardening or other agricultural activities at on-site locations. Since impacted groundwater has not migrated to off-site wells, this exposure pathway is also incomplete for current and future off-site receptors.

- Dermal contact with chemicals in surface water is incomplete for current and future escorted visitors and off-site receptors since these receptors are not expected to directly contact surface water. This exposure pathway is insignificant relative to other exposure pathways for the future on-site residents (adults/children) as well as future industrial workers, future construction workers, future on-site agricultural workers and future on-site recreational users.

- Incidental ingestion of chemicals in surface water is incomplete for current and future escorted visitors and off-site receptors since these receptors are not expected to directly contact surface water. This exposure pathway is insignificant relative to other exposure pathways for the future on-site residents (adults/children) as well as future industrial workers, future construction workers, future on-site agricultural workers and future on-site recreational users.

- Inhalation of VOCs in contaminated surface water is insignificant relative to other exposure pathways for current and future escorted visitors (adults/juveniles), future on-site residents (adults/children) as well as future industrial workers, future construction workers, current and future off-site agricultural workers and future on-site recreational users.

- Bioaccumulation and consumption of food contaminated from surface water is insignificant relative to other exposure pathways for off-site receptors, future on-site residents and future on-site agricultural workers. The exposure pathway is incomplete for future recreational users, future industrial workers, future construction workers, and current and future escorted visitors since these receptors are not expected to be engaged in gardening or other agricultural activities at on-site locations.

8.4.3.2 POTENTIALLY COMPLETE EXPOSURE PATHWAYS

Potential exposures to COPCs in surface and subsurface soil-derived pathways require quantitative assessment. The following exposure pathways are considered complete and require evaluation:

- Dermal contact with chemicals in surface soil by future on-site residents (adults/children), future on-site industrial workers, future on-site construction workers, current and future escorted visitors, future on-site agricultural workers, and future on-site recreational visitors.
- Incidental ingestion of chemicals in surface soil by future on-site residents (adults/children), future on-site industrial workers, future on-site construction workers, current and future escorted visitors, future on-site agricultural workers, and future on-site recreational visitors.
- Inhalation of VOCs in ambient air from impacted surface soil by future on-site residents (adults/children), future on-site industrial workers, future on-site construction workers, current and future escorted visitors and future on-site recreational workers.
- Inhalation of fugitive particles in contaminated surface soil by future on-site residents (adults/children), future on-site industrial workers, future on-site construction workers, current and future escorted visitors, future on-site agricultural workers and future on-site recreational visitors.
- Dermal contact with chemicals in subsurface soil by future on-site residents (adults/children) future on-site industrial workers, future on-site construction workers and future on-site agricultural workers.
- Incidental ingestion of chemicals in subsurface soil by future on-site residents (adults/children) future on-site industrial workers, future on-site construction workers and future on-site agricultural workers.
- Inhalation of fugitive dust particles from contaminated subsurface soil by future on-site residents (adults/children), future on-site industrial workers, future on-site construction workers and future on-site agricultural workers.
- Inhalation of VOCs in ambient air from impacted subsurface soil by future on-site residents (adults/children), future on-site industrial workers, future on-site construction workers, current escorted visitors, future off-site agricultural workers and future on-site recreational users.
- Inhalation of VOCs in indoor air as a result of VOC migration from impacted subsurface soil by future on-site residents and industrial workers.
- Ingestion of chemicals in groundwater by future on-site residents (adult/children), future on-site industrial workers and future on-site agricultural workers through the use of a future on-site well.
- Dermal contact with chemicals in groundwater by future on-site residents (adult/children), future on-site industrial workers and future on-site agricultural workers through the use of a future on-site well.
- Inhalation of VOCs in groundwater by future potential on-site residents (adult/children) during showering events.
- Inhalation of VOCs in indoor air as a result of VOC migration from impacted groundwater by future on-site residents and future on-site industrial workers who may live or work indoors.

While exposure to groundwater through ingestion, dermal absorption or inhalation of VOC is potentially complete for some of the other site-specific receptors, only the resident is potentially exposed to a significant degree through all three pathways. Therefore, the evaluation of groundwater for potable residential use is necessarily protective of the other potential uses. For that reason, groundwater is evaluated only for its most beneficial, residential use and not carried forward to all receptors.

Special Case – Ambient Air

Ambient air and soil gas samples have been collected from the landfill area. These samples were collected to characterize ambient air concentrations that were a result of chemicals in the soil and groundwater media and to illustrate concentrations to which a human receptor might be exposed. These data are summarized in Tables 6-6 through 6-8 of the RI report and discussed in Section 6. Only methane exceeded the LEL.

Methane migration from the site was evaluated in two ways. Surface gas measurements from the waste placement area surface were compared to ambient air measurements made at the waste area perimeter. In addition, perimeter soil gas (subsurface) measurements were used to evaluate potential gas migration beneath the ground surface. The field screening results for the subsurface soil gas samples showed non-detect methane concentrations at 25 of 33 sampling locations, with detected concentrations (at 8 locations) ranging from 6,000 ppm_v to 230,000 ppm_v. The 8 locations with detectable methane concentrations were confined to the central portion of the site, with only 3 central sampling locations (out of 33 total locations) exceeding the Title 27 CCR stipulated LEL of 50,000 ppm_v for methane. These 8 locations were not clustered, which would have indicated a locus of methane gas accumulation. Based on the presence of non-detect locations interspersed among the 8 detected locations, the likelihood for a large area of significant methane accumulation is considered low.

As discussed in Sections 6.2 and 6.3, methane readings for ambient air at AA 3 were all less than 1 ppm_v. Ambient air samples collected at the waste area perimeter were also analyzed for methane and all samples had methane concentrations less than 1 ppm_v. None of the 33 shallow soil gas samples collected from within the debris placement boundary, as part of the soil gas survey, had detected concentrations of methane. Similarly, none of the 43 subsurface soil gas samples (also collected from within the debris placement boundary as part of the soil gas survey) had any detections of 51 VOC analytes. No methane was detected in any of the perimeter soil gas wells during three rounds of sampling.

Concentrations of methane gas at the surface are low and any potential contact/exposure with this gas would only occur in areas where there would be soil disturbance. As detailed in the letter to the CIWMB (DON 2004c), passive gas controls would be a part of the remedy for the site. The design of the gas control system will be such that it could be changed to active gas controls if the threshold values are exceeded at the perimeter of the site. Therefore, the likelihood of methane accumulation in the center or perimeter of the site is considered low.

As a toxicant, methane is biologically inactive and essentially non-toxic. The primary concern, however, with exposure to methane is the potential for vapors to accumulate in locations at levels in excess of its LEL. Since the site in question is currently undeveloped with little or no potential for vapor accumulation to occur, the safety hazard associated with methane is expected to be negligible. Moreover, less than 15 percent of the soil gas samples contained methane at levels above the detection limit.

These data suggest that area-wide methane emissions are not substantial.

8.4.3.3 Summary of Sources and Exposure Pathways

A description of exposure pathways reasonably anticipated for each impacted medium at the site is described.

Surface Soil. Significant potential pathways for human exposure at the site include direct contact by dermal absorption and incidental ingestion of COPCs in surface soil. The inhalation of VOCs was conservatively included despite that chemicals of this constituent class are not persistent in the shallow soil environment unless a current VOC source is present at shallow depths. The inhalation of other compounds via particulates is also included.

Subsurface Soil. Exposure to chemicals in subsurface soil at this site may occur via direct contact with the soil (by dermal adsorption or incidental ingestion), and inhalation of VOCs and particulates during construction activities or while future potential residents are gardening. Future industrial workers may also be potentially exposed if subsurface soil is brought to the surface by future excavation activities. While the lack of VOCs in subsurface soil gas samples at the perimeter of the landfill area suggests that the indoor air pathway may be of minor significance relative to other exposure pathway, potential exposure to volatile chemicals in indoor air was evaluated for future on-site residents and industrial workers who live or may work indoors.

Some of the chemicals detected in the subsurface could potentially leach into the groundwater; however, the potential is minimal for most COPCs. Most inorganics have limited mobility in soil of neutral pH, particularly soil with high silt and clay content. Dioxins tend to be relatively immobile because of their low solubility and high affinity for soil. Long-chain petroleum hydrocarbons (i.e., diesel and oil range) tend to adsorb strongly to soil.

Groundwater. Exposure to chemicals in groundwater may be through tap water ingestion or dermal contact and inhalation of VOCs (if present) during household use. Although unlikely, groundwater beneath the site may potentially be used as a source of drinking water or for irrigation purposes in the future. However, exposure to contaminants in food items that have been irrigated or watered with impacted groundwater is considered insignificant relative to exposure through potential direct use of the impacted groundwater.

8.4.4 Estimation of Exposure Point Concentrations

EPCs are used in both the RME and average (or central tendency exposure [CTE]) risk characterization. When conducting exposure evaluations for any receptor, the reported concentrations of a chemical in soil do not change – only the exposure pattern or conditions that define the exposure changes. Therefore, the same EPC is used in both CTE and RME risk characterization based on EPA guidance (EPA 1992b). When data sets are relatively small (less than or equal to 10 samples), there is great uncertainty in the calculated 95 percent UCL; therefore, the 95 percent UCL is only generated for data sets with 11 or more detections. In general, when the maximum detected concentration exceeds the 95 percent UCL, the 95 percent UCL is chosen as the EPC. Alternatively, when the maximum value is less than the 95 percent UCL, the maximum value is chosen as the EPC. According to EPA's most recent guidance for calculating UCLs for EPCs (EPA 2002d), "defaulting to the maximum value of small data sets" may be the best approach to use in evaluating risk at a site. To derive the 95 percent UCL and to minimize uncertainties that may arise with the use and application of various statistical software packages, ProUCL (Version 3) (EPA

2004d) was used to calculate the 95 percent UCL. To simplify, the following rules were applied when choosing the EPC:

3. When the number of detections was less than or equal to 10, the maximum detected concentration was used as the EPC.
4. When the number of detections was greater than or equal to 11, the 95 percent UCL was calculated using the ProUCL software; the appropriate 95 percent UCL was selected based on the recommended 95 percent UCL from the ProUCL results.
5. The lesser value of the calculated 95 percent UCL and the maximum detected concentration was chosen as the EPC.

There are two special case chemicals for which EPCs are calculated based on the potential risks that could occur from the additive nature of these special case chemicals. The special case chemicals are dioxins/furans and PAHs. The text that follows describes the process by which a "total" EPC is calculated. A discussion of the toxicity of these chemicals and the need for deriving a "total" EPC for these two groups of chemicals is presented in Section 8.5.

Dioxins/Furans

Dioxins and furans were detected in soil samples collected at AA 3. A residential PRG is only available for 2,3,7,8-TCDD. A provisional but generally accepted method exists that allows conversion of analytical concentrations to toxic equivalents relative to 2,3,7,8–TCDD. Therefore, the maximum detected concentration of each dioxin/furan congener is multiplied by a WHO-based TEFs to convert the concentration to an equipotent concentration of TCDD (Van den Berg, 2006). Available TEFs for dioxins and furans along with the maximum TCDD-equivalent concentrations for each dioxin/furan congener are presented in Tables 8-6 and 8-7 for surface and subsurface soil, respectively. The converted equipotent concentrations were then summed to obtain a maximum TEQ concentration. The TEQ approach is described mathematically in EPA guidance (2000c) as

$$Total\ \ Toxicity\ \ Equivalence\ \ (TEQ) = \sum_{n=1}^{k} C_n \quad * \quad TEF_n$$

Where:

C_n = Concentration of the individual congener in the complex mixture under analysis

TEF = Toxicity equivalency factor of the individual congener

Polycyclic Aromatic Hydrocarbons

PAHs were detected in the soil media at AA 3. The B[a]P equivalent (eq) concentration for the seven carcinogenic PAHs (EPA 1993c) is calculated using the same algorithm as the TCDD TEQ. The B[a]Peq is defined as:

$$Benzo(a)pyrene\ Equivalent\ \ (B[a]P_{eq}) = \sum_{n=1}^{k} C_n \quad * \quad RPF_n$$

Where:

C_n = Concentration of the individual carcinogenic PAH in the PAH mixture under analysis

RPF_n = Relative potency factor of the individual carcinogenic PAH

RPFs for the various carcinogenic PAHs have been assigned by EPA (1993c) and by the State of California Office of Environmental Health Hazard Assessment (OEHHA) (2002 as amended). Differences exist in the assigned RPFs for chrysene and dibenz[a,h]anthracene. The B[a]P equivalent concentrations for the surface soil using EPA RPFs are presented in Table 8-8. Because carcinogenic PAHs were analyzed by two methods (8270C and 8270-SIM), the B[a]P equivalent concentrations for the subsurface soil are presented by method in Tables 8-9 and 8-10. No additional subsurface soil samples were analyzed for carcinogenic PAHs using Method 8270-SIM; therefore the same B[a]P equivalent concentration (via Method 8270-SIM) is used for both surface soil (Table 8-8) and subsurface soil (Table 8-10). B[a]P equivalent concentrations for surface soil and subsurface soil (by method) using RPFs from California OEHHA are presented as Table E1-1 through E1-3 in Appendix E1.

Carcinogenic PAHs were also detected in a single groundwater sample. The B[a]P equivalent concentration for this sample using EPA RPFs is presented in Table 8-11. Using California OEHHA RPFs, the B[a]P equivalent concentration in groundwater is presented in Table E1-4 of Appendix E1.

8.5 RISK-BASED SCREENING EVALUATION

The human health RBS included the following steps:

Development of a CSM. Analysis of the CSM identified potentially complete exposure pathways for both current and future land uses (Section 8.4.3).

Identification of Relevant Data Sets. For this risk assessment, the following media were evaluated:

- Surface soils (0-foot to 1-foot bgs)
- Subsurface soils (0-foot to 10 feet bgs)
- Groundwater

Duplicate sample results were averaged according to the procedure in Section 8.2.3.1. Nondetected results with reporting limits exceeding two times the maximum detected concentration were excluded from the data sets. TPH analytical data were screened against non-risk-based criteria but were not included in the quantitative evaluation. As detailed in Section 8.4.4, B[a]P equivalent concentrations were determined by summing the product of individual carcinogenic PAHs with respective relative potency factors (RPFs). A conservative dioxin TEQ (or more specifically, 2,3,7,8-TCDD TEQ) was determined for surface and subsurface soil by summing the product of 17 individual dioxin/furan congeners with respective 2,3,7,8-TCDD TEFs.

Identification of COPCs. Any chemical detected in the soil or groundwater medium was considered a COPC for the screening RBS for the site. As previously stated, exposure to surface water and sediment media is expected to be insignificant, therefore the media were not quantitatively evaluated.

Table 8-6: Quantification of 2,3,7,8-TCDD Concentrations for Surface Soil (0-foot to 1-foot bgs) Samples at Anomaly Area 3

Dioxin/Furan Congeners	TEF Value	No. of Detects	No. of Samples	Frequency of Detects (%)	Sample_MaxDetect Location	MinDetect (pg/g)	MaxDetect[a] (pg/g)	TEF Concentration (pg/g)
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	3.00E-04	9	9	100%	AA3-HA26SS-S01-D001'	0.821	7.19	2.16E-03
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	3.00E-04	9	9	100%	AA3-HA26SS-S01-D001'	8.93	70.8	2.12E-02
1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.00E-02	9	9	100%	AA3-HA26SS-S01-D001'	0.394	7.26	7.26E-02
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	1.00E-02	9	9	100%	AA3-HA26SS-S01-D001'	0.947	10.11	1.01E-01
1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.00E-02	2	9	22%	AA3-HA26SS-S01-D001'	0.116	0.263	2.63E-03
1,2,3,4,7,8-Hexachlorodibenzofuran	1.00E-01	8	9	89%	AA3-HA26SS-S01-D001'	0.0617	1.46	1.46E-01
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	1.00E-01	4	9	44%	AA3-HA26SS-S01-D001'	0.0835	0.418	4.18E-02
1,2,3,6,7,8-Hexachlorodibenzofuran	1.00E-01	8	9	89%	AA3-HA26SS-S01-D001'	0.0829	6.88	6.88E-01
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	1.00E-01	8	9	89%	AA3-HA26SS-S01-D001'	0.117	1.7	1.70E-01
1,2,3,7,8,9-Hexachlorodibenzofuran	1.00E-01	6	9	67%	AA3-HA26SS-S01-D001'	0.193	0.976	9.76E-02
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	1.00E-01	8	9	89%	AA3-HA26SS-S01-D001'	0.115	0.854	8.54E-02
1,2,3,7,8-Pentachlorodibenzofuran	3.00E-02	6	9	67%	AA3-HA26SS-S01-D001'	0.0744	0.918	2.75E-02
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	1.00E+00	6	9	67%	AA3-HA26SS-S01-D001'	0.0791	0.506	5.06E-01
2,3,4,6,7,8-Hexachlorodibenzofuran	1.00E-01	8	9	89%	AA3-HA26SS-S01-D001'	0.134	13	1.30E+00
2,3,4,7,8-Pentachlorodibenzofuran	3.00E-01	9	9	100%	AA3-HA26SS-S01-D001'	0.081	29.4	8.82E+00
2,3,7,8-Tetrachlorodibenzofuran	1.00E-01	9	9	100%	AA3-HA26SS-S01-D001'	0.0617	2.58	2.58E-01
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	1.00E+00	6	9	67%	AA3-HA26SS-S01-D001'	0.103	0.2	2.00E-01
Heptachlorodibenzofurans	NA	9	9	100%	AA3-HA26SS-S01-D001'	0.417	13.9	NA
Heptachlorodibenzo-P-Dioxins	NA	9	9	100%	AA3-HA26SS-S01-D001'	1.9	22	NA
Hexachlorodibenzofurans	NA	9	9	100%	AA3-HA26SS-S01-D001'	0.442	178	NA
Hexachlorodibenzo-P-Dioxins	NA	8	9	89%	AA3-HA26SS-S01-D001'	0.413	18.8	NA
Pentachlorodibenzofurans	NA	9	9	100%	AA3-HA26SS-S01-D001'	0.681	658	NA
Pentachlorodibenzo-P-Dioxins	NA	7	9	78%	AA3-HA26SS-S01-D001'	0.0444	4.86	NA
Tetrachlorodibenzofurans	NA	9	9	100%	AA3-HA26SS-S01-D001'	0.324	320	NA
Tetrachlorodibenzo-P-Dioxins	NA	5	9	56%	AA3-HA26SS-S01-D001'	0.123	0.922	NA
Total 2,3,7,8-TCDD[b]								**1.25E+01**

Notes:

[a] Maximum Detected Value.

[b]Total 2,3,7,8-TCDD equivalent is the sum of the individual congener concentrations adjusted by the appropriate TEF.

Because there were fewer than 11 detected concentrations of a dioxin/furan congener AND because all of the maximum detected concentrations of a dioxin/furan congener were from the same surface sample location, the maximum total 2,3,7,8-TCDD equivalent is derived from the maximum detected concentrations in this table, as adjusted by the appropriate TEF.

TEF = Toxicity equivalency factor. TEFs were taken from Van den Berg et al. 2006.

% = percentage
pg/g = picagrams per gram
No. = number

NA = not analyzed
min = minimum
max = maximum

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Table 8-7: Quantification of 2,3,7,8-TCDD Concentrations for Subsurface Soil (0-foot to 10 feet bgs) Samples at Anomaly Area 3

Dioxin/Furan Congeners	TEF Value	No. of Detects	No. of Samples	Frequency of Detects (%)	Sample_MaxDetect Location	MinDetect	MaxDetect[a] (pg/g)	TEF Concentration (pg/g)
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	3.00E-04	11	11	100%	AA3-4E-01	0.821	10	3.00E-03
1,2,3,4,6,7,8,9-Octachlorodibenzo-P-Dioxin	3.00E-04	11	11	100%	AA3-4E-01	8.93	330	9.90E-02
1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.00E-02	9	11	82%	AA3-HA26SS-S01-D001'	0.394	7.26	7.26E-02
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	1.00E-02	11	11	100%	AA3-4E-01	0.947	39	3.90E-01
1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.00E-02	2	11	18%	AA3-HA26SS-S01-D001'	0.116	0.263	2.63E-03
1,2,3,4,7,8-Hexachlorodibenzofuran	1.00E-01	8	11	73%	AA3-HA26SS-S01-D001'	0.0617	1.46	1.46E-01
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	1.00E-01	4	11	36%	AA3-HA26SS-S01-D001'	0.0835	0.418	4.18E-02
1,2,3,6,7,8-Hexachlorodibenzofuran	1.00E-01	8	11	73%	AA3-HA26SS-S01-D001'	0.0829	6.88	6.88E-01
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	1.00E-01	8	11	73%	AA3-HA26SS-S01-D001'	0.117	1.7	1.70E-01
1,2,3,7,8,9-Hexachlorodibenzofuran	1.00E-01	6	11	55%	AA3-HA26SS-S01-D001'	0.193	0.976	9.76E-02
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	1.00E-01	8	11	73%	AA3-HA26SS-S01-D001'	0.115	0.854	8.54E-02
1,2,3,7,8-Pentachlorodibenzofuran	3.00E-02	6	11	55%	AA3-HA26SS-S01-D001'	0.0744	0.918	2.75E-02
1,2,3,7,8-Pentachlorodibenzo-P-Dioxin	1.00E+00	6	11	55%	AA3-HA26SS-S01-D001'	0.0791	0.506	5.06E-01
2,3,4,6,7,8-Hexachlorodibenzofuran	1.00E-01	8	11	73%	AA3-HA26SS-S01-D001'	0.134	13	1.30E+00
2,3,4,7,8-Pentachlorodibenzofuran	3.00E-01	9	11	82%	AA3-HA26SS-S01-D001'	0.081	29.4	8.82E+00
2,3,7,8-Tetrachlorodibenzofuran	1.00E-01	9	11	82%	AA3-HA26SS-S01-D001'	0.0617	2.58	2.58E-01
2,3,7,8-Tetrachlorodibenzo-P-Dioxin	1.00E+00	6	11	55%	AA3-HA26SS-S01-D001'	0.103	0.2	2.00E-01
Heptachlorodibenzofurans	NA	11	11	100%	AA3-HA26SS-S01-D001'	0.417	13.9	NA
Heptachlorodibenzo-P-Dioxins	NA	11	11	100%	AA3-4E-01	1.9	66	NA
Hexachlorodibenzofurans	NA	9	11	82%	AA3-HA26SS-S01-D001'	0.442	178	NA
Hexachlorodibenzo-P-Dioxins	NA	9	11	82%	AA3-HA26SS-S01-D001'	0.413	18.8	NA
Pentachlorodibenzofurans	NA	9	11	82%	AA3-HA26SS-S01-D001'	0.681	658	NA
Pentachlorodibenzo-P-Dioxins	NA	7	11	64%	AA3-HA26SS-S01-D001'	0.0444	4.86	NA
Tetrachlorodibenzofurans	NA	9	11	82%	AA3-HA26SS-S01-D001'	0.324	320	NA
Tetrachlorodibenzo-P-Dioxins	NA	5	11	45%	AA3-HA26SS-S01-D001'	0.123	0.922	NA
Total 2,3,7,8-TCDD[b]								**1.29E+01**

Notes:

[a] Maximum Detected Value.

[b] Total 2,3,7,8-TCDD equivalent is the sum of the individual congener concentrations adjusted by the appropriate TEF.

The total TCDD TEQ was defined by the samples presented in this table, which were the maximum detected congener concentrations based on the following reasons:

1. The majority of the samples that comprise the total 2,3,7,8-TCDD equivalent are from the same surface sample AND because the congeners that contribute the majority of the total 2,3,7,8-TCDD are from the surface soil sample, the maximum concentration as defined in this table were used to derive the total 2,3,7,8-TCDD value.
2. Only 5 of the detected 25 congeners had 11 detections, which is the minimum number of detections for generating a 95UCL.
3. The congeners that contributed the most to the total TCDD TEQ were from the same location and were up to five orders of magnitude greater than other congeners.
4. Based on reasons 1, 2, and 3 above, the use of the maximum concentrations would not be an underestimate of risk whether any 95UCL were generated because:
   a. The lesser of the maximum detection or the 95UCL is used when selecting an EPC
   b. The use of the maximum detection when the 95UCL was actually the lesser value would result in an overestimate of risk

% = percentage
pg/g = picagrams per gram
min = minimum
max = maximum
NA = not analyzed
TEF = Toxicity equivalency factor. TEFs were taken from Van den Berg et al. 2006.
TEQ = toxicity equivalency quotient

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Table 8-8: Quantification of B[a]P Equivalent Concentrations (Method 8270 SIM) for Maximum Detections in Surface Soil (0-foot to 1-foot bgs) Samples at Anomaly Area 3 Using EPA Relative Potency Factors

PAHs[a]	RPF[b]	Maximum Detection (mg/kg)	Maximum Reporting Limit	BaP Equivalent Concentration (mg/kg)
Benz(a)anthracene	0.1	0.73	32	7.30E-02
Benzo(a)pyrene	1.0	1.03	32	1.03E+00
Benzo(b)fluoranthene	0.1	1.79	32	1.79E-01
Benzo(k)fluoranthene	0.1	0.51	32	5.10E-02
Chrysene	0.001	0.87	32	8.70E-04
Dibenz(a,h)anthracene	1.0	0.097	32	9.70E-02
Indeno(1,2,3-cd)pyrene	0.1	0.46	32	4.60E-02
Total B[a]P Equivalent Concentration[c]				**1.48E+00**

Notes:

[a]These PAHs are the seven carcinogenic PAHs as defined in EPA 1993c.

[b]RPF - relative potency factor; RPF taken from EPA 1993c.

[c]The total B[a]P equivalent concentration is the sum of the individual PAH in B[a]P equivalent concentrations.

B[a]P = benzo(a)pyrene

bgs = below ground surface

EPA = Environmental Protection Agency

mg/kg = milligrams per kilogram

PAHs = polynucleararomatic hydrocarbons

Reference:

EPA. 1993c. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. Final Draft. ECAO-CIN-842. Environmental Criteria and Assessment Office. Cincinnati. March.

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Table 8-9: Quantification of B[a]P Equivalent Concentrations (Method 8270C) for Maximum Detections in Subsurface Soil (0-foot to 10 feet bgs) Samples at Anomaly Area 3 Using EPA Relative Potency Factors

PAHs[a]	RPF[b]	Maximum Detection (mg/kg)	Maximum Reporting Limit	B[a]P Equivalent Concentration (mg/kg)
Benz(a)anthracene	0.1	0.27	32	2.70E-02
Benzo(a)pyrene	1.0	0.23	32	2.30E-01
Benzo(b)fluoranthene	0.1	0.44	32	4.40E-02
Benzo(k)fluoranthene	0.1	--	32	--
Chrysene	0.001	0.25	32	2.50E-04
Dibenz(a,h)anthracene	1.0	--	32	--
Indeno(1,2,3-cd)pyrene	0.1	0.081	32	8.10E-03
Total BaP Equivalent Concentration[c]				**3.09E-01**

Notes:

[a]These PAHs are the seven carcinogenic PAHs as defined in EPA 1993c.

[b]RPF - relative potency factor; RPF taken from EPA 1993c.

[c]The total B[a]P equivalent concentration is the sum of the individual PAH in B[a]P equivalent concentrations.

B[a]P = benzo(a)pyrene

bgs = below ground surface

EPA = Environmental Protection Agency

mg/kg = milligrams per kilogram

PAHs = polynucleararomatic hydrocarbons

Reference:

EPA. 1993c. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. Final Draft. ECAO-CIN-842. Environmental Criteria and Assessment Office. Cincinnati. March.

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Table 8-10: Quantification of B[a]P Equivalent Concentrations (Method 8270 SIM) for Maximum Detections in Subsurface Soil (0-foot to 10 feet bgs) Samples at Anomaly Area 3 Using EPA Relative Potency Factors

PAHs[a]	RPF[b]	Maximum Detection (mg/kg)	Maximum Reporting Limit	B[a]P Equivalent Concentration (mg/kg)
Benz(a)anthracene	0.1	0.73	32	7.30E-02
Benzo(a)pyrene	1.0	1.03	32	1.03E+00
Benzo(b)fluoranthene	0.1	1.79	32	1.79E-01
Benzo(k)fluoranthene	0.1	0.51	32	5.10E-02
Chrysene	0.001	0.87	32	8.70E-04
Dibenz(a,h)anthracene	1.0	0.097	32	9.70E-02
Indeno(1,2,3-cd)pyrene	0.1	0.46	32	4.60E-02
Total BaP Equivalent Concentration[c]				**1.48E+00**

Notes:

[a]These PAHs are the seven carcinogenic PAHs as defined in EPA 1993c.

[b]RPF - relative potency factor; RPF taken from EPA 1993c.

[c]The total B[a]P equivalent concentration is the sum of the individual PAH in B[a]P equivalent concentrations.

B[a]P = benzo(a)pyrene

bgs = below ground surface

EPA = Environmental Protection Agency

mg/kg = milligrams per kilogram

PAHs = polynucleararomatic hydrocarbons

Reference:

EPA. 1993c. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. Final Draft. ECAO-CIN-842. Environmental Criteria and Assessment Office. Cincinnati. March.

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Table 8-11: Quantification of B[a]P Equivalent Concentrations (Method 8270-SIM) for Maximum Detections in Groundwater Samples at Anomaly Area 3 Using EPA Relative Potency Factors

PAHs[a]	RPF[b]	Maximum Detection (ug/L)	Maximum Reporting Limit	B[a]P Equivalent Concentration (ug/L)
Benz(a)anthracene	0.1	0.04	0.5	4.00E-03
Benzo(a)pyrene	1.0	0.46	0.2	4.60E-01
Benzo(b)fluoranthene	0.1	0.6	0.5	6.00E-02
Benzo(k)fluoranthene	0.1	--	0.5	--
Chrysene	0.001	0.04	0.5	4.00E-05
Dibenz(a,h)anthracene	1.0	0.1	0.5	1.00E-01
Indeno(1,2,3-cd)pyrene	0.1	0.4	0.5	4.00E-02
Total B[a]P Equivalent Concentration[c]				**6.64E-01**

Notes:

[a]These PAHs are the seven carcinogenic PAHs as defined in EPA 1993c.

[b]RPF - relative potency factor; RPF taken from EPA 1993c.

[c]The total B[a]P equivalent concentration is the sum of the individual PAH in B[a]P equivalent concentrations.

"--" - not detected

µg/L = micrograms per liter

B[a]P = benzo(a)pyrene

bgs = below ground surface

EPA = Environmental Protection Agency

mg/kg = milligrams per kilogram

PAHs = polynucleararomatic hydrocarbons

Reference:

EPA. 1993c. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. Final Draft. ECAO-CIN-842. Environmental Criteria and Assessment Office. Cincinnati. March.

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Selection of EPCs. The EPC was selected based on the process summarized in Section 8.4.4, where the lesser value of the maximum detected concentration and the 95 percent UCL (if calculated) was used.

- Comparison of COPC EPCs to Screening Criteria. The EPCs were compared to EPA Region 9 (EPA 2004b) residential and industrial PRGs to provide options for land use considerations.
- Assessment of Soil Vapor Migration. EPCs in soil and groundwater were used to model indoor air concentrations, which were compared to EPA Region 9 ambient air PRGs (EPA 2004b) and a second set of criteria calculated for an industrial setting.

EPA Region 9 soil PRGs are concentrations of COPCs in soil that are based on standardized equations and exposure factors for residential and industrial land use. Corresponding to the points of departure defined in the NCP (EPA 1990) (i.e., a cancer risk of 10^{-6} or a noncancer hazard quotient [HQ] of 1), soil PRGs represent COPC concentrations at or below which no substantive adverse health effects are likely to occur from the exposures assumed in the RBS.

EPA Region 9 PRGs do not consider all possible soil exposure pathways. For instance, some exposure scenarios for which the PRG use is not intended include exposure to COPCs in indoor air from soil gas; water used for swimming or wading; food such as contaminated fish, meat, dairy products, fruit, or vegetables; and groundwater contaminated from leaching processes. Further, and as noted by EPA Region 9, PRGs are not intended as stand-alone decision-making tools or as substitutes for EPA guidance when preparing risk assessments. However, they do suffice to evaluate the potential for adverse health effects for a relatively wide range of exposure conditions and land uses (i.e., residential and industrial) commonly encountered by the DON. In such applications, risk can be adequately characterized if exposure assumptions inherent in the PRGs are similar to those made in the exposure assessment of the RBS.

For the SSRBE, the EPA Region 9 PRGs are used to identify COPCs and to illustrate risk/hazard estimates for the default residential and industrial scenarios. For instance, EPCs for chemicals in soil exceeding residential PRGs are identified as COPCs in the SSRBE (or site-specific PRE under the EPA Region 9 terminology). Such a comparison also provides insight into the potential for unrestricted land use for the site, and in cases where the site is industrial, PRGs for industrial land use are potential target cleanup goals protective of industrial workers. The Tier 1A RBS first entailed a comparison of site EPCs to residential PRGs for relevant exposure pathways. This comparison was performed:

- If the complete or potentially complete exposure pathways of concern at a site were identical to those used in the development of PRGs, and
- If the pathway-specific exposure parameters were similar to the EPA Region 9 default assumptions used to develop the PRGs.

As a conservative approach, the screening RBS consisted of a comparison of site EPCs to residential PRGs. EPCs were then compared to industrial PRGs. If ILCRs and cumulative noncancer hazard estimates for the residential receptor are below target levels of 10^{-6} and 1, respectively; then cancer and noncancer estimates are necessarily below target levels for other receptors that are potentially exposed to a lesser degree (i.e., receive a smaller chemical intake) such that further site-specific estimates are not necessary. If potential risk exceeded the target risk of 10^{-6} or the target noncancer HQ of 1.0, or if exposure pathways and parameters were identified that were not consistent with those used to develop the PRGs, a SSRBE was completed. In this case, only those chemicals that exceeded the residential PRG screening process were carried forward.

For PRGs to be relevant in the evaluation, exposure pathways and exposure parameters in the CSM should be similar to those used to develop the PRGs used for comparison. The residential and industrial exposure pathways and default exposure parameters are assumed to be the same as those used to develop respective PRGs. However, because no EPA Region 9 PRGs are available for exposures to visitors, construction/utility workers, recreational users, and agricultural workers, the risk evaluation for these receptors was conducted in the SSRBE if concentrations exceeded residential PRGs.

In addition to the PRG comparisons, EPCs in soil and groundwater were used to model potential VOC concentrations in indoor air using the EPA Johnson & Ettinger (J&E) Model (EPA 2004e), using the California EPA-recommended indoor air exchange values (Cal-EPA 2004). This additional evaluation is necessary because: a) the inhalation of VOCs in indoor air is considered potentially complete for future on-site residents and industrial workers, and b) EPA Region 9 does not consider this exposure pathway in the development of its PRGs.

Evaluation of risks for each of the receptors identified for AA 3 considers the various behaviors and levels of activity by which potential exposure may occur. Since risks are determined assuming both RME and CTE scenarios, PRGs were therefore calculated assuming both RME and CTE scenarios. The purpose for providing risk estimates under both exposure scenarios is to give a sense of the variability surrounding a risk estimate; the two comparisons provide a bounded risk estimate for typical exposures. Because typical exposures would expectedly encounter average chemical concentrations over the area of exposure; the 95 percent UCL of the mean was used as the representative contaminant concentration whenever the data set allowed.

8.5.1 Selection of Screening Criteria

As noted above, the general approach for the human health RBS is to conduct a risk screening using EPA Region 9 PRGs. Chemical-specific toxicity values are integrated with the exposure parameters to derive the PRGs. A summary of the approach used to the obtain toxicity values follows.

8.5.1.1 Toxicity Values

Because PRGs are based on the toxicity of chemicals that may be ingested, inhaled, or dermally absorbed, it is helpful to understand the derivation of toxicity values used in a toxicity assessment. The purpose of the toxicity assessment is to weigh the available evidence regarding the potential for chemicals to cause adverse health effects and to provide a quantitative estimate of the relationship between the magnitude of exposure and the likelihood or severity of adverse health effects (i.e., dose-response assessment; EPA 1989a). Toxicity values are used to provide a quantitative estimate of the relationship between the magnitude of exposure and the potential for adverse health effects.

Because PRGs are based on the toxicity of chemicals that may be ingested, inhaled, or dermally absorbed, it is helpful to understand the derivation of toxicity values used in a toxicity assessment. The purpose of the toxicity assessment is to weigh the available evidence regarding the potential for chemicals to cause adverse health effects and to provide a quantitative estimate of the relationship between the magnitude of exposure and the likelihood or severity of adverse health effects (i.e., dose-response assessment; EPA 1989s). Toxicity values are used to provide a quantitative estimate of the relationship between the magnitude of exposure and the potential for adverse health effects.

Pursuant to EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-53 (EPA 2003a), the current hierarchy for human toxicity values is:

- Tier 1 – EPA's Integrated Risk Information System (IRIS)
- Tier 2 – EPA's Provisional Peer Reviewed Toxicity Values (PPRTVs)
- Tier 3 – Other Toxicity Values including Cal-EPA Toxicity Values

The primary source of toxicity information is EPA IRIS. When a toxicity value is not available in IRIS, other sources of toxicity information can be considered in accordance with EPA Guidance (EPA 2003a); these additional sources are often considered "provisional." In this assessment, any chemical for which a Region 9 PRG was predicated on a provisional toxicity value will be listed in the uncertainty section (8.7.3) and the effect on the risk estimates will be discussed in terms of a bias high or bias low based on available toxicity information.

8.5.1.1.1 Toxicity Values for Non-carcinogens

Toxicity values are presented as reference doses (RfDs) for non-carcinogens. The EPA Region 9 PRG tables provided virtually all the RfDs and sources of those PRGs used in the current SRA (EPA 2004b). Many of the RfDs used by EPA Region 9 in deriving PRGs were obtained from the IRIS database (EPA 2003a), but the RfD for barium has since been revised (EPA 2005). The RfD for 2-methylnaphthalene was added to the IRIS database soon after the database search used in the development of Region 9 PRGs. The revised value for barium and the new value for 2-methylnaphthalene are used to calculate PRGs using equations as presented by EPA Region 9. Non-carcinogenic chemicals with provisional values are listed and discussed in the uncertainty section (Section 8.7.3).

Oral RfDs (expressed in units of milligrams per kilogram per day [mg/kg-day]) have been developed to evaluate the potential for adverse noncancer health effects from ingestion of chemicals. Chronic RfDs are specifically developed to be protective for long-term exposure to a chemical and are generally used to evaluate the potential noncancer effects associated with exposure periods between seven years and a lifetime (EPA 1989a). The RfD is derived from a no-observed-adverse-effect-level (NOAEL) or a lowest-observed-adverse-effect-level (LOAEL). For the risk assessment, a NOAEL is the key datum obtained from a study of a dose-response relationship. It is the highest level tested at which no adverse effects were demonstrated. In some studies, only a LOAEL rather than a NOAEL is available. However, the use of a LOAEL requires additional uncertainty factors (UFs) and modifying factors (MFs) to ensure that a health-protective toxicity value is used.

UFs are typically 10 fold factors used for estimating RfDs from laboratory data (EPA unknown) to account for the (1) variation in sensitivity among the members of the human population (i.e., inter-human or intra-species variability); (2) uncertainty in extrapolating animal data to humans (i.e., inter-species variability); (3) uncertainty in extrapolating from data obtained in a study with less-than-lifetime exposure to lifetime exposure (i.e., extrapolating from sub-chronic to chronic exposure); (4) uncertainty in extrapolating from a LOAEL rather than from a NOAEL; and (5) uncertainty associated with extrapolation from animal data when the database is incomplete.

MFs are included to reflect the scientific uncertainties not explicitly addressed using UFs, and range from 1 to 10. The default value for a MF is 1.

Methods used to derive inhalation RfDs are conceptually similar to those used to derive oral RfDs. However, the actual analysis of inhalation exposures is more complex than that for oral exposures because of the dynamics and differential structures of the respiratory system and the ability to

account for the inhaled dose in the experiment design of laboratory studies. The reference values from inhalation studies are generally reported as a reference concentration (RfC) in air (milligrams per cubic meter [mg/m^3]). However, these values are converted to RfDs for use in risk assessments. As noted in its documentation, EPA Region 9 has converted inhalation RfCs to RfDs using a human body weight of 70 kilograms (kg) and inhalation rate of 20 cubic meters per day (m^3/day).

All screening tables presented in this SRA present the PRGs predicated on non-carcinogenic toxicity values recommended by EPA Region 9, except those for barium and 2-methylnaphthalene. A revised oral RfD of 0.2 mg/kg-day for barium and a (relatively) new oral RfD of 0.004 mg/kg-day for 2-methylnaphthalene from the IRIS database are included.

8.5.1.1.2 Toxicity Values for Carcinogens

The predominant theory behind cancer development as it relates to risk assessment is that a small number of molecular events can evoke changes in a single cell, which can lead to uncontrolled cellular proliferation and, eventually, to cancer. In this model (i.e., the linear low-dose model), it is assumed that there is no level of exposure to a chemical that does not pose "a finite probability, however small, of generating a carcinogenic response" (EPA 1989a). Recent insight into the cancer processes does, however, suggest that theoretically, a threshold mechanism may be operative, especially if the cancer is a "...secondary effect of toxicity or of an induced physiological change that is itself a threshold" (EPA 2003f). Generally, data are not yet sufficient to apply the "threshold" concept in the development of risk assessments for carcinogens that are intended to be protective of the potentially exposed receptor group. There are however, chemicals such as chloroform, for which the slope factor is based on a threshold concept. Thus, the linear low-dose model is still considered applicable in most instances.

The evaluation of the chemical carcinogenicity is a complex process that can be summarized by two primary steps. Initially, the toxicity database for a substance is evaluated for its potential utility in assessing carcinogenic potential. In this step, a weight-of-evidence (WOE) classification is assigned to the chemical. The WOE classification scheme is designed to present the likelihood that a chemical will cause cancer in humans based on the strength of supporting human and/or animal data.

Currently, there are two WOE classifications available for use in conjunction with human health risk assessments. The most recent WOE classification is defined in the latest EPA cancer risk assessment guidelines (EPA 2005) and is designed to revise and replace the *Guidelines for Carcinogen Risk Assessment* published in September 1986 (EPA 1986b). While the IRIS program will incorporate the new WOE discussion/criteria into revised or new IRIS chemical profiles, many of the existing chemical profiles are still based on the 1986 EPA guidelines.

This WOE descriptors based on the 2005 Revised Guidelines are summarized as:

- "Likely To Be Carcinogenic to Humans" – this descriptor reflects strong evidence of carcinogenicity.
- "Suggestive Evidence of Carcinogenic Potential" – this descriptor is used when there is sufficient evidence to demonstrate potential carcinogenicity to humans.
- "Inadequate Information to Assess Carcinogenic Potential" – this descriptor is used when there is sufficient evidence to suggest a concern for potential carcinogenic effects in humans, but data are not sufficient for a strong conclusion.

- "Not Likely To Be Carcinogenic to Humans" – this descriptor is used when data are determined to be inadequate for applying one of the other three descriptors.

Because the "final" revised cancer guidelines are not yet incorporated into many of the IRIS chemical profiles at the time of this evaluation, the WOE classifications as employed by EPA (1986b) are still used when interpreting this AA 3. This WOE classification used in this risk assessment is defined as:

- Group A: Known human carcinogen,
- Group B: Probable human carcinogen,
- Group B1: Limited evidence of carcinogenicity in humans,
- Group B2: Sufficient evidence in animals, but inadequate evidence in humans,
- Group C: Possible human carcinogen (limited evidence of carcinogenicity in animals in the absence of human data),
- Group D: Human carcinogenicity not classifiable because of lack of data,
- Group E: Evidence of non-carcinogenicity in humans (no evidence in at least two adequate animal tests in different species or in both epidemiological and animal studies).

Oral cancer slope factors (CSF_o), are expressed as the proportion of a population affected per mg/kg-day dose (EPA 1989a) and are typically reported in units of $(mg/kg\text{-}day)^{-1}$. Currently, CSF_o are derived for chemicals with WOE classifications of A, B1, or B2, and occasionally C (noted above). Inhalation cancer toxicity data are presented as a unit risk (expressed as $[mg/m^3]^{-1}$ or micrograms per cubic meter $[\mu g/m^3]^{-1}$) and can be interpreted as "...the increase in the lifetime risk of an individual who is exposed for a lifetime to either 1 mg/m^3 or $\mu g/m^3$ of the cancer agent" (EPA 1986c). EPA Region 9 converted unit risks to CSF_o by multiplying the inhalation rate of 20 m^3/day and dividing by a body weight of 70 kg. All PRGs for carcinogenic chemicals evaluated in this SRA are based on the cancer slope factors recommended and used by Region 9 (EPA 2004b).

8.5.1.2 Availability of Toxicity Values

Some chemicals may exhibit both carcinogenic and non-carcinogenic health effects. Toxicity values are generally available for the oral route of exposure. Inhalation toxicity values have also been developed for some constituents. However, route-to-route extrapolations are frequently used when there are no toxicity values available for a given route of exposure. Oral CSF_o and RfD_o were used for both oral and inhalation routes of exposures for organic chemicals lacking inhalation values (EPA 2004b).

Chemical disposition in the body may determine the dose of toxicant that reaches the target organ, confounding the interpretation of toxicity values. For instance, dermal exposures rarely result in the entire applied dose entering the systemic circulation. However, because this phenomenon is poorly quantified, toxicity values for evaluating risk from dermal exposure may employ route-to-route (oral to dermal) extrapolations that do not consider the fraction absorbed. Similarly, for the oral route, the orally administered dose is often not entirely absorbed from the gastrointestinal (GI) tract into systemic circulation. Because of incomplete absorption from the GI tract, correcting the administered dose by the fraction absorbed might be preferred to better determine a toxicity value that reflects the actual dose to the target organ.

However, this is not possible for many chemicals because a sufficiently credible database does not exist to allow such refinements. Therefore, EPA Region 9 did not adjust toxicity values to correct for the fraction absorbed for any of the COPCs identified in the SRA (EPA 2004b).

Of all the toxicity data that are available, some chemicals do not have data to enable quantitative development of toxicity values. In these instances, the toxicity of these chemicals is evaluated qualitatively in Section 8.7.3. In some instances, because "groups" of chemicals may have similar toxicity (and therefore additive toxicity), it is important to consider the potential additive toxicity of these special case chemicals; these special case chemicals are discussed below.

8.5.1.2.1 Special Case Chemicals

When groups of structurally similar chemicals are present in the environment, such as dioxins/furans and PAHs, it is important to adequately characterize the potential risks that could occur from exposure to such chemicals based on their additive nature.

Deriving Toxicity Equivalence for Dioxins/Furans

For the dioxins/furans, the TEFs derived by the WHO (WHO 1997) are sometimes used to estimate a total 2,3,7,8-TCDD TEQ concentration for comparison to the 2,3,7,8-TCDD PRG. Although this procedure is provisional, the comparison of the TEQ concentration to the TCDD PRG is included in the cumulative risk estimate. The uncertainty associated with deriving the 2,3,7,8-TCDD TEQ concentration is presented in Section 8.7.3. The procedure for deriving the 2,3,7,8-TCDD TEQ is provided in Section 8.4.4 with the TEQ results for soil being presented in Tables 8-6 and 8-7.

Deriving Toxicity Equivalence for Benzo(a)pyrene

For carcinogenic PAHs, relative potency factors (RPFs) developed by the EPA were applied to estimate toxicity values for PAHs based on the relative potency of PAHs to B[a]P (EPA 1993c). The PRG values for the individual carcinogenic PAHs shown in the RBS tables reflect the use of the RPFs as applied by EPA Region 9. In addition, a B[a]P equivalent concentration was estimated based on the RPFs provided by California OEHHA (OEHHA 2002 as amended). The procedure for deriving the B[a]P equivalent concentration is provided in Section 8.4.4 with the B[a]Peq results for soil being presented in Tables 8-8 through 8-10 and groundwater in Table 8-11. Using Cal-EPA toxicity information, the B[a]P equivalent concentrations are presented in Table E1-1 through E1-4 in Appendix E1.

California-Approved Toxicity Values

The California Environmental Protection Agency (Cal-EPA) Office of Environmental Health Hazard Assessment (OEHHA) has established different toxicity values for several chemicals identified at AA 3 than used by EPA Region 9. Chemicals include arsenic, beryllium, lead, manganese, mercury, nickel, selenium, benzene, methylene chloride, bis(2-ethylhexyl)phthalate, hexachlorobenzene, phenol, benzo[a]pyrene and 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). Cancer risk and noncancer hazard estimates were also calculated using these California-modified toxicity values (Appendix E1). A summary of these estimates are provided in Section 8.5.7.4.

8.5.2 Screening Criteria—EPA Region 9 PRGs for Soil

The screening criteria for use in the RBS are based on those PRGs that have been developed by EPA Region 9 for the reasonable maximum exposure or RME scenario. Their development assumes that

exposure to chemicals at or below PRG concentrations represent a minimal risk to human health. For soil, two sets of exposure criteria exist:

> **Residential PRGs**: A conservative set of PRGs are applicable to sites 1) that currently or are anticipated to be used for residential purposes, or 2) for which the DON wishes to determine the potential for unencumbered transfer of property.
>
> **Industrial PRGs**: One set is used for sites currently or anticipating industrial land use.

For groundwater, a single set of criteria are used:

> **Residential PRGs for Tap Water:** A conservative set of PRGs is used to evaluate consumption of water at the tap under the residential scenario.

The PRGs provided by EPA Region 9 are derived using standard equations and exposure factors for the RME scenario. The substitution of exposure factors under an average or CTE scenario produces another set of PRGs that is based on the CTE scenario. The exposure factors used in deriving residential and industrial PRGs under the RME and CTE assumptions are presented in Table 8-12. By including PRGs for both RME and CTE scenarios, cumulative risk estimates for each receptor and exposure medium are presented for an average and high-end level of exposure. The presentation of both estimates provides a measure of the variability surrounding the risk estimate.

Many of the exposure factor values used in the CTE evaluation were obtained from the USEPA *Exposure Factors Handbook* (EPA 1997a), the USEPA *Child-Specific Exposure Factors Handbook* (EPA 2002a), *Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Values"* (EPA 1991b), or USEPA *Risk Assessment Guidance for Superfund, Volume I: HHEM (Part E, Supplemental Guidance for Dermal Risk Assessment)-Final* (EPA 2004c). Values selected from these sources focused on median (or mean) measurements reported for the various factors. Professional judgment was used in defining realistic values for average values of time (in hours/day) for soil exposure, and average exposure frequency (in days/year) for residential exposures. The average residential time spent exposed to soil of 16 hours/day was conservatively chosen as all waking hours (24 hours minus 8 sleeping hours). This value is 33 percent less than the 24 hours/day soil exposure assumed for the RME scenario. The CTE value for exposure frequency for residents assumes two weeks vacation and weekends away from the residence. Some chemicals (e.g., TPH) do not have accepted toxicity values from which PRGs can be estimated based on potential health effects, but do have levels that are suggested for use by state governments and/or local municipalities. These levels are often based on aesthetic criteria or the toxicity of specific petroleum hydrocarbon fractions. In such instances, indicator chemicals (Section 8.2.2) accounted for the assessment of petroleum hydrocarbon toxicity while a non-health-based screening level was used for qualitative comparisons of petroleum hydrocarbon data. In other instances (i.e., lead), values deemed to be protective of the potential receptor groups are based on the potential for adverse health effects, but are not amenable to the evaluation of risk in the context of slope factors or RfDs. In this instance, screening levels for lead are included in the RBS tables for comparison purposes, but are not used in the calculation of ILCR or cumulative non-cancer hazard index (HI).

There are several instances where the risk-based PRGs exceed the EPA Region 9 ceiling limit of 1E+05 mg/kg (or 1E+08 ug/kg) (EPA 2004c). This occurs for relatively less toxic inorganic chemicals and semivolatile organic chemicals. In these instances, the ceiling concentration is presented and the chemical is excluded in the calculation of ILCR or HI.

In summary, only EPA Region 9 PRGs were used to derive estimates of carcinogenic risk and non-carcinogenic health effects in the RBS under the RME scenario. Calculated site-specific PRGs were used to evaluate risks and hazards under the CTE scenario. Incremental cancer risk and HQs were not estimated for COPCs without available PRGs. Comparisons of the EPCs to non-risk-based screening levels were not included in the ILCR or the HI. Rather, these comparisons are presented qualitatively because the screening criteria are not risk-based.

8.5.3 Soil Screening Levels

The RBS for soil data also included a comparison with EPA Region 9 SSLs for protection of groundwater (EPA 2004b). This comparison was conducted to provide a comprehensive evaluation of all chemical data with respect to all environmental media that are relevant for the site. Although the results of the comparison were not included in the derivation of the cancer risk or the HQ, the results are discussed qualitatively in the results section. Because of the conservative nature of the SSLs, exceedances of these criteria are not considered sufficient evidence in themselves to warrant further evaluation in the risk evaluation process; rather, they serve to assist in potential resource/use decisions in the future.

8.5.4 Background Comparisons

The site is located in an area of California that characteristically has elevated levels of various elements (i.e., arsenic and chromium) in soil. Derivation of the soil background concentrations for former MCAS El Toro is presented in the *Final Technical Memorandum, Background and Reference Levels, Remedial Investigations, Marine Corps Air Station, El Toro, California* (BNI 1996).

While natural and anthropogenic sources for B[a]P and other carcinogenic PAHs may exist in the area near AA 3, the concentrations of B[a]P exceed the anthropogenic level for former MCAS El Toro (BNI 1996). The published background is less than the EPA Region 9 PRG of 62 micrograms per kilogram (μg/kg). As a result, B[a]P is assumed to be site-related.

However, rather than eliminate elements detected at concentrations equal to or below their background concentrations before risk is characterized (DON 2004b), all data, regardless of source origin, have been included in the determination of cancer risk and noncancer hazard. Thus, cancer risks and noncancer hazards are presented as the sum of estimated potential risks associated with all COPCs with EPA Region 9 PRGs (EPA 2004b), irrespective of elevated chemical concentration that may not be related to facility activity. However, to better ascertain the risks associated with site-related activities, cancer risks and noncancer hazards are also presented without the contribution of background levels of metals. A single detection (i.e., the maximum detected concentration) above the background level was used to define a chemical that is considered site-related. The uncertainty associated with this definition is presented in Section 8.7.4, Uncertainties in Estimation of Site-Related Risk.

8.5.5 Estimation of Cumulative Health Risks

To evaluate risk from exposure to COPCs in soil, EPCs were compared to residential soil PRGs under both the RME and CTE scenarios. The following soil and air pathways were considered in the development of soil PRGs:

- Incidental ingestion of chemicals in soil,
- Dermal contact with chemicals in soil,

- Inhalation of chemicals in fugitive dust,
- Inhalation of ambient VOCs.

In accordance with EPA Region 9 PRG guidance (EPA 2004b), exposure parameters for children aged 0 to 6 years were used to estimate non-carcinogenic residential PRGs. Age-adjusted exposure parameters were used to estimate carcinogenic residential PRGs for individuals from 0 years to 30 years old (i.e., 30-year residents).

Excess (incremental) cancer risk associated with a COPC, using its EPC and carcinogenic PRG, was estimated using the following formula:

$$Excess\ Cancer\ Risk = TR \times \frac{EPC_i}{PRG_i}$$

Where:
TR = The target ILCR of $1x10^{-6}$
EPC_i = EPC of COPCi detected in soil (µg/kg or mg/kg)
PRG_i = PRG for $COPC_i$ in soil (µg/kg or mg/kg) based on carcinogenic effects

An HQ for COPC, using an EPC and its respective non-carcinogenic PRG, was estimated using the following formula:

$$Hazard\ Quotient(HQ) = THQ \times \frac{EPC_i}{PRG_i}$$

Where:
THQ = The target HQ of 1

The ILCR is also estimated to evaluate potential exposure to multiple COPCs using the following equation:

$$Incremental\ Lifetime\ Cancer\ Risk = \sum_{i=1}^{i=n}\left[TR \times \frac{EPC_i}{PRG_i}\right]$$

The cumulative non-carcinogenic HI for exposure to multiple COPCs was estimated as follows:

$$Cumulative\ Noncarcinogenic\ Hazard\ Index = \sum_{i=1}^{i=n}\left[THQ \times \frac{EPC_i}{PRG_i}\right]$$

Cumulative excess cancer risks and noncancer HIs were evaluated for both residential and industrial use scenarios.

8.5.6 Indoor Air Evaluation

Certain volatile chemicals in soil and groundwater have the potential, through vaporization and soil gas migration, to enter into buildings, where persons may become exposed through inhalation. To evaluate whether this potentially complete exposure pathway is significant at AA 3 and could potentially pose adverse health effects, concentrations of chemicals in indoor air were estimated using the Advanced J&E Model (EPA 2004e) and were compared to EPA Region 9 ambient air PRGs for residential exposures and a second set of PRGs calculated for the industrial setting. Individual J&E Model runs for soil and groundwater are presented in Attachment E1-1. Derivation of ambient air PRGs is presented in a table as Attachment E1-2. Residential and industrial exposure scenarios were evaluated for soil at AA 3 under the RME and CTE scenarios. A residential exposure scenario was evaluated for groundwater.

8.5.6.1 MODEL THEORY

The Advanced J&E Model (EPA 2004e) is a screening-level tool that incorporates both convective and diffusive mechanisms for estimating the transport of certain volatile chemical vapors emanating from either contaminated soil or groundwater into an indoor space located directly above the source of contamination. By applying the Advanced J&E Model, the user is able to estimate volatile chemical concentrations (and incremental risk due to the volatile chemicals) in the indoor space. In the case of AA 3, this indoor space is a hypothetical future building.

EPA Region 9 ambient air PRGs were used to compare against the resulting concentrations in indoor air for screening purposes because:

1. Values are risk-based and incorporate inhalation toxicity values (RfDs or slope factors) accepted by EPA Region 9;
2. The ambient air PRGs incorporate a daily inhalation rate that is based on a 24-hour exposure (an entire day) and is therefore conservative;
3. The carcinogenic screening values are based on an age-adjusted residential exposure duration of 30 years to account for exposure as both a child and adult;
4. The noncarcinogenic screening values conservatively assume an adult exposure over the entire 30 years which results in a greater chemical dose than (and therefore is protective of) a child's six years of exposure.

8.5.6.2 VAPOR EMISSION AND MIGRATION FROM SOIL

At AA 3, chemicals detected in soil at depths from 0-foot to 10 feet included 3 volatile organic compounds, 9 SVOCs including B[a]P equivalents concentration, 21 metals, dioxins, and hydrocarbons. Of these chemicals, only 5 are sufficiently volatile to migrate in soil gas and enter buildings via vapor intrusion: acetone, benzene, hexachlorobenzene, methylene chloride, and pyrene.

8.5.6.2.1 Residential Scenario

Using the EPCs in subsurface soil for each of these five chemicals in soil, the Advanced J&E Model (EPA 2004e) was utilized with the following assumptions:

- The hypothetical building was assumed to be a slab-on-grade construction with a depth of 15 cm since basements are uncommon in the vicinity of the site;

- Shallow soil on-site was conservatively selected as sand for its high transmissivity despite the presence of silt and clay lenses since the presence of debris down to 23 feet bgs would provide a likely pathway of least resistance;

- Depth to contamination was assumed to equal the depth of the maximum detected concentration;

- Soil parameters measured from a nearby site (IRP Site 1) were used in this evaluation. Parameters include fraction of organic carbon (0.005), total porosity (38.37 percent) and water-filled porosity (12.30 percent) (Earth Tech 2005c);

- The residential indoor air exchange rate was set at 0.5 per hour (Cal-EPA 2004). Although the default for J & E is 0.25 per hour, Cal-EPA recommends the use of 0.5 per hour for sites in California;

- The model was used to estimate the average vapor flow rate into buildings.

Using the above assumptions, indoor air VOC concentrations were estimated from soil EPCs and compared against ambient air PRGs to estimate ILCRs and cumulative noncancer HIs under the RME scenario. To evaluate risks/hazards under the CTE scenario, modeled indoor air concentrations were compared to PRGs that were specifically calculated using equations of EPA Region 9 (2004b) and the exposure factors for the CTE scenario that are identified in Table 8-12 (Attachment E1-2).

8.5.6.2.2 Industrial Scenario

To evaluate indoor air under an industrial use scenario, indoor air VOC concentrations were compared to PRGs that were calculated for an industrial worker. Using the same equations as EPA Region 9, values for exposure frequency (250 days/year) and exposure duration (25 years) were used for the industrial scenario. Additionally, the adult daily inhalation rate of 20 m^3/day was conservatively used in development of the PRGs and approaches the same numerical value as an upper percentile inhalation rate for an 8-hour workday for outdoor workers (EPA 1997a). Indoor air VOC concentrations were estimated using the same J&E assumptions except that a commercial air exchange rate of 1/hour was used, which is recommended by Cal-EPA for sites in California (Cal-EPA 2004). The resulting PRGs and comparisons with estimated indoor air VOC concentrations are used to estimate ILCRs and cumulative noncancer HIs.

8.5.7 Results of the Risk-Based Screening

If the maximum detected concentration was below the residential PRG for a particular chemical and the ILCR was below $1x10^{-6}$, and/or the HI was less than 1.0, then no further action was recommended for the site and the evaluation of risk was complete. If any of these criteria were exceeded, then an SSRBE was prepared. In the case of lead, if its EPC was less than the EPA Region 9 residential criterion of 400 mg/kg, no further action was recommended with respect to lead.

EPCs for chemicals detected in surface soil, subsurface soil, and groundwater collected from AA 3 were compared to EPA Region 9 (2004b) residential and industrial PRGs for the appropriate medium in Tables 8-13 through 8-21. The following text summarizes the carcinogenic risk and non-cancer hazard estimated for these media under the residential and industrial land use scenarios.

8.5.7.1 Residential Land Use Evaluation

Because the site is located in a semi-urban area, evaluation of the residential land use scenario can aid in determining if remediation is required to permit unrestricted transfer of the property. This section summarizes the results of the residential evaluation of both surface and subsurface soil. Potential risks associated with the EPC are estimated using comparisons between the EPC and either the Region 9 PRGs (under the RME scenario) or PRGs that were calculated for the CTE scenario. The results presented in Table 8-13 for surface soil and Table 8-14 for subsurface soil are summarized below with emphasis on those chemicals that are associated with a majority of the excess cancer risk and noncancer hazard.

Surface Soil (0-foot to 1-foot bgs). EPCs for surface soil data collected from AA 3 were compared to EPA Region 9 residential soil PRGs under the RME scenario and site-specific PRGs under the CTE scenario in Table 8-13. The following paragraphs summarize the carcinogenic risk and noncancer hazard estimated for surface soil under the residential land use scenario.

Carcinogenic Risk. The ILCR for surface soil under an assumed residential land use is $4x10^{-5}$ for the RME scenario and $4x10^{-6}$ for the CTE scenario (Table 8-13). Excluding the contribution of metals at background levels, the RME cancer risk estimate decreases to $3x10^{-5}$ while the CTE estimate decreases to $3x10^{-6}$. Under the RME scenario, 23 percent of the excess cancer risk is attributed to arsenic, 68 percent is attributed to B[a]P equivalent concentration and 9 percent is attributed to 2,3,7,8-TCDD TEQ. The maximum detected concentration (4.6 mg/kg) and EPC (3.16 mg/kg) of arsenic are within (or are consistent with) the background concentration of 6.86 mg/kg. Carcinogenic PAHs included in the B[a]P equivalent concentration were detected in 7 of 33 surface soil samples. Various dioxin/furan congeners were detected in all 9 surface soil samples analyzed for dioxins/furans with the maximum concentration of each congener included in the 2,3,7,8-TCDD equivalent.

Noncarcinogenic Hazard. The cumulative noncancer hazards associated with potential exposure to the EPCs are expressed as HIs of 1 and less than 0.01 under the RME and CTE scenarios, respectively (Table 8-13). Neither estimate exceeds the target HI of 1. The majority of the HI is attributed to iron (38 percent), vanadium (25 percent), arsenic (10 percent), aluminum (9 percent) and manganese (8 percent) under the RME scenario. Excluding the contribution of metals at background levels, non-cancer HI decreases to 0.7 for the RME scenario while the estimate for the CTE scenario decreases below 0.01.

For lead, the maximum detected concentration (20.7 mg/kg) and EPC (8.5 mg/kg) do not exceed the residential criterion of 400 mg/kg. No further evaluation of the lead in the surface soil is warranted.

Maximum detected concentrations of arsenic, B[a]P equivalents, and dioxin (2,3,7,8-TCDD TEQ) in surface soils exceeded their respective residential PRGs under the RME scenario. Therefore, these COPCs were carried forward to the SSRBE. Maximum concentrations of B[a]P, antimony, arsenic, barium, cadmium, chromium, nickel and selenium exceeded the SSLs.

Subsurface Soil (0 to 10 feet bgs). EPCs for chemical data for subsurface soil collected from AA 3 are compared to EPA Region 9 residential soil PRGs and site-specific PRGs under the CTE scenario in Table 8-14. The following discussion summarizes the carcinogenic risk and noncancer hazard estimated for subsurface soil under the residential land use scenario.

Carcinogenic Risk. The ILCR for exposure to subsurface soil in the area of AA 3 under an assumed residential land use is $4x10^{-5}$ for the RME scenario and $4x10^{-6}$ for an average or CTE scenario (Table 8-14). Excluding the contribution of metals at background levels, the RME cancer risk estimate decreases to $3x10^{-5}$ while the CTE estimate decreases to $3x10^{-6}$. Under the RME scenario, 23 percent of the excess cancer risk is attributed to arsenic, 66 percent is attributed to B[a]P equivalent concentration and 9 percent is attributed to 2,3,7,8-TCDD TEQ. The maximum detected concentration (4.63 mg/kg) and EPC (3.206 mg/kg) of arsenic are within (or are consistent with) the background concentration of 6.86 mg/kg. Carcinogenic PAHs included in the B[a]P equivalent concentration were detected in 7 of 33 surface soil samples. Dioxin/furan congeners were detected in all 11 subsurface soil samples analyzed for dioxins/furans with the maximum concentration of each congener included in the 2,3,7,8-TCDD equivalent.

Noncarcinogenic Hazard. The cumulative noncancer hazards associated with potential exposure to subsurface soil are expressed as HIs of 1 under the RME scenario and 0.1 under the CTE scenario. Neither estimate exceeds the target HI of 1. The main noncarcinogenic risk drivers are iron and vanadium. Excluding the contribution of metals at background levels, non-cancer HI decreases to 0.7 for the RME scenario while the estimate for the CTE scenario decreases to 0.004.

For lead, the maximum detected concentration (20.7 mg/kg) and EPC (8.4 mg/kg) does not exceed the residential criterion of 400 mg/kg. No further evaluation of the lead in the subsurface soil is warranted.

Maximum detected concentrations of arsenic, B[a]P equivalent concentration and 2,3,7,8-TCDD TEQ in subsurface soil exceeded the residential PRGs under the RME scenario. Therefore, these COPCs were carried forward to the SSRBE.

Maximum concentrations of benzene, methylene chloride, hexachlorobenzene, B[a]P equivalent concentration, antimony, arsenic, barium, cadmium, chromium, nickel and selenium exceeded the SSLs.

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Table 8-12. RME and CTE Exposure Factors for Residential and Industrial Land Uses, Anomaly Area 5, El Toro

		RME[a]					CTE				
		Soil			Groundwater		Soil			Groundwater	
		Residential		Industrial	Residential		Residential		Industrial	Residential	
Parameter	Definition	Adult	Child		Adult	Child	Adult	Child		Adult	Child
IngR(s)	Ingestion Rate of Soils (mg/d)	100	200	100			50[b]	100[b]	50[b]		
IngR(gw)	Ingestion Rate of Groundwater (L/d)				2.0	1.0				1[b]	0.5[b]
FI(s)	Fraction Ingestion from Source-soil (unitless)	1.0	1.0	1.0			0.5[d]	0.5[d]	0.5[d]	--	--
FI(gw)	Fraction Ingestion from Source-groundwater (unitless)				1.0	1.0				1[d]	1[d]
InhR	Inhalation Rate (m^3/hr)	0.83	0.42	0.83	0.83	0.42	0.63[c]	0.35[c]	0.63[c]	0.63[c]	0.35[c]
PEF	Particlate Emission Factor (m^3/kg)	1.32E+09	1.32E+09	1.32E+09	--	--	1.32E+09	1.32E+09	1.32E+09	--	--
VFw	Volatilization Factor-water (L/m^3)	--	--	--	0.5	0.5				0.5	0.5
SA	Exposed Surface Area (cm^2)	5,700	2,800	3,300	--	--	5700[f]	2800[f]	3300[f]	--	--
AF	Adherence Factor (mg/cm^2)	0.07	0.20	0.20	--	--	0.01[f]	0.04[f]	0.02[f]	--	--
ABS	Absorption Factor (unitless)	c-s	c-s	c-s	--	--	c-s	c-s	c-s	--	--
ET-soil	Exposure Time (hr/d)	24	24	24	--	--	16[d]	16[d]	4[d]	--	--
ET-gw	Exposure Time (hr/d)	--	--	--	24[f]	24[f]	--	--	--	24[f]	24[f]
EF	Exposure Frequency (d/yr)	350	350	250	350	350	252[h]	252[h]	219[f]	252[h]	252[h]
ED	Exposure Duration (yr)	30[(i)]	6	25	30[(i)]	6	9[b]	6[b]	6.6[b]	9[b]	6[b]
CF	Conversion Factor (kg/mg)	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06
BW	Body Weight (kg)	70	15	70	70	15	70[c]	15[c]	70[c]	70[c]	15[c]
AT	Averaging Time (d)										
	Noncarcinogenic	10,950	2,190	9,125	8,760	2,190	3,285	2,190[g]	2,409[g]	3,285[g]	2,190[g]
	Carcinogenic	25,550	25,550	25,550	25,550	25,550	25,550	25,550[g]	25,550[g]	25,550[g]	25,550[g]
TCR	Target Cancer Risk	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06
THQ	Target Hazard Quotient	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Notes:

RME = reasonable maximum exposure
CTE = central tendency exposure
c-s = chemical-specific
mg/d = milligrams per day
m^3/hr = cubic meters per hour
m^3/kg = cubic meters per kilogram
cm^2 = square centimeters
mg/cm^2 = milligrams per square centimeter
hr/d = hours per day
d/yr = days per year
kg/mg = kilogram per milligram
L/d = liters per day
L/m^3 = liter per cubic meter
EPA = Environmental Protection Agency
RAGS = Risk Assessment Guidance for Superfund

[a] RME exposure parameters are default Region 9 exposure parameters.
[b] Exposure Factors Handbook (EPA 1997a) and Child-Specific Exposure Factors Handbook (EPA 2002a) where appropriate.
[c] Human Health Evaluation Manual, Supplemental Guidance:"Standard Default Values" (EPA 1991b)
[d] Professional judgement
[e] RAGS, Volume I Part B (EPA 1991a).
[f] RAGS, Volume I: HHEM (Part E, Supplemental Guidance for Dermal Risk Assessment)-Final (EPA 2004c).
[g] RAGS, Volume I, Part A (EPA 1989a).
[h] CTE value for EF assumes two weeks and weekends away from the residence.
[(i)] Lifetime residential exposure under RME scenario is to be 30 years. For carcinogens, exposure is age-adjusted for the adult (24 years) and the child (6 years).

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Table 8-13: Risk-Based Screening Evaluation of Surface Soil (0 - 1 ft bgs) for (Current/Future) Residential Receptor

									Preliminary Remediation Goals					Maximum Detect Evaluation							RME Evaluation							CTE Evaluation						
									Region 9 PRGs (RME)		CTE PRGs			Carcinogenic				Noncarcinogenic			Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Concentration[b]	95% UCL	EPC[c]	Background Concentration	Site Metal Exceed Background?	Carcinogenic PRG[d]	Noncarcinogenic PRG[d]	Carcinogenic PRG[d]	Noncarcinogenic PRG[d]	SSL DAF 1[e]	>SSL	>PRG (ca)	Excess Cancer Risk[f]	% Contribution Risk	>PRG (nc)	HQ[g]	% Contribution HI	>PRG (ca)	Excess Cancer Risk[f]	% Contribution Risk	>PRG (nc)	HQ[g]	% Contribution HI	>PRG (ca)	Excess Cancer Risk[f]	% Contribution Risk	>PRG (nc)	HQ[g]	% Contribution HI
Metals (6010B & 7471A) (mg/kg)																																	
Aluminum	33	33	100%	15800	9.98E+03	9.98E+03	1.48E+04	Yes	--	7.61E+04	--	1E+05 max	--	--	--	--	--	No	2.08E-01	9.5%	--	--	--	No	1.31E-01	9%	--	--	--	No	-[d]	--
Antimony	1	33	3%	2.1	--	2.10E+00	3.06E+00	No	--	3.13E+01	--	1.74E+02	3.00E-01	Yes	--	--	--	No	6.71E-02	3.1%	--	--	--	No	6.71E-02	5%	--	--	--	No	1.21E-08	0%
Arsenic	33	33	100%	4.8	3.16E+00	3.16E+00	9.98E+00	No	3.90E-01	2.16E+01	3.00E+00	1.22E+03	1.00E+00	Yes	Yes	1.18E-06	30.4%	No	2.13E-01	9.7%	Yes	8.11E-06	23%	No	1.46E-01	10%	Yes	1.08E-06	24%	No	2.59E-08	0%
Barium	33	33	100%	187	1.07E+02	1.07E+02	1.73E+02	Yes	--	5.37E+03	--	7.77E+04	8.20E+01	Yes	--	--	--	No	3.48E-02	1.6%	--	--	--	No	1.99E-02	1%	--	--	--	No	1.38E-09	0%
Beryllium	10	33	30%	0.31	--	3.10E-01	6.60E-01	No	1.05E+03	1.54E+02	5.94E+03	8.44E+02	3.00E+00	No	No	2.94E-10	0.0%	No	2.01E-03	0.1%	No	2.94E-10	0%	No	2.01E-03	0%	No	5.21E-11	0%	No	3.67E-10	0%
Cadmium	33	33	100%	1	6.71E-01	6.71E-01	2.35E+00	No	1.40E+03	3.70E+01	7.93E+03	2.17E+02	4.00E-01	Yes	No	7.14E-10	0.0%	No	2.70E-02	1.2%	No	4.79E-10	0%	No	1.81E-02	1%	No	8.47E-11	0%	No	3.09E-09	0%
Calcium	33	33	100%	25200	8.55E+03	8.55E+03	4.60E+04	No	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium (total)	33	33	100%	15.8	1.09E+01	1.09E+01	2.80E+01	No	2.11E+02	--	1.19E+03	--	2.00E+00	Yes	No	7.50E-08	0.2%	--	--	--	No	5.17E-08	0%	--	--	--	No	9.17E-09	0%	--	--	--
Cobalt	33	33	100%	7.6	5.08E+00	5.08E+00	6.98E+00	Yes	9.03E+02	1.38E+03	5.10E+03	6.69E+03	--	--	No	8.42E-09	0.0%	No	5.51E-03	0.3%	No	5.80E-09	0%	No	3.67E-03	0%	No	9.92E-10	0%	No	7.58E-04	1%
Copper	33	33	100%	10.8	6.71E+00	6.71E+00	8.41E+00	Yes	--	3.13E+03	--	1.74E+04	--	--	--	--	--	No	3.45E-03	0.2%	--	--	--	No	2.14E-03	0%	--	--	--	No	3.86E-04	0%
Iron	33	33	100%	19400	1.25E+04	1.25E+04	1.84E+04	Yes	--	2.35E+04	--	1E+05 max	--	--	--	--	--	No	8.27E-01	37.8%	--	--	--	No	5.33E-01	38%	--	--	--	No	-[d]	--
Lead	33	33	100%	20.7	8.50E+00	8.50E+00	1.51E+01	Yes	--	4.00E+02	--	--	--	--	--	--	--	No	5.18E-02	2.4%	--	--	--	No	--[h]	--	--	--	--	No	--[h]	--
Magnesium	33	33	100%	6900	4.37E+03	4.37E+03	8.37E+03	No	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	33	33	100%	289	1.97E+02	1.97E+02	2.91E+02	No	--	1.76E+03	--	9.13E+03	--	--	--	--	--	No	1.64E-01	7.5%	--	--	--	No	1.12E-01	8%	--	--	--	No	2.16E-02	24%
Mercury	33	33	100%	0.069	3.06E-02	3.06E-02	2.20E-01	No	--	2.35E+01	--	1.30E+02	--	--	--	--	--	No	2.94E-03	0.1%	--	--	--	No	1.30E-03	0%	--	--	--	No	2.35E-04	0%
Nickel	33	33	100%	12.1	7.72E+00	7.72E+00	1.53E+01	No	--	1.56E+03	--	8.69E+03	7.00E+00	Yes	--	--	--	No	7.74E-03	0.4%	--	--	--	No	4.94E-03	0%	--	--	--	No	8.88E-04	1%
Potassium	33	33	100%	3970	2.64E+03	2.64E+03	4.80E+03	No	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	20	33	61%	1.1	6.62E-01	6.62E-01	3.20E-01	Yes	--	3.91E+02	--	2.17E+03	3.00E-01	Yes	--	--	--	No	2.81E-03	0.1%	--	--	--	No	1.69E-03	0%	--	--	--	No	3.05E-04	0%
Silver	1	33	3%	2	--	2.00E+00	5.30E-01	Yes	--	3.91E+02	--	2.17E+03	2.00E+00	No	--	--	--	No	5.11E-03	0.2%	--	--	--	No	5.11E-03	0%	--	--	--	No	9.22E-04	1%
Vanadium	33	33	100%	44.1	2.81E+01	2.81E+01	7.18E+01	No	--	7.82E+01	--	4.25E+02	3.00E+02	No	--	--	--	No	5.64E-01	25.8%	--	--	--	No	3.59E-01	25%	--	--	--	No	6.61E-02	72%
Zinc	33	33	100%	57.1	3.74E+01	3.74E+01	7.79E+01	No	--	2.35E+04	--	1E+05 max	8.20E+02	No	--	--	--	No	2.43E-03	0.1%	--	--	--	No	1.59E-03	0%	--	--	--	No	-[d]	--
Extractable Hydrocarbons (8015B) (mg/kg)																																	
PHC as Diesel Fuel	14	33	42%	15	3.95E+01	1.50E+01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHC as Motor Oil	20	33	61%	160	4.39E+01	4.39E+01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Purgeable Hydrocarbons (8015B) (mg/kg)																																	
PHC as Gasoline	26	33	79%	2.77	9.99E+00	2.77E+00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Semivolatile Organics (8270C) (mg/kg)																																	
bis(2-Ethylhexyl) Phthalate	3	33	9%	0.07	--	7.00E-02	--	--	3.47E+01	1.20E+03	2.81E+02	7.10E+03	--	--	No	2.01E-09	0.0%	No	5.83E-05	0.0%	No	2.01E-09	0%	No	5.83E-05	0%	No	2.49E-10	0%	No	9.88E-08	0%
Diethylphthalate	1	33	3%	0.225	--	2.25E-01	--	--	--	4.80E+04	--	1.00E+05 max		--	--	--	--	No	4.80E-08	0.0%	--	--	--	No	4.80E-08	0%	--	--	--	No	-[d]	--
Phenol	12	33	36%	0.936	7.16E-01	7.16E-01	--	--	--	1.83E+04	--	1.00E+05 max	5.00E+00	No	--	--	--	No	5.11E-05	0.0%	--	--	--	No	3.91E-05	0%	--	--	--	No	-[d]	--
Semivolatile Organics (8270C-SIM) (mg/kg)																																	
Anthracene	1	33	3%	0.044	--	4.40E-02	--	--	--	2.19E+04	--	1.00E+05 max	5.90E+02	No	--	--	--	No	2.01E-08	0.0%	--	--	--	No	2.01E-08	0%	--	--	--	No	-[d]	--
Benzo(g,h,i)Perylene	4	33	12%	0.44	--	4.40E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	5	33	15%	1	--	1.00E+00	--	--	--	2.29E+03	--	1.35E+04	2.10E+02	No	--	--	--	No	4.36E-04	0.0%	--	--	--	No	4.36E-04	0%	--	--	--	No	7.43E-05	0%
Phenanthrene	2	33	6%	0.29	--	2.90E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	5	33	15%	0.98	--	9.80E-01	--	--	--	2.32E+03	--	1.30E+04	2.10E+02	No	--	--	--	No	4.15E-04	0.0%	--	--	--	No	4.15E-04	0%	--	--	--	No	7.36E-05	0%
Benzo(a)pyrene Equivalent	7	33	21%	1.48	--	1.48E+00	--	--	6.21E-02	--	8.10E-01	--	4.00E-01	Yes	Yes	2.39E-06	61.1%	--	--	--	Yes	2.34E-06	88%	--	--	--	Yes	2.90E-08	88%	--	--	--
Dioxins and Furans (8290) (mg/kg)																																	
2,3,7,8-TCDD TEQ	9	9	100%	0.0000126	--	1.26E-05	--	--	3.90E-06	--	9.00E-05	--	--	--	Yes	2.22E-08	9.9%	--	--	--	Yes	2.22E-08	9%	--	--	--	No	4.18E-07	10%	--	--	--
Incremental Lifetime Cancer Risk/Hazard Index Including Background:																4E-06			2E+00			4E-06			1E+00			4E-06			9E-02	
Incremental Lifetime Cancer Risk/Hazard Index Excluding Background:																3E-06			1E+00			3E-06			7E-01			3E-06			3E-03	

NOTES:

-- = no data or not applicable
% = percent
ca = carcinogenic
HI = hazard index
mg/kg = milligrams per kilogram
nc = noncarcinogenic
PRG = preliminary remediation goals
SSL = soil screening levels
EPC = exposure point concentration
EPA = Environmental Protection Agency
HQ = hazard quotient
RME = reasonable maximum exposure
FOD = frequency of detection
CTE = central tendency exposure
UCL = upper confidence limit
bgs = below ground surface
PHC = petroleum hydrocarbon
TCDD = tetrachlorodibenzodioxin
DAF = dilution attenuation factor
> = greater than

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Maximum concentration is the maximum detected concentration of an analyte.
[c] EPC is the minimum of either the 95% UCL or the max EPC. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region IX PRG table (EPA Region 9 2004b). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.
[f] Excess cancer risk = 1E-06 x (Maximum Detected Concentration or EPC / Carcinogenic PRG)
[g] HQ = EPC / Noncarcinogenic PRG
[h] An HQ for lead could not be determined because the PRGs for lead were developed using blood-lead levels and a reference dose is not available.

Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (EPA Region 9 2004b).

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Table 8-14: Risk-Based Screening Evaluation of Subsurface Soil (0-foot to 10 feet bgs) for (Current/Future) Residential Receptor

Chemical	Number of Detects	Sample Size [a]	FOD	Maximum EPC[b]	95% UCL	EPC[c]	Background Concentration	Site Metal Exceed Background?	Preliminary Remediation Goals: Region 9 PRGs (RME) Carcinogenic PRG[d]	Preliminary Remediation Goals: Region 9 PRGs (RME) Noncarcinogenic PRG[d]	Preliminary Remediation Goals: CTE PRGs Carcinogenic PRG[d]	Preliminary Remediation Goals: CTE PRGs Noncarcinogenic PRG[d]	SSL DAF 1[e]	Maximum Detect Evaluation: >SSL	Maximum Detect Evaluation: Carcinogenic >PRG (ca)	Maximum Detect Evaluation: Carcinogenic Excess Cancer Risk[f]	Maximum Detect Evaluation: Carcinogenic % Contribution Risk	Maximum Detect Evaluation: Noncarcinogenic >PRG (nc)	Maximum Detect Evaluation: Noncarcinogenic HQ[g]	Maximum Detect Evaluation: Noncarcinogenic % Contribution HI	RME Comparisons: Carcinogenic >PRG (ca)	RME Comparisons: Carcinogenic Excess Cancer Risk[f]	RME Comparisons: Carcinogenic % Contribution to Risk	RME Comparisons: Noncarcinogenic >PRG (nc)	RME Comparisons: Noncarcinogenic HQ[g]	RME Comparisons: Noncarcinogenic % Contribution to HI	CTE Comparisons: Carcinogenic >PRG (ca)	CTE Comparisons: Carcinogenic Excess Cancer Risk[f]	CTE Comparisons: Carcinogenic % Contribution to Risk	CTE Comparisons: Noncarcinogenic >PRG (nc)	CTE Comparisons: Noncarcinogenic HQ[g]	CTE Comparisons: Noncarcinogenic % Contribution to HI
Metals (6010B & 7471A) (mg/kg)																																
Aluminum	33	33	100%	1.58E+04	9.98E+03	9.98E+03	1.48E+04	Yes	–	7.81E+04	–	1E+05 max	–	–	–	–	–	No	2.08E-01	–	–	–	–	No	1.31E-01	9%	–	–	–	No	–[d]	–
Antimony	1	42	2%	2.10E+00	–	2.10E+00	3.06E+00	No	–	3.13E+01	–	1.74E+02	3.00E-01	Yes	–	–	–	No	6.71E-02	3.1%	–	–	–	No	6.71E-02	5%	–	–	–	No	1.21E-02	9%
Arsenic	42	42	100%	4.03E+00	3.20E+00	3.20E+00	8.86E+00	No	3.90E-01	2.16E+01	3.00E+00	1.22E+02	1.00E+00	Yes	Yes	1.19E-05	26.7%	No	2.14E-01	9.9%	Yes	8.20E-06	23%	No	1.46E-01	10%	Yes	1.06E-06	24%	No	2.62E-02	19%
Barium	42	42	100%	1.87E+02	1.04E+02	1.04E+02	1.73E+02	Yes	–	5.37E+03	–	7.77E+04	8.20E+01	Yes	–	–	–	No	3.48E-02	–	–	–	–	No	1.94E-02	1%	–	–	–	No	1.34E-03	1%
Beryllium	10	42	24%	3.10E-01	–	3.10E-01	6.69E-01	No	1.05E+03	1.54E+02	5.94E+03	8.44E+02	3.00E+00	No	No	2.94E-10	0.0%	No	2.01E-03	0.1%	No	2.94E-10	0%	No	2.01E-03	0%	No	5.21E-11	0%	No	3.67E-04	0%
Cadmium	33	42	79%	1.00E+00	7.74E-01	7.74E-01	2.35E+00	No	1.40E+03	3.70E+01	7.93E+03	2.17E+02	4.00E-01	Yes	No	7.14E-10	0.0%	No	2.70E-02	1.3%	No	5.53E-10	0%	No	2.09E-02	1%	No	9.77E-11	0%	No	3.57E-03	3%
Calcium	33	33	100%	2.52E+04	8.55E+03	8.55E+03	4.60E+04	No	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chromium	42	42	100%	1.64E+01	1.09E+01	1.09E+01	2.69E+01	No	2.11E+02	–	1.19E+03	–	2.00E+00	Yes	No	7.78E-08	0.2%	–	–	–	No	5.19E-08	0%	–	–	–	No	9.20E-09	0%	–	–	–
Cobalt	42	42	100%	7.60E+00	4.88E+00	4.88E+00	6.98E+00	Yes	9.03E+02	1.38E+03	5.10E+03	6.69E+03	–	–	No	8.42E-09	0.0%	No	5.51E-03	0.3%	No	5.40E-09	0%	No	3.53E-03	0%	No	9.56E-10	0%	No	7.29E-04	1%
Copper	42	42	100%	1.27E+01	7.02E+00	7.02E+00	6.41E+00	Yes	–	3.13E+03	–	1.74E+04	–	–	–	–	–	No	4.06E-03	–	–	–	–	No	2.25E-03	0%	–	–	–	No	4.04E-04	0%
Iron	33	33	100%	1.94E+04	1.25E+04	1.25E+04	1.84E+04	Yes	–	2.35E+04	–	1E+05 max	–	–	–	–	–	No	8.27E-01	–	–	–	–	No	5.32E-01	37%	–	–	–	No	–[d]	–
Lead	42	42	100%	2.07E+01	8.40E+00	8.40E+00	1.51E+01	Yes	–	4.00E+02	–	–	–	–	–	–	–	No	–	–	–	–	–	–	–[h]	–	–	–	–	No	–[h]	–
Magnesium	33	33	100%	6.90E+03	4.37E+03	4.37E+03	8.37E+03	No	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Manganese	42	42	100%	2.89E+02	1.96E+02	1.96E+02	2.01E+02	No	–	1.76E+03	–	9.13E+03	–	–	–	–	–	No	1.64E-01	–	–	–	–	No	1.11E-01	8%	–	–	–	No	2.14E-02	16%
Mercury	33	42	79%	6.90E-02	6.67E-02	6.67E-02	2.20E-01	No	–	2.35E+01	–	1.30E+02	–	–	–	–	–	No	2.94E-03	–	–	–	–	No	2.84E-03	0%	–	–	–	No	5.13E-04	0%
Nickel	41	42	98%	1.37E+01	7.86E+00	7.86E+00	1.53E+01	No	–	1.56E+03	–	8.69E+03	7.00E+00	Yes	–	–	–	No	8.76E-03	–	–	–	–	No	5.02E-03	0%	–	–	–	No	9.04E-04	1%
Potassium	33	33	100%	3.97E+03	2.64E+03	2.64E+03	4.89E+03	No	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Selenium	20	42	48%	1.10E+00	7.77E-01	7.77E-01	3.20E-01	Yes	–	3.91E+02	–	2.17E+03	3.00E-01	Yes	–	–	–	No	2.81E-03	–	–	–	–	No	1.99E-03	0%	–	–	–	No	3.58E-04	0%
Silver	1	42	2%	2.00E+00	–	2.00E+00	5.39E-01	Yes	–	3.91E+02	–	2.17E+03	2.00E+00	No	–	–	–	No	5.11E-03	–	–	–	–	No	5.11E-03	0%	–	–	–	No	9.22E-04	1%
Vanadium	42	42	100%	4.41E+01	2.79E+01	2.79E+01	7.18E+01	No	–	7.82E+01	–	4.25E+02	3.00E+02	No	–	–	–	No	5.64E-01	–	–	–	–	No	3.56E-01	25%	–	–	–	No	6.56E-02	49%
Zinc	42	42	100%	5.71E+01	3.77E+01	3.77E+01	7.79E+01	No	–	2.35E+04	–	1E+05 max	6.20E+02	No	–	–	–	No	2.43E-03	–	–	–	–	No	1.61E-03	0%	–	–	–	No	–[d]	–
Extractable Hydrocarbons (8015B) (mg/kg)																																
PHC as Diesel Fuel	19	42	45%	5.60E+03	1.48E+03	1.48E+03	–		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PHC as Motor Oil	20	33	61%	1.60E+02	4.39E+01	4.39E+01	–		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Purgeable Hydrocarbons (8015B) (mg/kg)																																
PHC as Gasoline	26	42	62%	2.78E+00	1.84E+01	2.78E+00	–		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Volatile Organics (8260B) (mg/kg)																																
Acetone	5	42	12%	1.00E-01	–	1.00E-01	–		–	1.40E+04	–	6.27E+04	8.00E-01	No	–	–	–	No	7.14E-06	–	–	–	–	No	7.14E-06	0%	–	–	–	No	1.60E-06	0%
Benzene	1	42	2%	2.40E-03	–	2.40E-03	–		6.40E-01	3.30E-01	3.99E+00	9.39E+01	2.00E-03	Yes	No	3.75E-09	0.0%	No	7.27E-03	0.3%	No	3.75E-09	0%	No	7.27E-03	1%	No	6.02E-10	0%	No	2.56E-05	0%
Methylene Chloride	1	9	11%	9.20E-03	–	9.20E-03	–		9.11E+00	2.00E+03	6.89E+01	7.78E+03	1.00E-03	Yes	No	1.01E-09	0.0%	No	4.60E-06	0.0%	No	1.01E-09	0%	No	4.60E-06	0%	No	1.34E-10	0%	No	1.18E-06	0%
Semivolitile Organics (8270C) (mg/kg)																																
bis(2-Ethylhexyl) Phthalate	3	33	9%	7.00E-02	–	7.00E-02	–		3.47E+01	1.20E+03	2.81E+02	7.10E+03	–	–	No	2.01E-09	0.0%	No	5.83E-05	0.0%	No	2.01E-09	0%	No	5.83E-05	0%	No	2.49E-10	0%	No	9.86E-06	0%
Diethylphthalate	3	42	7%	2.60E-01	–	2.60E-01	–		–	4.89E+04	–	1E+05 max	–	–	–	–	–	No	5.32E-06	–	–	–	–	No	5.32E-06	0%	–	–	–	No	–[d]	–
Hexachlorbenzene	1	9	11%	1.50E-01	–	1.50E-01	–		3.04E-01	4.90E+01	2.46E+00	2.84E+02	1.00E-01	Yes	No	4.93E-07	1.1%	No	3.06E-03	0.1%	No	4.93E-07	1%	No	3.06E-03	0%	No	6.10E-08	1%	No	5.28E-04	0%
Phenol	12	33	36%	9.36E-01	3.29E+00	9.36E-01	–		–	1.83E+04	–	1E+05 max	5.00E+00	No	–	–	–	No	5.11E-05	–	–	–	–	No	5.11E-05	0%	–	–	–	No	–[d]	–
Fluoranthene	1	9	11%	6.00E-01	–	6.00E-01	–		–	2.29E+03	–	1.35E+04	2.10E+02	No	–	–	–	No	2.62E-04	–	–	–	–	No	2.62E-04	–[i]	–	–	–	No	4.46E-05	–[i]
Phenanthrene	1	9	11%	1.40E-01	–	1.40E-01	–		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pyrene	1	9	11%	4.60E-01	–	4.60E-01	–		–	2.32E+03	–	1.30E+04	2.10E+02	No	–	–	–	No	1.99E-04	–	–	–	–	No	1.99E-04	–[i]	–	–	–	No	3.53E-05	–[i]
Benzo(a)pyrene Equivalent	1	9	11%	3.09E-01	–	3.09E-01	–		6.21E-02	–	5.10E-01	–	4.00E-01	No	Yes	4.97E-08	11.2%	–	–	–	Yes	4.97E-08	–	–	–	–	No	6.06E-07	–[i]	–	–	–
Semivolatile Organics (8270C-SIM) (mg/kg)																																
Anthracene	1	33	3%	4.40E-02	–	4.40E-02	–		–	2.19E+04	–	1E+05 max	5.90E+02	No	–	–	–	No	2.01E-06	–	–	–	–	No	2.01E-06	0%	–	–	–	No	–[d]	–
Benzo(g,h,i)Perylene	4	33	12%	4.40E-01	–	4.40E-01	–		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Fluoranthene	5	33	15%	1.00E+00	–	1.00E+00	–		–	2.29E+03	–	1.35E+04	2.10E+02	No	–	–	–	No	4.30E-04	–	–	–	–	No	4.30E-04	0%	–	–	–	No	7.43E-05	0%
Phenanthrene	2	33	6%	2.90E-01	–	2.90E-01	–		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pyrene	5	33	15%	9.60E-01	–	9.60E-01	–		–	2.32E+03	–	1.30E+04	2.10E+02	No	–	–	–	No	4.15E-04	–	–	–	–	No	4.15E-04	0%	–	–	–	No	7.36E-05	0%
Benzo(a)pyrene Equivalent[j]	7	33	21%	1.48E+00	–	1.48E+00	–		6.21E-02	–	5.10E-01	–	4.00E-01	Yes	Yes	2.38E-05	53.9%	–	–	–	Yes	2.38E-06	86%	–	–	–	Yes	2.90E-06	65%	–	–	–
Dioxins and Furans (8290) (mg/kg)																																
2,3,7,8-TCDD TEQ	11	11	100%	1.29E-06	–[k]	1.20E-06	–		3.90E-06	–	3.00E-06	–	–	–	Yes	3.31E-06	7.4%	–	–	–	Yes	3.31E-06	9%	–	–	–	No	4.30E-07	10%	–	–	–
Incremental Lifetime Cancer Risk/Hazard Index Including Background:																4E-05			2E+00			4E-05			1E+00			4E-06			1E-01	
Incremental Lifetime Cancer Risk/Hazard Index Excluding Background:																4E-05			2E+00			3E-05			7E-01			3E-06			4E-03	

Notes:

– = no data or not applicable
% = percent
ca = carcinogenic
HI = hazard index
mg/kg = milligrams per kilogram
nc = noncarcinogenic
PRG = preliminary remediation goal
SSL = soil screening level
EPC = exposure point concentration
EPA = Environmental Protection Agency
HQ = hazard quotient
RME = reasonable maximum exposure
FOD = frequency of detection
CTE = central tendency exposure
UCL = upper confidence limit
bgs = below ground surface
TCDD = tetrachlorodibenzodioxin
PHC = petroleum hydrocarbon
DAF = dilution attenuation factor
> = greater than

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Maximum concentration is the maximum detected concentration of an analyte.
[c] EPC is the minimum of either the 95% UCL or the max EPC. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region 9 PRG table (EPA Region 9 2004b). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.
[f] Excess cancer risk = 1E-06 x (Maximum Detected Concentration or EPC / Carcinogenic PRG)
[g] HQ = EPC / Noncarcinogenic PRG
[h] An HQ for lead could not be determined because the PRGs for lead were developed using blood-lead levels and a reference dose is not available.
[i] Only the higher concentration using the 8270C-SIM method is included in the quantitative risk estimate(s).
[j] A 95 percent UCL was not calculated as only 5 of the 25 detected congeners had 11 detections, and none of the 5 congeners contributed significantly to the TCDD TEQ.
Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (EPA Region 9 2004b).

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Table 8-15: Risk-Based Screening of Indoor Air from Soil for (Current/Future) Residential Receptor

							Preliminary Remedial Goals						RME Evaluation						CTE Evaluation					
							RME PRGs		CTE PRGs		EPA Region 9 PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect in Soil (mg/kg)[a]	Soil EPC[b]	Estimated Indoor Air Concentration (mg/m^3)	Carcinogenic PRG	Non-carcinogenic PRG	Carcinogenic PRG	Non-carcinogenic PRG	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[c]	% Contribution to Risk	>PRG (nc)	HQ[d]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI
Acetone	5	42	12%	1.00E-01	1.00E-01	2.02E-03	--	3.29E+00	--	6.08E+00	--	No	--	--	--	No	6.14E-04	10%	--	--	--	No	3.32E-04	10%
Benzene	1	42	2%	2.40E-03	2.40E-03	6.37E-06	2.49E-04	3.14E-02	9.38E-04	5.81E-02	No	No	No	2.56E-08	1%	No	2.03E-04	3%	No	6.79E-09	1%	No	1.10E-04	3%
Hexachlorobenzene	1	9	11%	1.50E-01	1.50E-01	1.47E-05	4.20E-06	2.92E-03	1.58E-05	5.41E-03	Yes	No	Yes	3.49E-06	98%	No	5.03E-03	85%	No	9.27E-07	98%	No	2.71E-03	85%
Methylene Chloride	1	9	11%	9.20E-03	9.20E-03	1.86E-04	4.10E-03	3.13E+00	1.54E-02	5.79E+00	No	No	No	4.53E-08	1%	No	5.93E-05	1%	No	1.20E-08	1%	No	3.20E-05	1%
Pyrene	1	9	11%	9.60E-01	9.60E-01	2.18E-07	--	1.10E-01	--	2.03E-01	--	No	--	--	--	No	1.99E-06	0%	--	--	--	No	1.08E-06	0%
						Cumulative Incremental Lifetime Cancer Risk/Hazard Index:								4E-06			6E-03			9E-07			3E-03	

Notes:

[a] Maximum detect is the maximum detected concentration of an analyte in the medium.

[b] EPC is the maximum detected concentration since there are too few number of detections (less than 11) to estimate a UCL of a mean concentration using ProUCL.

[c] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[d] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[e] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[f] HQ = EPC / CTE Noncarcinogic PRG

-- = no data or not applicable

> = greater than

% = percent

ca = carcinogenic

COPEC = chemical of potential ecological concern

CTE = central tendency exposure

EPA = Environmental Protection Agency

EPC = exposure point concentration

FOD = frequency of detection

HI = hazard index

mg/kg = milligrams per kilogram

mg/m^3 = milligrams per cubic meter

nc = noncarcinogenic

PRG = preliminary remediation goal

RME = reasonable maximum exposure

Shading identifies COPCs with indoor air concentrations above PRGs.

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Table 8-16: Risk-Based Screening Evaluation of Surface Soil (0-foot to 1-foot bgs) for (Current/Future) Industrial Receptor

Chemical	Number of Detects	Sample Size[a]	FOD	Maximum EPC[b]	95% UCL	EPC[c]	Background Concentration	Site Metal Exceed Background?	Preliminary Remediation Goals: Region 9 PRGs (RME) Carcinogenic PRG[d]	Region 9 PRGs (RME) Noncarcinogenic PRG[d]	CTE PRGs Carcinogenic PRG[d]	CTE PRGs Noncarcinogenic PRG[d]	SSL DAF 1[e]	Maximum Detect Evaluation >SSL	Maximum Detect Evaluation >PRG (ca)	Maximum Detect Evaluation >PRG (nc)	RME Evaluation Carcinogenic >PRG (ca)	RME Carcinogenic Incremental Cancer Risk[f]	RME Carcinogenic % Contribution to Risk	RME Noncarcinogenic >PRG (nc)	RME Noncarcinogenic HQ[g]	RME Noncarcinogenic % Contribution to HI	CTE Evaluation Carcinogenic >PRG (ca)	CTE Carcinogenic Incremental Cancer Risk[f]	CTE Carcinogenic % Contribution to Risk	CTE Noncarcinogenic >PRG (nc)	CTE Noncarcinogenic HQ[g]	CTE Noncarcinogenic % Contribution to HI
Metals (6010B & 7471A) (mg/kg)																												
Aluminum	33	33	100%	1.58E+04	9.98E+03	9.98E+03	1.48E+04	Yes	–	1E+05 max	–	1E+05 max	–	–	–	–	–	–	–	–	–[d]	–	–	–	–	No	–[d]	–
Antimony	1	33	3%	2.10E+00	–	2.10E+00	3.06E+00	No	–	4.09E+02	–	1.87E+03	3.00E-01	Yes	–	No	–	–	–	No	5.14E-03	9%	–	–	–	No	1.13E-03	9%
Arsenic	33	33	100%	4.60E+00	3.16E+00	3.16E+00	6.86E+00	No	1.59E+00	2.56E+02	3.06E+01	1.30E+03	1.00E+00	Yes	Yes	No	Yes	1.99E-06	19%	No	1.23E-02	21%	No	1.03E-07	23%	No	2.43E-03	20%
Barium	33	33	100%	1.87E+02	1.07E+02	1.07E+02	1.73E+02	Yes	–	6.66E+04	–	1E+05 max	8.20E+01	Yes	–	No	–	–	–	No	1.61E-03	3%	–	–	–	No	–[d]	–
Beryllium	10	33	30%	3.10E-01	–	3.10E-01	6.69E-01	No	2.20E+03	1.90E+03	7.69E+04	9.09E+03	3.00E+00	No	No	No	No	1.41E-10	0%	No	1.63E-04	0%	No	4.03E-12	0%	No	3.41E-05	0%
Cadmium	33	33	100%	1.00E+00	6.71E-01	6.71E-01	2.35E+00	No	3.00E+03	4.51E+02	1E+05 max	2.33E+03	4.00E-01	Yes	No	No	No	2.24E-10	0%	No	1.49E-03	2%	No	–[d]	–	No	2.88E-04	2%
Calcium	33	33	100%	2.52E+04	8.55E+03	8.55E+03	4.60E+04	No	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chromium (total)	33	33	100%	1.58E+01	1.09E+01	1.09E+01	2.69E+01	No	4.50E+02	–	1.54E+04	–	2.00E+00	Yes	No	–	No	2.42E-08	0%	–	–	–	No	7.08E-10	0%	–	–	–
Cobalt	33	33	100%	7.60E+00	5.06E+00	5.06E+00	6.98E+00	Yes	1.92E+03	1.30E+04	6.59E+04	7.36E+04	–	–	No	No	No	2.63E-09	0%	No	3.89E-04	1%	No	7.67E-11	0%	No	6.88E-05	1%
Copper	33	33	100%	1.08E+01	6.71E+00	6.71E+00	6.41E+00	Yes	–	4.09E+04	–	1E+05 max	–	–	–	No	–	–	–	No	1.64E-04	0%	–	–	–	No	–[d]	–
Iron	33	33	100%	1.94E+04	1.25E+04	1.25E+04	1.84E+04	Yes	–	1.0E+05 max	–	1E+05 max	–	–	–	–	–	–	–	–	–[d]	–	–	–	–	No	–[d]	–
Lead	33	33	100%	2.07E+01	8.50E+00	8.50E+00	1.51E+01	Yes	–	8.00E+02	–	–	–	–	–	No	–	–	–	No	–[h]	–	–	–	–	No	–[h]	–
Magnesium	33	33	100%	6.90E+03	4.37E+03	4.37E+03	8.37E+03	No	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Manganese	33	33	100%	2.89E+02	1.97E+02	1.97E+02	2.91E+02	No	–	1.95E+04	–	9.92E+04	–	–	–	No	–	–	–	No	1.01E-02	17%	–	–	–	No	1.99E-03	16%
Mercury	33	33	100%	6.90E-02	3.06E-02	3.06E-02	2.20E-01	No	–	3.10E+02	–	1.40E+03	–	–	–	No	–	–	–	No	9.87E-05	0%	–	–	–	No	2.19E-05	0%
Nickel	33	33	100%	1.21E+01	7.72E+00	7.72E+00	1.53E+01	No	–	2.04E+04	–	9.33E+04	7.00E+00	Yes	–	No	–	–	–	No	3.78E-04	1%	–	–	–	No	8.27E-05	1%
Potassium	33	33	100%	3.97E+03	2.64E+03	2.64E+03	4.89E+03	No	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Selenium	20	33	61%	1.10E+00	6.62E-01	6.62E-01	3.20E-01	Yes	–	5.11E+03	–	2.33E+04	3.00E-01	Yes	–	No	–	–	–	No	1.30E-04	0%	–	–	–	No	2.84E-05	0%
Silver	1	33	3%	2.00E+00	–	2.00E+00	5.39E-01	Yes	–	5.11E+03	–	2.33E+04	2.00E+00	No	–	No	–	–	–	No	3.91E-04	1%	–	–	–	No	8.58E-05	1%
Vanadium	33	33	100%	4.41E+01	2.81E+01	2.81E+01	7.18E+01	No	–	1.02E+03	–	4.55E+03	3.00E+02	No	–	No	–	–	–	No	2.75E-02	46%	–	–	–	No	6.18E-03	50%
Zinc	33	33	100%	5.71E+01	3.74E+01	3.74E+01	7.79E+01	No	–	1.0E+05 max	–	1.00E+05 max	6.20E+02	No	–	–	–	–	–	–	–[d]	–	–	–	–	No	–[d]	–
Extractable Hydrocarbons (8015B) (mg/kg)																												
PHC as Diesel Fuel	14	33	42%	1.50E+01	3.95E+01	1.50E+01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PHC as Motor Oil	20	33	61%	1.60E+02	4.39E+01	4.39E+01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Purgeable Hydrocarbons (8015B) (mg/kg)																												
PHC as Gasoline	26	33	79%	2.77E+00	9.99E+00	2.77E+00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Semivolitile Organics (8270C) (mg/kg)																												
bis(2-Ethylhexyl) Phthalate	3	33	9%	7.00E-02	–	7.00E-02	–	–	1.20E+02	1.20E+04	2.80E+03	7.38E+04	–	–	No	No	No	5.83E-10	0%	No	5.83E-06	0%	No	2.50E-11	0%	No	9.48E-07	0%
Diethylphthalate	1	33	3%	2.25E-01	–	2.25E-01	–	–	–	1.0E+05 max	–	1.0E+05 max	–	–	–	–	–	–	–	–	–[d]	–	–	–	–	No	–[d]	–
Phenol	12	33	36%	9.36E-01	7.16E-01	7.16E-01	–	–	–	1.0E+05 max	–	1.0E+05 max	5.00E+00	No	–	–	–	–	–	–	–[d]	–	–	–	–	No	–[d]	–
Semivolitile Organics (8270C-SIM) (mg/kg)																												
Anthracene	1	33	3%	4.40E-02	–	4.40E-02	–	–	–	1.0E+05 max	–	1.0E+05 max	5.90E+02	No	–	–	–	–	–	–	–[d]	–	–	–	–	No	–[d]	–
Benzo(g,h,i)Perylene	4	33	12%	4.40E-01	–	4.40E-01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Fluoranthene	5	33	15%	1.00E+00	–	1.00E+00	–	–	–	2.20E+04	–	1.0E+05 max	2.10E+02	No	–	No	–	–	–	No	4.55E-05	0%	–	–	–	No	–[d]	–
Phenanthrene	2	33	6%	2.90E-01	–	2.90E-01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pyrene	5	33	15%	9.60E-01	–	9.60E-01	–	–	–	2.91E+04	–	1.0E+05 max	2.10E+02	No	–	No	–	–	–	No	3.30E-05	0%	–	–	–	No	–[d]	–
Benzo(a)pyrene Equivalent	7	33	21%	1.58E+00	–	1.58E+00		–	2.11E-01	–	6.05E+00	–	4.00E-01	Yes	Yes	–	Yes	7.49E-06	73%	–	–	–	No	3.13E-07	68%	–	–	–
Dioxins and Furans (8290) (mg/kg)																												
2,3,7,8-TCDD TEQ	9	9	100%	1.25E-05	–	1.25E-05	–	–	1.59E-05	–	3.06E-04	–	–	–	No	–	No	7.87E-07	8%	–	–	–	No	4.10E-08	8%	–	–	–
Incremental Lifetime Cancer Risk/Hazard Index Including Background:																		1E-05			6E-02			5E-07			1E-02	
Incremental Lifetime Cancer Risk/Hazard Index Excluding Background:																		8E-06			3E-03			4E-07			2E-04	

Notes:

– = no data or not applicable
% = percent
ca = carcinogenic
HI = hazard index
mg/kg = milligrams per kilogram
nc = noncarcinogenic
PRG = preliminary remediation goals
SSL = soil screening levels
EPC = exposure point concentration
EPA = Environmental Protection Agency
HQ = hazard quotient
RME = reasonable maximum exposure
FOD = frequency of detection
CTE = central tendency exposure
UCL = upper confidence limit
bgs = below ground surface
TCDD = tetrachlorodibenzo-dioxin
PHC = petroleum hydrocarbon
DAF = dilution attenuation factor
> = greater than

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Max EPC is the maximum detected concentration of an analyte.
[c] EPC is the minimum of either the 95% UCL or the max EPC. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region 9 PRG table (EPA Region 9 2004b). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.
[f] Excess cancer risk = 1E-06 x (EPC / Carcinogenic PRG)
[g] HQ = EPC / Noncarcinogenic PRG
[h] An HQ for lead could not be determined because the PRGs for lead were developed using blood-lead levels and a reference dose is not available.

Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (EPA Region 9 2004b).

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Table 8-17: Risk-Based Screening Evaluation of Subsurface Soil (0-foot to 10 feet bgs) for (Current/Future) Industrial Receptor

Chemical	Number of Detects	Sample Size [a]	FOD	Maximum EPC[b]	95% UCL	EPC[c]	Background Concentration	Site Metal Exceed Background?	Preliminary Remediation Goals: Region 9 PRGs (RME) Carcinogenic PRG[d]	Region 9 PRGs (RME) Noncarcinogenic PRG[d]	CTE PRGs Carcinogenic PRG[d]	CTE PRGs Noncarcinogenic PRG[d]	SSL DAF 1[e]	Maximum Detect Evaluation >SSL	Maximum Detect Evaluation Carcinogenic >PRG (ca)	Maximum Detect Evaluation Noncarcinogenic >PRG (nc)	RME Evaluation Carcinogenic >PRG (ca)	RME Carcinogenic Excess Cancer Risk[f]	RME Carcinogenic % Contribution to Risk	RME Noncarcinogenic >PRG (nc)	RME Noncarcinogenic HQ[g]	RME Noncarcinogenic % Contribution to HI	CTE Evaluation Carcinogenic >PRG (ca)	CTE Carcinogenic Excess Cancer Risk[f]	CTE Carcinogenic % Contribution to Risk	CTE Noncarcinogenic >PRG (nc)	CTE Noncarcinogenic HQ[g]	CTE Noncarcinogenic % Contribution to HI
Metals (6010B & 7471A) (mg/kg)																												
Aluminum	33	33	100%	1.58E+04	9.98E+03	9.98E+03	1.48E+04	Yes	--	1.00E+05 max	--	1E+05 max	--	--	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Antimony	1	42	2%	2.10E+00	--	2.10E+00	3.06E+00	No	--	4.09E+02	--	1.87E+03	3.00E-01	Yes	--	No	--	--	--	No	5.14E-03	8%	--	--	--	No	1.13E-03	9%
Arsenic	42	42	100%	4.63E+00	3.20E+00	3.20E+00	6.86E+00	No	1.59E+00	2.56E+02	3.06E+01	1.30E+03	1.00E+00	Yes	Yes	No	Yes	2.01E-06	10%	No	1.25E-02	20%	No	1.06E-07	22%	No	2.46E-03	20%
Barium	42	42	100%	1.87E+02	1.04E+02	1.04E+02	1.73E+02	Yes	--	6.86E+04	--	1E+05 max	8.20E+01	Yes	--	No	--	--	--	No	1.56E-03	3%	--	--	--	No	--[d]	--
Beryllium	10	42	24%	3.10E-01	--	3.10E-01	6.69E-01	No	2.20E+03	1.90E+03	7.69E+04	9.09E+03	3.00E+00	No	No	No	No	1.41E-10	0%	No	1.63E-04	0%	No	4.03E-12	0%	No	3.41E-05	0%
Cadmium	33	42	79%	1.00E+00	7.74E-01	7.74E-01	2.35E+00	No	3.00E+03	4.51E+02	1E+05 max	2.33E+03	4.00E-01	Yes	No	No	No	2.58E-10	0%	No	1.72E-03	3%	--	--[d]	--	No	3.32E-04	3%
Calcium	33	33	100%	2.52E+04	8.55E+03	8.55E+03	4.60E+04	No	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium (total)	42	42	100%	1.64E+01	1.09E+01	1.09E+01	2.69E+01	No	4.48E+02	--	1.54E+04	--	2.00E+00	Yes	No	--	No	2.44E-08	0%	--	--	--	No	7.11E-10	0%	--	--	--
Cobalt	42	42	100%	7.60E+00	4.88E+00	4.88E+00	6.98E+00	Yes	1.92E+03	1.30E+04	6.59E+04	7.36E+04	--	--	No	No	No	2.54E-09	0%	No	3.75E-04	1%	No	7.40E-11	0%	No	6.63E-05	1%
Copper	42	42	100%	1.27E+01	7.02E+00	7.02E+00	6.41E+00	Yes	--	4.09E+04	--	1E+05 max	--	--	--	No	--	--	--	No	1.72E-04	0%	--	--	--	No	--[d]	--
Iron	33	33	100%	1.94E+04	1.25E+04	1.25E+04	1.84E+04	Yes	--	1.00E+05 max	--	1E+05 max	--	--	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Lead	42	42	100%	2.07E+01	8.40E+00	8.40E+00	1.51E+01	Yes	--	8.00E+02	--	--	--	--	--	No	--	--	--	No	--[h]	--[h]	--	--	--	No	--[h]	--
Magnesium	33	33	100%	6.90E+03	4.37E+03	4.37E+03	8.37E+03	No	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	42	42	100%	2.89E+02	1.96E+02	1.96E+02	2.91E+02	No	--	1.95E+04	--	9.92E+04	--	--	--	No	--	--	--	No	1.01E-02	16%	--	--	--	No	1.97E-03	16%
Mercury	33	42	79%	6.90E-02	6.67E-02	6.67E-02	2.20E-01	No	--	3.10E+02	--	1.40E+03	--	--	--	No	--	--	--	No	2.15E-04	0%	--	--	--	No	4.77E-05	0%
Nickel	41	42	98%	1.37E+01	7.86E+00	7.86E+00	1.53E+01	No	--	2.04E+04	--	9.33E+04	7.00E+00	Yes	--	No	--	--	--	No	3.85E-04	1%	--	--	--	No	8.42E-05	1%
Potassium	33	33	100%	3.97E+03	2.64E+03	2.64E+03	4.89E+03	No	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	20	42	48%	1.10E+00	7.77E-01	7.77E-01	3.20E-01	Yes	--	5.11E+03	--	2.33E+04	3.00E-01	Yes	--	No	--	--	--	No	1.52E-04	0%	--	--	--	No	3.33E-05	0%
Silver	1	42	2%	2.00E+00	--	2.00E+00	5.39E-01	Yes	--	5.11E+03	--	2.33E+04	2.00E+00	No	--	No	--	--	--	No	3.91E-04	1%	--	--	--	No	8.58E-05	1%
Vanadium	42	42	100%	4.41E+01	2.79E+01	2.79E+01	7.18E+01	No	--	1.00E+03	--	4.55E+03	3.00E+02	No	--	No	--	--	--	No	2.79E-02	46%	--	--	--	No	6.13E-03	49%
Zinc	42	42	100%	5.71E+01	3.77E+01	3.77E+01	7.79E+01	No	--	1.00E+05 max	--	1.00E+05 max	6.20E+02	No	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Extractable Hydrocarbons (8015B) (mg/kg)																												
PHC as Diesel Fuel	19	42	45%	5.60E+03	1.48E+03	1.48E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHC as Motor Oil	20	33	61%	1.60E+02	4.39E+01	4.39E+01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Purgeable Hydrocarbons (8015B) (mg/kg)																												
PHC as Gasoline	26	42	62%	2.78E+00	1.84E+01	2.78E+00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Volatile Organics (8260B) (mg/kg)																												
Acetone	5	42	12%	1.00E-01	--	1.00E-01	--	--	--	5.40E+04	--	1.00E+05 max	8.00E-01	No	--	No	--	--	--	No	1.85E-06	0%	--	--	--	No	--[d]	--
Benzene	1	42	2%	2.40E-03	--	2.40E-03	--	--	1.40E+00	1.20E+02	5.10E+01	1.11E+03	2.00E-03	Yes	No	No	No	1.71E-09	0%	No	2.00E-05	0%	No	4.71E-11	0%	No	2.16E-06	0%
Methylene Chloride	1	9	11%	9.20E-03	--	9.20E-03	--	--	2.05E+01	9.30E+03	8.67E+02	8.98E+04	1.00E-03	Yes	No	No	No	4.48E-10	0%	No	9.89E-07	0%	No	1.06E-11	0%	No	1.02E-13	0%
Semivolatile Organics (8270C) (mg/kg)																												
bis(2-Ethylhexyl) Phthalate	3	33	9%	7.00E-02	--	7.00E-02	--	--	1.20E+02	1.20E+04	2.80E+03	7.38E+04	--	--	No	No	No	5.83E-10	--	No	5.83E-06	--	No	2.50E-11	0%	No	9.48E-07	0%
Diethylphthalate	3	42	7%	2.60E-01	--	2.60E-01	--	--	--	1.00E+05 max	--	1.00E+05 max	--	--	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Hexachlorobenzene	1	9	11%	1.50E-01	--	1.50E-01	--	--	1.08E+00	4.90E+02	2.45E+01	2.95E+03	1.00E-01	Yes	No	No	No	1.39E-07	1%	No	3.06E-04	1%	No	6.13E-09	1%	No	5.08E-05	0%
Phenol	12	33	36%	9.36E-01	3.29E+00	9.36E-01	--	--	--	1.00E+05 max	--	1.00E+05 max	5.00E+00	No	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Fluoranthene	1	9	11%	6.00E-01	--	6.00E-01	--	--	--	2.20E+04	--	1.00E+05 max	2.10E+02	No	--	No	--	--	--	No	2.73E-05	--[i]	--	--	--	No	--[d]	--
Phenanthrene	1	9	11%	1.40E-01	--	1.40E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	1	9	11%	4.60E-01	--	4.60E-01	--	--	--	2.91E+04	--	1.00E+05 max	2.10E+02	No	--	No	--	--	--	No	1.58E-05	--[i]	--	--	--	No	--[d]	--
Benzo(a)pyrene Equivalent	1	9	11%	3.48E-01		3.48E-01	--	--	2.11E-01	--	5.05E+00	--	4.00E-01	No	Yes	--	Yes	1.65E-06	--	--	--	--	No	6.89E-08	--	--	--	--
Semivolatile Organics (8270C-SIM) (mg/kg)																												
Anthracene	1	33	3%	4.40E-02	--	4.40E-02	--	--	--	2.40E+05	--	1.00E+05 max	5.90E+02	No	--	No	--	--	--	No	1.83E-07	0%	--	--	--	No	--[d]	--
Benzo(G,H,I)Perylene	4	33	12%	4.40E-01	--	4.40E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	5	33	15%	1.00E+00	--	1.00E+00	--	--	--	2.20E+04	--	1.00E+05 max	2.10E+02	No	--	No	--	--	--	No	4.55E-05	0%	--	--	--	No	--[d]	--
Phenanthrene	2	33	6%	2.90E-01	--	2.90E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	5	33	15%	9.60E-01	--	9.60E-01	--	--	--	2.91E+04	--	1.00E+05 max	2.10E+02	No	--	No	--	--	--	No	3.30E-05	0%	--	--	--	No	--[d]	--
Benzo(a)pyrene Equivalent	7	33	21%	1.58E+00	--	1.58E+00	--	--	2.11E-01	--	5.05E+00	--	4.00E-01	Yes	Yes	--	Yes	7.40E-06	71%	--	--	--	No	3.13E-07	87%	--	--	--
Dioxins and Furans (8290) (mg/kg)																												
2,3,7,8-TCDD TEQ	11	11	100%	1.29E-05	--[j]	1.29E-05	--	--	1.52E-05	--	3.06E-04	--	--	--	No	--	No	8.10E-07	8%	--	--	--	No	4.22E-08	0%	--	--	--
Incremental Lifetime Cancer Risk/Hazard Index Including Background:																		1E-05			6E-02			5E-07			1E-02	
Incremental Lifetime Cancer Risk/Hazard Index Excluding Background:																		8E-06			3E-03			4E-07			2E-04	

Notes:

-- = no data or not applicable
% = percent
ca = carcinogenic
HI = hazard index
mg/kg = milligrams per kilogram
nc = noncarcinogenic
PRG = preliminary remediation goals
SSL = soil screening levels
EPC = exposure point concentration
EPA = Environmental Protection Agency
HQ = hazard quotient
RME = reasonable maximum exposure
FOD = frequency of detection
CTE = central tendency exposure
UCL = upper confidence limit
bgs = below ground surface
max = maximum
PHC = petroleum hydrocarbon
DAF = dilution attenuation factor
> = greater than
TCDD = tetrachlorodibenzodioxin

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Max EPC is the maximum detected concentration of an analyte.
[c] EPC is the minimum of either the 95% UCL or the max EPC. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region 9 PRG table (EPA Region 9 2004b). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.
[f] Excess cancer risk = 1E-06 x (EPC / Carcinogenic PRG)
[g] HQ = EPC / Noncarcinogenic PRG
[h] An HQ for lead could not be determined because the PRGs for lead were developed using blood-lead levels and a reference dose is not available.
[i] Only the higher concentration using the 8270C-SIM method is included in the quantitative risk estimate(s).
[j] A 95 percent UCL was not calculated as only 5 of the 25 detected congeners had 11 detections, and none of the 5 congeners contributed significantly to the TCDD TEQ.
Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (EPA Region 9 2004b).

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Table 8-18: Risk-Based Screening of Indoor Air from Soil for (Current/Future) Industrial Receptor

							Preliminary Remedial Goals						RME Evaluation						CTE Evaluation					
							RME PRGs		CTE PRGs		EPA Region 9 PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect in Soil (mg/kg)[a]	Soil EPC[b]	Estimated Indoor Air Concentration (mg/m^3)	Carcinogenic PRG	Non-carcinogenic PRG	Carcinogenic PRG	Non-carcinogenic PRG	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[c]	% Contribution to Risk	>PRG (nc)	HQ[d]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI
Acetone	5	42	12%	1.00E-01	1.00E-01	1.21E-03	–	4.60E+00	–	7.23E+00	–	No	–	–	–	No	2.63E-04	12%	–	–	–	No	1.67E-04	12%
Benzene	1	42	2%	2.40E-03	2.40E-03	3.18E-06	5.30E-04	4.39E-02	3.16E-03	6.91E-02	No	No	No	6.01E-09	1%	No	7.25E-05	3%	No	1.01E-09	1%	No	4.61E-05	3%
Hexachlorobenzene	1	9	11%	1.50E-01	1.50E-01	7.34E-06	8.94E-06	4.09E-03	5.33E-05	6.43E-03	No	No	No	8.20E-07	98%	No	1.79E-03	83%	No	1.38E-07	98%	No	1.14E-03	83%
Methylene Chloride	1	9	11%	9.20E-03	9.20E-03	1.11E-04	8.72E-03	4.38E+00	5.20E-02	6.89E+00	No	No	No	1.28E-08	2%	No	2.54E-05	1%	No	2.14E-09	2%	No	1.62E-05	1%
Pyrene	1	9	11%	9.60E-01	9.60E-01	1.09E-07	–	1.53E-01	–	2.41E-01	–	No	–	–	–	No	7.12E-07	0%	–	–	–	No	4.53E-07	0%
Cumulative Incremental Lifetime Cancer Risk/Hazard Index:														8E-07			2E-03			1E-07			1E-03	

Notes:

[a] Maximum detect is the maximum detected concentration of an analyte in the medium.

[b] EPC is the maximum detected concentration since there are too few number of detections (less than 11) to estimate a UCL of a mean concentration using ProUCL.

[c] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[d] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[e] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[f] HQ = EPC / CTE Noncarcinogic PRG

– = no data or not applicable

> = greater than

% = percent

ca = carcinogenic

COPEC = chemical of potential ecological concern

CTE = central tendency exposure

EPA = Environmental Protection Agency

EPC = exposure point concentration

FOD = frequency of detection

HI = hazard index

mg/kg = milligrams per kilogram

mg/m^3 = milligrams per cubic meter

nc = noncarcinogenic

PRG = preliminary remediation goal

RME = reasonable maximum exposure

Shading identifies COPCs with indoor air concentrations above PRGs.

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Table 8-19: Risk-Based Screening Evaluation of Groundwater for Future Residential Receptor

Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detection[b]	95% UCL	EPC[c]	Preliminary Remediation Goals: Region 9 PRGs (RME) Carcinogenic PRG[d]	Preliminary Remediation Goals: Region 9 PRGs (RME) Noncarcinogenic PRG[d]	Preliminary Remediation Goals: CTE PRGs Carcinogenic PRG[d]	Preliminary Remediation Goals: CTE PRGs Noncarcinogenic PRG[d]	Maximum Detect Evaluation: Carcinogenic >PRG (ca)	Maximum Detect Evaluation: Noncarcinogenic >PRG (nc)	RME Evaluation: Carcinogenic >PRG (ca)	RME Carcinogenic: Excess Cancer Risk[e]	RME Carcinogenic: % Contribution to Risk	RME Noncarcinogenic: >PRG (nc)	RME Noncarcinogenic: HQ[f]	RME Noncarcinogenic: % Contribution to HI	CTE Evaluation: Carcinogenic >PRG (ca)	CTE Carcinogenic: Excess Cancer Risk[g]	CTE Carcinogenic: % Contribution to Risk	CTE Evaluation: Noncarcinogenic >PRG (nc)	CTE Noncarcinogenic: HQ[h]	CTE Noncarcinogenic: % Contribution to HI
Total Petroleum Hydrocarbons (mg/L) by Method 8015B DRO																								
Motor Oils	15	91	16%	3.70E-01	6.41E-02	6.41E-02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
PHC as Diesel Fuel	20	111	18%	1.30E+00	1.95E-01	1.95E-01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
PHC as Gasoline	22	111	20%	5.00E-02	1.53E-01	5.00E-02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Volatile Organic Chemicals (ug/L) by Method 8260B																								
4-Methyl-2-Pentanone	3	111	3%	1.35E+01	—	1.35E+01	—	2.00E+03	—	3.46E+03	—	No	—	—	—	No	6.75E-03	0%	—	—	—	No	3.90E-03	0%
Chloroform	2	111	2%	9.50E-01	—	9.50E-01	1.70E-01	8.00E+01	9.47E+01	4.17E+02	Yes	No	Yes	5.59E-06	2%	No	1.19E-02	0%	No	1.00E-08	0%	No	2.28E-03	0%
Methyl ethyl ketone	1	111	1%	1.00E+00	—	1.00E+00	—	7.00E+03	—	2.54E+04	—	No	—	—	—	No	1.43E-04	0%	—	—	—	No	3.93E-05	0%
Methyl Tert-Butyl Ether	1	111	1%	2.55E+00	—	2.55E+00	6.23E+00	5.21E+03	2.51E+01	3.96E+03	No	No	No	4.10E-07	0%	No	4.89E-04	0%	No	1.02E-07	0%	No	6.44E-04	0%
Methylene chloride	2	111	2%	6.60E-01	—	6.60E-01	4.30E+00	1.60E+03	5.50E+01	2.60E+03	No	No	No	1.53E-07	0%	No	4.13E-04	0%	No	1.20E-08	0%	No	2.54E-04	0%
Semivolatile Organic Chemicals (ug/L) by Method 8270C																								
4-Methylphenol	1	103	1%	6.00E+00	—	6.00E+00	—	1.80E+02	—	2.17E+02	—	No	—	—	—	No	3.33E-02	0%	—	—	—	No	2.76E-02	0%
Bis(2-chloroethoxy)Methane	1	103	1%	2.00E+00	—	2.00E+00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Bis(2-Ethylhexyl)Phthalate	4	103	4%	3.90E+00	—	3.90E+00	4.80E+00	7.30E+02	2.98E+01	8.69E+02	No	No	No	8.12E-07	0%	No	5.34E-03	0%	No	1.31E-07	0%	No	4.49E-03	0%
Butyl Benzyl Phthalate	1	103	1%	7.00E-01	—	7.00E-01	—	7.30E+03	—	8.69E+03	—	No	—	—	—	No	9.59E-05	0%	—	—	—	No	8.05E-05	0%
Diethyl Phthalate	2	103	2%	2.00E+00	—	2.00E+00	—	2.90E+04	—	3.48E+04	—	No	—	—	—	No	6.90E-05	0%	—	—	—	No	5.75E-05	0%
Phenol	1	103	1%	1.20E+01	—	1.20E+01	—	1.10E+04	—	1.30E+04	—	No	—	—	—	No	1.09E-03	0%	—	—	—	No	9.21E-04	0%
Semivolatile Organics (8270C-SIM) (ug/L)																								
Acenaphthene	3	103	3%	1.55E+00	—	1.55E+00	—	3.65E+02	—	2.61E+03	—	No	—	—	—	No	4.25E-03	0%	—	—	—	No	5.95E-04	0%
Anthracene	2	103	2%	8.50E-02	—	8.50E-02	—	1.83E+03	—	1.30E+04	—	No	—	—	—	No	4.66E-05	0%	—	—	—	No	6.52E-06	0%
Benzo(g,h,i)Perylene	1	103	1%	4.00E-01	—	4.00E-01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fluoranthene	2	103	2%	8.50E-02	—	8.50E-02	—	1.46E+03	—	1.74E+03	—	No	—	—	—	No	5.82E-05	0%	—	—	—	No	4.89E-05	0%
Fluorene	1	103	1%	1.00E-01	—	1.00E-01	—	2.43E+02	—	1.74E+03	—	No	—	—	—	No	4.12E-04	0%	—	—	—	No	5.75E-05	0%
Naphthalene	1	103	1%	3.50E-02	—	3.50E-02	—	6.20E+00	—	3.71E+02	—	No	—	—	—	No	5.65E-03	0%	—	—	—	No	9.44E-05	0%
Phenanthrene	2	102	2%	1.00E-01	—	1.00E-01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Pyrene	1	103	1%	6.00E-02	—	6.00E-02	—	1.83E+02	—	1.30E+03	—	No	—	—	—	No	3.29E-04	0%	—	—	—	No	4.60E-05	0%
Benzo(a)pyrene Equivalent[m]	1	91	1%	6.64E-01	—	8.64E-01	9.21E-03	—	5.72E-02	—	Yes	—	Yes	7.21E-05	22%	—	—	—	Yes	1.16E-05	23%	—	—	—
Metals (ug/L) by Method 6010B																								
Aluminum	63	106	59%	1.70E+03	2.16E+02	2.16E+02	—	3.65E+04	—	4.35E+04	—	No	—	—	—	No	5.92E-03	0%	—	—	—	No	4.97E-03	0%
Antimony	17	114	15%	2.09E+01	1.24E+01	1.24E+01	—	1.48E+01	—	1.74E+01	—	Yes	—	—	—	No	8.49E-01	11%	—	—	—	No	7.13E-01	12%
Arsenic	46	114	40%	6.03E+01	1.10E+01	1.10E+01	4.48E-02	1.09E+01	2.78E-01	1.30E+01	Yes	Yes	Yes	2.45E-04	76%	Yes	1.00E+00	14%	Yes	3.95E-05	77%	No	8.44E-01	14%
Barium	104	114	91%	3.33E+02	6.17E+01	6.17E+01	—	2.55E+03	—	8.69E+03	—	No	—	—	—	No	2.41E-02	0%	—	—	—	No	7.10E-03	0%
Cadmium	4	114	4%	2.10E+00	—	2.10E+00	—	1.82E+01	—	2.17E+01	—	No	—	—	—	No	1.15E-01	2%	—	—	—	No	9.67E-02	2%
Chromium	73	114	64%	3.57E+02	4.04E+01	4.04E+01	—	1.09E+02	—	1.30E+02	—	Yes	—	—	—	No	3.69E-01	5%	—	—	—	No	3.10E-01	5%
Cobalt	8	114	7%	1.29E+01	—	1.29E+01	—	7.30E+02	—	8.69E+02	—	No	—	—	—	No	1.77E-02	0%	—	—	—	No	1.49E-02	0%
Copper	64	114	56%	4.72E+01	1.28E+01	1.28E+01	—	1.46E+03	—	1.74E+03	—	No	—	—	—	No	8.77E-03	0%	—	—	—	No	7.36E-03	0%
Iron	80	106	75%	6.95E+03	1.06E+03	1.06E+03	—	1.09E+04	—	1.30E+04	—	No	—	—	—	No	9.68E-02	1%	—	—	—	No	8.13E-02	1%
Lead [d]	16	114	14%	7.75E+00	2.18E+00	2.18E+00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Manganese	96	114	84%	1.95E+03	3.72E+02	3.72E+02	—	8.76E+02	—	1.04E+03	—	Yes	—	—	—	No	4.25E-01	6%	—	—	—	No	3.57E-01	6%
Nickel	65	114	57%	1.05E+02	3.24E+01	3.24E+01	—	7.30E+02	—	8.69E+02	—	No	—	—	—	No	4.44E-02	1%	—	—	—	No	3.73E-02	1%
Selenium	67	114	59%	1.65E+02	2.90E+01	2.90E+01	—	1.82E+02	—	2.17E+02	—	No	—	—	—	No	1.59E-01	2%	—	—	—	No	1.33E-01	2%
Silver	17	114	15%	1.81E+01	5.41E+00	5.41E+00	—	1.82E+02	—	2.17E+02	—	No	—	—	—	No	2.96E-02	0%	—	—	—	No	2.49E-02	0%
Thallium	9	114	8%	7.80E+00	—	7.80E+00	—	2.41E+00	—	2.87E+00	—	Yes	—	—	—	Yes	3.24E+00	44%	—	—	—	Yes	2.72E+00	44%
Vanadium	92	114	81%	5.75E+01	2.81E+01	2.81E+01	—	3.60E+01	—	4.35E+01	—	Yes	—	—	—	No	7.81E-01	11%	—	—	—	No	6.47E-01	10%
Zinc	72	114	63%	2.05E+02	2.33E+01	2.33E+01	—	1.09E+04	—	1.30E+04			—	—	—	No	2.13E-03	0%	—	—	—	No	1.79E-03	0%
Hexavalent Chromium (ug/L) by Method 7199																							—	—	—
Hexavalent Chromium	6	13	46%	1.40E+01	—	1.40E+01	—	1.10E+02	—	1.30E+02	—	No	—	—	—	No	1.27E-01	2%	—	—	—	No	1.07E-01	2%
Mercury (ug/L) by Method 7470A																								
Mercury[k]	90	114	79%	1.20E+00	2.90E-01	2.90E-01	—	1.10E+01	—	1.30E+01	—	No	—	—	—	No	2.64E-02	0%	—	—	—	No	2.22E-02	0%
Other Inorganics (mg/L) by Method 300.0																								
Nitrate as N (Method 300.0)[L]	15	16	94%	9.91E+00	4.71E+00	4.71E+00	—	1.00E+01	—	8.95E+01	—	No	—	—	—	—	—	—	—	—	—	No	6.77E-08	0%
										Incremental Lifetime Cancer Risk/Hazard Index Including Background:				3E-04			7E+00			5E-05			6E+00	

NOTES:

— = no data or not applicable
% = percent
ug/L = micrograms per liter
mg/L = milligrams per liter

ca = carcinogenic
nc = noncarcinogenic
HI = hazard index
PHC = petroleum hydrocarbon

> = greater than
COEPC = chemical of potential ecological concern

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Maximum detection is the maximum detected concentration of an analyte in the medium.
[c] Reasonable maximum exposure (RME) EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum EPC. The 95% UCL is determined using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects. CTE PRGs are calculated using CTE exposure factors in Region 9 PRG equations.
[e] Excess cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)
[f] Hazard quotient (HQ) = EPC / RME Noncarcinogenic PRG
[g] Excess cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)
[h] HQ = EPC / CTE Noncarcinogenic PRG
[i] According to the California Regional Water Quality Control Board (RWQCB 1996), the American Society for Testing and Materials (ASTM) standard for Risk Based Corrective Action (RBCA), ASTM E-1739-95 is recommended to perform a risk analysis at petroleum release sites. The ASTM methodology provides screening levels for PHC indicator chemicals. Therefore, the health risk for PHCs is assessed based on indicator chemicals (i.e., benzene, ethylbenzene, toluene, xylene, and polycyclic aromatic hydrocarbons).
[j] No tap water PRG is available for inorganic lead.
[k] PRG is for mercury chloride
[L] RME PRG for nitrate is provided for comparison purposes only and not included in risk calculations since the tap water PRG, taken from IRIS and equal to the maximum contaminant level of 10 mg/L, is based on exposure as an infant and not an adult like other noncarcinogenic tap water PRGs.
[m] The Benzo(a)pyrene equivalent concentration taken from Table 8-11.
Shading identifies COPCs with maximum detections above PRGs.

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Table 8-20: Risk-Based Screening of Indoor Air from Groundwater for (Current/Future) Residential Receptor

							Preliminary Remedial Goals						RME Evaluation						CTE Evaluation					
							RME PRGs		CTE PRGs		EPA Region 9 PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size	FOD	Maximum Detect in Groundwater (ug/L)[a]	Groundwater EPC (ug/L)[b]	Estimated Indoor Air Concentration (mg/m^3)	Carcinogenic PRG (mg/m^3)	Non-carcinogenic PRG (mg/m^3)	Carcinogenic PRG (mg/m^3)	Non-carcinogenic PRG (mg/m^3)	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[c]	% Contribution to Risk	>PRG (nc)	HQ[d]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI
Volatile Organic Chemicals (ug/L) by Method 8260B																								
4-Methyl-2-pentanone	3	111	3%	1.35E+01	1.35E+01	1.31E-05	–	3.14E+00	–	5.81E+00	–	No	–	–	–	No	4.18E-06	1%	–	–	–	No	2.26E-06	1%
Chloroform	2	111	2%	9.50E-01	9.50E-01	3.20E-05	8.30E-05	5.11E-02	3.13E-04	9.46E-02	No	No	No	3.86E-07	98%	No	6.27E-04	93%	No	1.02E-07	98%	No	3.39E-04	93%
Methyl ethyl ketone	1	111	1%	1.00E+00	1.00E+00	4.65E-07	–	5.11E+00	–	9.46E+00	–	No	–	–	–	No	9.10E-08	0%	–	–	–	No	4.91E-08	0%
Methyl tert-butyl ether	1	111	1%	2.55E+00	2.55E+00	1.47E-05	3.74E-03	3.13E+00	1.41E-02	5.79E+00	No	No	No	3.94E-09	1%	No	4.70E-06	1%	No	1.05E-09	1%	No	2.54E-06	1%
Methylene chloride	2	111	2%	6.60E-01	6.60E-01	1.31E-05	4.10E-03	3.13E+00	1.54E-02	5.79E+00	No	No	No	3.19E-09	1%	No	4.19E-06	1%	No	8.48E-10	1%	No	2.26E-06	1%
Semivolatile Organics (8270C-SIM) (ug/L)																								
Acenaphthene	3	103	3%	1.55E+00	1.55E+00	9.28E-07	–	2.19E-01	–	4.06E-01	–	No	–	–	–	No	4.24E-06	1%	–	–	–	No	2.29E-06	1%
Fluorene	1	103	1%	1.00E-01	1.00E-01	2.36E-08	–	1.46E-01	–	2.70E-01	–	No	–	–	–	No	1.62E-07	0%	–	–	–	No	8.72E-08	0%
Naphthalene	1	103	1%	3.50E-02	3.50E-02	8.73E-08	–	3.14E-03	–	5.81E-03	–	No	–	–	–	No	2.78E-05	4%	–	–	–	No	1.50E-05	4%
Pyrene	1	9	11%	9.60E-01	9.60E-01	2.03E-09	–	1.10E-01	–	2.03E-01	–	No	–	–	–	No	1.85E-08	0%	–	–	–	No	1.00E-08	0%
Cumulative Incremental Lifetime Cancer Risk/Hazard Index:														4E-07			7E-04			1E-07			4E-04	

Notes:

[a] Maximum detect is the maximum detected concentration of an analyte in the medium.

[b] EPC is the maximum detected concentration since there are too few number of detections (less than 11) to estimate a UCL of a mean concentration using ProUCL.

[c] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[d] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[e] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[f] HQ = EPC / CTE Noncarcinogic PRG

– = no data or not applicable

% = percent

> = greater than

µg/L = micrograms per liter

ca = carcinogenic

CTE = central tendency exposure

EPA = Environmental Protection Agency

EPC = exposure point concentration

FOD = frequency of detection

HI = hazard index

mg/m^3 = milligrams per cubic meter

nc = noncarcinogenic

PRG = preliminary remediation goal

RME = reasonable maximum exposure

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Table 8-21: Risk-Based Screening of Indoor Air from Groundwater for (Current/Future) Industrial Receptor

							Preliminary Remedial Goals						RME Evaluation						CTE Evaluation					
							RME PRGs		CTE PRGs		EPA Region 9 PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size	FOD	Maximum Detect in Groundwater (ug/L)[a]	Groundwater EPC (ug/L)[b]	Estimated Indoor Air Concentration (mg/m^3)	Carcinogenic PRG (mg/m^3)	Non-carcinogenic PRG (mg/m^3)	Carcinogenic PRG (mg/m^3)	Non-carcinogenic PRG (mg/m^3)	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[c]	% Contribution to Risk	>PRG (nc)	HQ[d]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI
Volatile Organic Chemicals (ug/L) by Method 8260B																								
4-Methyl-2-pentanone	3	111	3%	1.35E+01	1.35E+01	6.56E-06	--	4.39E+00	--	6.91E+00	--	No	--	--	--	No	1.49E-06	1%	--	--	--	No	9.50E-07	1%
Chloroform	2	111	2%	9.50E-01	9.50E-01	1.60E-05	1.77E-04	7.15E-02	1.05E-03	1.12E-01	No	No	No	9.07E-08	98%	No	2.24E-04	93%	No	1.52E-08	98%	No	1.42E-04	93%
Methyl ethyl ketone	1	111	1%	1.00E+00	1.00E+00	2.33E-07	--	7.15E+00	--	1.12E+01	--	No	--	--	--	No	3.25E-08	0%	--	--	--	No	2.07E-08	0%
Methyl tert-butyl ether	1	111	1%	2.55E+00	2.55E+00	7.35E-06	7.95E-03	4.38E+00	4.73E-02	6.89E+00	No	No	No	9.25E-10	1%	No	1.68E-06	1%	No	1.55E-10	1%	No	1.07E-06	1%
Methylene chloride	2	111	2%	6.60E-01	6.60E-01	6.55E-06	8.72E-03	4.38E+00	5.20E-02	6.89E+00	No	No	No	7.51E-10	1%	No	1.50E-06	1%	No	1.26E-10	1%	No	9.51E-07	1%
Semivolatile Organics (8270C-SIM) (ug/L)																								
Acenaphthene	3	103	3%	1.55E+00	1.55E+00	4.64E-07	--	3.07E-01	--	4.82E-01	--	No	--	--	--	No	1.51E-06	1%	--	--	--	No	9.62E-07	1%
Fluorene	1	103	1%	1.00E-01	1.00E-01	1.18E-08	--	2.04E-01	--	3.21E-01	--	No	--	--	--	No	5.77E-08	0%	--	--	--	No	3.67E-08	0%
Naphthalene	1	103	1%	3.50E-02	3.50E-02	4.37E-08	--	4.39E-03	--	6.91E-03	--	No	--	--	--	No	9.94E-06	4%	--	--	--	No	6.32E-06	4%
Pyrene	1	9	11%	9.60E-01	9.60E-01	1.01E-09	--	1.53E-01	--	2.41E-01	--	No	--	--	--	No	6.62E-09	0%	--	--	--	No	4.21E-09	0%
Cumulative Incremental Lifetime Cancer Risk/Hazard Index:														9E-08			2E-04			2E-08			2E-04	

Notes:

[a] Maximum detect is the maximum detected concentration of an analyte in the medium.

[b] EPC is the maximum detected concentration since there are too few number of detections (less than 11) to estimate a UCL of a mean concentration using ProUCL.

[c] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)

[d] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG

[e] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)

[f] HQ = EPC / CTE Noncarcinogic PRG

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Soil Vapor Migration of VOCs from Soil. The evaluation of potential soil vapor migration into indoor air resulted in estimated ILCR under the assumed residential land use of $4x10^{-6}$ for the RME scenario and $9x10^{-7}$ for the CTE scenario (Table 8-15). Only the RME estimate is within the risk management range of 10^{-6} to 10^{-4}. Most of the potential carcinogenic risk (98 percent) is due to hexachlorobenzene, which was detected in only one of nine subsurface soil samples. Noncancer hazard estimates from the potential exposure to VOCs in indoor air were below 0.01 for both RME and CTE scenarios. Using the J&E Model, the single detection of hexachlorobenzene resulted in an estimated indoor air concentration of 1.47E-05 mg/m^3. This concentration in air exceeds the EPA Region 9 ambient air PRG of 4.20E-06 mg/m^3.

8.5.7.2 INDUSTRIAL LAND USE EVALUATION

As indicated in Section 8.1.2, the Tier 1A screening includes the evaluation of the default industrial scenario, in addition to evaluation of the default residential scenario. Therefore, exposure to surface and subsurface soil for the industrial scenario was evaluated. Tables 8-16 and 8-17 present the comparisons between EPCs and the EPA Region 9 industrial PRGs for surface and subsurface soils, respectively. The following discussion summarizes the carcinogenic risk and noncancer hazard estimated for surface and subsurface soil under the industrial land use scenario. These tables indicate that certain COPCs contribute to an incremental carcinogenic risk above EPA permissible levels.

Surface Soil (0-foot to 1-foot bgs). EPCs for chemical data for surface soil collected from AA 3 were compared to EPA Region 9 industrial soil PRGs and calculated PRGs for evaluating RME and CTE scenarios (Table 8-16). The following discussion summarizes the carcinogenic risk and noncancer hazard estimated for surface soil under the industrial land use scenario.

Carcinogenic Risk. The cumulative carcinogenic risk for the surface soil under an assumed RME scenario of an industrial land use is $1x10^{-5}$, which is within the risk management range of 10^{-6} to 10^{-4}. The cumulative risk under the CTE scenario is $5x10^{-7}$, which is below range. Excluding the contribution of metals at background levels, the RME cancer risk decreases to $8x10^{-6}$ while the CTE estimate decreases to $4x10^{-7}$. Under the RME scenario, arsenic, B[a]P equivalent concentration and 2,3,7,8-TCDD TEQ constitute 19 percent, 73 percent and 8 percent, respectively of the excess cancer risk. Arsenic is present within its background levels. Carcinogenic PAHs contributing to the B[a]P equivalent were detected in 7 of 33 surface soil samples. Various dioxin/furan congeners were detected in all 9 surface soil samples analyzed for dioxins/furans with the maximum concentration of each congener included in the 2,3,7,8-TCDD equivalent.

Noncarcinogenic Hazard. The cumulative noncancer hazards associated with potential exposure to surface soil under the RME and CTE scenarios are expressed as HIs of 0.06 and 0.01, respectively, which are below the target HI of 1. Vanadium, arsenic and manganese comprise much of the noncancer hazard. Excluding the contribution of metals at background levels, non-cancer HIs decrease to less than 0.01 for both RME and CTE scenarios.

Maximum detected concentrations of arsenic, B[a]P equivalent concentration, and 2,3,7,8-TCDD TEQ in surface soils exceeded the industrial PRGs under the RME scenario. These COPCs were further evaluated in the SSRBE. Maximum concentrations of B[a]P equivalent concentration, antimony, arsenic, barium, cadmium, chromium, nickel and selenium exceeded the SSLs.

Subsurface Soil (0-foot to 10 feet bgs). EPCs for chemical data for subsurface soil collected from AA 3 were compared to EPA Region 9 industrial soil PRGs and calculated PRGs for evaluating RME and CTE scenarios (Table 8-17). The following discussion summarizes the carcinogenic risk and noncancer hazard estimated for subsurface soil under the industrial land use scenario.

Carcinogenic Risk. The cumulative carcinogenic risk from exposure to the COPCs in subsurface soil at AA 3 under an assumed RME scenario of an industrial land use is $1x10^{-5}$, which is within the risk management range of 10^{-6} to 10^{-4}. Arsenic, B[a]P equivalent concentration and 2,3,7,8-TCDD TEQ constitute 19 percent, 71 percent, and 8 percent of the incremental cancer risk. Under an average or CTE scenario, the cumulative incremental cancer risk is $5x10^{-7}$, which is below the risk management range of 10^{-6} to 10^{-4}. Excluding the contribution of metals at background levels, the RME cancer risk decreases to $8x10^{-6}$ while the CTE estimate decreases to $4x10^{-7}$. Arsenic is present within its background levels. Carcinogenic PAHs contributing to the B[a]P equivalent concentration were detected in 7 of 33 subsurface soil samples. Various dioxin/furan congeners were detected in all 11 subsurface soil samples analyzed for dioxins/furans with the maximum concentration of each congener included in the 2,3,7,8-TCDD equivalent

Noncarcinogenic Hazard. The cumulative noncancer hazards associated with potential industrial exposure to subsurface soil at AA 3 under the RME and CTE scenarios are expressed as HIs of 0.06 and 0.01, respectively. As with surface soil, vanadium, arsenic and manganese comprise much of the noncancer hazard in subsurface soil. Excluding the contribution of metals at background levels, non-cancer HIs decrease to less than 0.01 for both RME and CTE scenarios.

Maximum detected concentrations of arsenic, B[a]P equivalent concentration and 2,3,7,8-TCDD TEQ in subsurface soils exceeded the industrial PRGs under the RME scenario. These COPCs were carried forward to the SSRBE. Maximum concentrations of benzene, methylene chloride, hexachlorobenzene, B[a]P equivalent concentration, antimony, arsenic, barium, cadmium, chromium, nickel and selenium exceeded the SSLs.

Soil Vapor Migration of VOCs from Soil. The evaluation of potential soil vapor migration into indoor air resulted in estimated ILCR under the assumed industrial land use of $8x10^{-7}$ for the RME scenario and $1x10^{-7}$ for the CTE scenario (Table 8-18). Both cancer risk estimates are below the risk management range of 10^{-6} to 10^{-4}. Most of the potential carcinogenic risk (98 percent) is due to hexachlorobenzene, which was detected in only one of nine subsurface soil samples. Noncancer hazard estimates from the potential exposure to VOCs in indoor air were below 0.01 for both RME and CTE scenarios.

8.5.7.3 GROUNDWATER RBS

Groundwater results from nine rounds of sampling (conducted from October and November 2002 to February 2007) were combined. Groundwater EPCs were compared to Region 9 tap water PRGs for residential use under the RME scenario and calculated, site-specific PRGs for the CTE scenario. The summary of the RBS comparison is presented in Table 8-19.

Groundwater was evaluated as a source for drinking water with tap water PRGs being developed only under a residential land use scenario. Carcinogenic and non-carcinogenic risk evaluation was performed for unfiltered groundwater at AA 3 under the residential land use scenario (Table 8-19). The following discussion summarizes the carcinogenic risk and noncancer hazard estimated for groundwater under the residential land use scenario.

Carcinogenic Risk. Under an RME scenario, the cumulative incremental cancer risk associated with potential residential exposure to unfiltered groundwater is $3x10^{-4}$, which exceeds the action level (10^{-4}) typically associated with remediation requirements. Arsenic accounted for 76 percent of the risk estimate. The incremental cancer risk under an average or CTE scenario is $5x10^{-5}$.

Noncarcinogenic Hazard. The cumulative noncancer hazard associated with potential exposure to the EPC in groundwater is expressed as HIs of 7 and 6 under the RME and CTE scenarios, respectively. The primary contributors to the noncancer hazard estimate are the metals thallium (44 percent), arsenic (14 percent), antimony (11 percent), and vanadium (11 percent).

Eight chemicals detected in groundwater, namely antimony, arsenic, chromium, manganese, thallium, vanadium, chloroform and B[a]P equivalent had maximum detected concentrations that exceeded the Region 9 tap water PRGs for residential use.

Soil Vapor Migration of VOCs from Groundwater. The evaluation of potential soil vapor migration of VOCs emanating from groundwater into indoor air resulted in estimated ILCR under the assumed residential land use of $4x10^{-7}$ for the RME scenario and $1x10^{-7}$ for the CTE scenario (Table 8-20). Most of the potential carcinogenic risk (98 percent) is due to chloroform, which was detected in only 2 of 111 groundwater samples. Noncancer hazard estimates from the potential exposure to VOCs in indoor air are below 0.001 for both RME and CTE scenarios.

For the industrial worker potentially exposed to VOCs in an indoor setting, the estimated ILCR under the assumed industrial use is $9x10^{-8}$ for the RME scenario and $2x10^{-8}$ for the CTE scenario (Table 8-21). Noncancer hazard estimates from the potential exposure to VOCs in indoor air are below 0.001 for both RME and CTE scenarios.

8.5.7.4 Risk-Based Screening Summary

The risk-based screening assessment of AA 3 evaluated surface soil, subsurface soil and groundwater for potential residential exposure, and evaluated surface soil and subsurface soil for potential industrial exposure. Risks were evaluated under RME and CTE scenarios. In addition, potential risks associated with the inhalation of volatile chemicals that have migrated from subsurface soil or groundwater into buildings were evaluated for both the residential and industrial exposure scenarios. A summary of those risks is presented in Table 8-22.

The evaluation of surface soil scenarios under the RME scenario resulted in potential ILCRs that exceeded the target incremental cancer risk level of 10^{-6} for both the future resident (ILCR = $4x10^{-5}$) and industrial worker (ILCR = $1x10^{-5}$). Under the CTE assumption, these risk estimates decrease to $4x10^{-6}$ for the resident and $5x10^{-7}$ for the industrial worker. The incremental cancer risk estimates for subsurface soil remains the same for both residential and industrial exposure scenarios. Without the contribution of background metals, the ILCRs decrease approximately 20 percent because arsenic is present at background levels and is not included in the cancer risk estimates. Regardless of the soil interval or receptor, B[a]P equivalent concentrations contribute most to these risk estimates.

Estimated non-cancer HI for the resident exposed to surface soil under the RME scenario is approximately 1, with iron and vanadium each contributing significantly (25 percent or more) to the hazard. Using the CTE assumption, the HI is reduced to less than 1. The HI for exposure to the subsurface by future potential residents under the RME scenario remains at 1, while the HI under the CTE scenario remains below the target hazard of 1. For the industrial worker, hazard estimates are below 1 for both surface and subsurface soil.

Risks/hazards associated with potential soil vapor migration into indoor air from subsurface soil were evaluated for both the residential and industrial land uses. Assuming the RME scenario, the ILCRs is estimated as $4x10^{-6}$ for the residential land use and $8x10^{-7}$ for the industrial land use. Under the CTE scenario, these estimates decrease to $9x10^{-7}$ and $1x10^{-7}$, respectively. Most of the potential carcinogenic risk (98 percent) is due to hexachlorobenzene, which was detected in only one of nine

subsurface soil samples. Noncancer hazard estimates from the potential exposure to VOCs in indoor air are less than 0.01 for both residential and industrial land use scenarios.

The evaluation of groundwater resulted in a potential ILCR for the future on-site resident under the RME scenario (ILCR = $3x10^{-4}$) that exceeded the target incremental cancer risk level of 10^{-6}. Under the CTE scenario, this risk estimate is reduced to $5x10^{-5}$. Most of this risk is due to arsenic, which was detected in 40 percent of the groundwater samples. The EPC of 11.0 µg/L for arsenic is based on the 95 percent UCL and exceeds the current EPA MCL of 10 µg/L. Fifteen of the 46 detections exceeded this MCL.

Evaluation of non-cancer hazards associated with on-site exposure to groundwater resulted in an estimated HI of 7, which was due to the presence of thallium, vanadium, arsenic and antimony. Under the CTE scenario, the estimated HI is reduced to 6. As the maximum detected concentrations and EPCs for arsenic and thallium exceed respective PRGs, target organ segregation was considered unnecessary since the resulting HIs would not significantly change and would remain above the target hazard of 1 for certain target organs. Because groundwater is evaluated for its most beneficial use (i.e., residential use as a drinking water source), it was not further evaluated for industrial use.

Attenuation processes including groundwater mixing, biodegradation and chemical retardation will expectedly reduce chemical concentrations in groundwater as it moves away from the site. Because chemical concentrations are lower in groundwater moving away from the source area, risks associated with exposure to groundwater for potential future off-site residents would be less. The likelihood of groundwater in the vicinity to be used for residential drinking water is unknown but expected to be low.

Potential cancer risks associated with potential vapor emission from groundwater into indoor air were evaluated for residential and industrial land uses. Regardless of the receptor or exposure assumption (RME or CTE), ILCR estimates were below $1x10^{-6}$ and non-cancer HIs were below 1.

California-Approved Toxicity Information

Toxicity information from the California Environmental Protection Agency (Cal-EPA), OEHHA, was substituted into the various PRG equations to derive a second set of receptor-specific PRGs for each medium. Those chemicals with different toxicity criteria, which produce different PRGs are incorporated into each risk table (Tables E1-5 through E1-13 in Appendix E1). A summary of the ILCRs and noncancer HIs that use the Cal-EPA toxicity information is presented in Table 8-23.

Incorporating California-modified toxicity values, the evaluation of surface soil exposure under the RME scenario resulted in ILCRs of $9x10^{-5}$ for the resident and $2x10^{-5}$ for the industrial worker. ILCR from subsurface soil exposure remains approximately the same as that for surface soil for both the resident and industrial worker. Risk estimates that utilize California-modified toxicity values are approximately 2½ times higher than when estimated using EPA Region 9 PRGs. The main reason for this increase is that California assigns a higher (i.e., more toxic) slope factor for arsenic. Without the contribution of background metals, the ILCRs decrease approximately 50 percent because arsenic is present at background levels and is not included in the cancer risk estimates.

The California-approved screening value for lead is 150 mg/kg. Despite this value being lower than the Federal screening value of 400 mg/kg, lead concentrations in soil at AA 3 (including the maximum detected concentration of 20.7 mg/kg) remain below this screening value.

Table 8-22: Summary of Incremental Lifetime Cancer Risks and Cumulative Noncancer Hazard Indices for Default Receptors Under RME and CTE Evaluations

Type	Residential		Industrial	
	RME	CTE	RME	CTE
Surface Soil - Including Background				
ILCR	4E-05	4E-06	1E-05	5E-07
B(a)P equiv.	68%	66%	73%	68%
arsenic	23%	24%	19%	23%
TCDD TEQ	9%	10%	8%	9%
HI	1	0.09	0.06	0.01
arsenic	10%	0%	21%	20%
iron	38%	--[a]	--[a]	--[a]
manganese	8%	24%	17%	16%
vanadium	25%	72%	46%	50%
Surface Soil -.Excluding Background				
ILCR	3E-05	3E-06	8E-06	4E-07
B(a)P equiv.	88%	87%	90%	88%
arsenic	--	--	--	--
TCDD TEQ	12%	13%	10%	12%
HI	0.7	0.003	0.003	<0.001
arsenic	--	--	--	--
iron	76%	--[a]	--[a]	--[a]
manganese	--	--	--	--
vanadium	--	--	--	--
Subsurface Soil - Including Background				
ILCR	4E-05	4E-06	1E-05	5E-07
B(a)P equiv.	66%	65%	71%	67%
arsenic	23%	24%	19%	22%
TCDD TEQ	9%	10%	8%	9%
HI	1	0.1	0.06	0.01
arsenic	10%	19%	20%	20%
iron	37%	--[a]	--[a]	--[a]
manganese	8%	16%	16%	16%
vanadium	25%	49%	46%	49%
Subsurface Soil - Excluding Background				
ILCR	3E-05	3E-06	8E-06	4E-07
B(a)P equiv.	86%	85%	89%	87%
arsenic	--	--	--	--
TCDD TEQ	12%	13%	10%	12%
HI	0.7	0.004	0.003	<0.001
arsenic	--	--	--	--
iron	75%	--[a]	--[a]	--[a]
manganese	--	--	--	--
vanadium	--	--	--	--
Indoor Air - Vapor Emission from Soil				
ILCR	4E-06	9E-07	8E-07	1E-07
Hexachlorobenzene	98%	98%	98%	98%
HI	0.006	<0.001	<0.001	<0.001
Hexachlorobenzene	85%	--	--	--
Groundwater				
ILCR	3E-04	5E-05	Not Evaluated	Not Evaluated
arsenic	76%	77%		
HI	7	6	Not Evaluated	Not Evaluated
antimony	11%	12%		
arsenic	14%	14%		
thallium	44%	44%		
vanadium	11%	10%		
Indoor Air - Vapor Emission from Groundwater				
ILCR	4E-07	1E-07	9E-08	2E-08
Chloroform	98%	98%	98%	98%
HI	<0.001	<0.001	<0.001	<0.001

NOTES:

[a] Noncancer from iron cannot be estimated as the PRG is the maximum concentration of 100,000 mg/kg and not risk-based.

B(a)P = benzo(a)pyrene
CTE = central tendency exposure
EPC = exposure point concentration
HI = hazard index
ILCR = incremental lifetime cancer risk
mg/kg = milligrams per kilogram
PRG = preliminary remediation goal
RME = reasonable maximum exposure
TCDD = 2,3,7,8-tetrachlorodibenzo-p-dioxin
TEQ = toxicity equivalency quotient
-- = not evaluated
< = less than
% = percent

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Using California-modified toxicity values, the evaluation of potential soil vapor migration from subsurface soil into buildings resulted in ILCRs of $4x10^{-6}$ for the resident and $1x10^{-6}$ for the industrial worker. Under the CTE scenario, these estimates decrease approximately 75 percent. Hexachlorobenzene represents most of the ILCR and noncancer hazard.

The evaluation of direct groundwater exposure using California-modified toxicity values resulted in an increase in the estimated cancer risk to $1x10^{-3}$ under the RME scenario. This increase is also due to the higher cancer slope factor for arsenic. While no site-specific background value of arsenic in groundwater has been determined, the levels detected are likely naturally occurring and not due to activities of the site.

The evaluation of potential soil vapor migration from groundwater into buildings resulted in ILCRs of $1x10^{-7}$ for the resident and $2x10^{-8}$ for the industrial worker. Under the CTE scenario, these estimates decrease approximately 75 percent. Chloroform represents most of the ILCR and noncancer hazard associated with the indoor inhalation of volatile chemicals from groundwater.

8.6 SITE-SPECIFIC RISK-BASED EVALUATION

This section presents the process for conducting site-specific risk-based evaluations (or screening PREs under the EPA Region 9 terminology) for site-specific receptors exposed to chemicals in surface soil and subsurface soil. The SSRBE presents risks for the future on-site construction worker, on-site escorted visitor, on-site agricultural worker and on-site recreational user potentially exposed to COPCs in surface soil and subsurface soil at AA 3. Residential and industrial workers are also site-specific receptors, but because the risks for them were previously presented in the RBS, risks are not completely re-evaluated in the SSRBE to avoid redundancy. In the SSRBE, site-specific RBCs (i.e., PRGs) were developed for site-specific land use and exposure conditions not addressed during PRG development for EPA Region 9.

8.6.1 Selection of COPCs

For the SSRBE, COPCs were identified as those chemicals in the RBS evaluation with maximum detected concentrations in surface soil or subsurface soil that exceeded their respective soil PRG. Because groundwater was only evaluated for its most beneficial (i.e., residential) use, groundwater is not evaluated in the SSRBE. The COPCs associated with surface and subsurface soil are arsenic, B[a]P equivalents, and 2,3,7,8-TCDD TEQ.

Where the maximum detected concentration for an inorganic constituent was within background levels, the presence of this inorganic COPC was not considered attributable to site-related activities. ILCRs and noncancer HIs were estimated both with and without contribution from naturally-occurring inorganic constituents. Derivation of the soil background concentrations is presented in the *Final Technical Memorandum, Background and Reference Levels, Remedial Investigations, Marine Corps Air Station, El Toro, California* (BNI 1996).

8.6.2 Receptor Selection and Exposure Factors

The site is located in a semi-urban setting and corresponding mix of land uses. Such uses include residential, industrial, and agricultural use. Future use plans for the site may include residential use. As noted in Section 8.4, because reuse has not been defined, several receptors were also evaluated to provide risk managers with risk estimates for alternate receptor scenarios. These receptors consist of visitors to the site, construction workers, agricultural workers, and individuals engaging in recreational activities. Activities that receptors may engage in are discussed below and a summary of the exposure factors used in deriving the site-specific, receptor PRGs is presented in Table 8-24.

Visitors. Visitors are not anticipated to be on the site without direct supervision or authorization. Their activities are expected to be limited to attending meetings, observing current work activities, reviewing land use plans, and other similar tasks. Another possibility is the presence of escorted juveniles ages 6 to 16 during various coordinated activities such as a school field trip. Only contact with surface soil is anticipated. It is not unreasonable to assume that such visitors may access the site one day per month. However, in order to maintain sufficient conservatism in the assessment, visitors are assumed to access the site one day each week of the year (minus 2 weeks vacation) or 50 days per year. Because activities will not generally involve purposeful contact with soil (as may occur with agricultural workers), soil ingestion rates for both the adult and juvenile are assumed to be equal to those used for an adult resident (i.e., 100 mg/day). The skin surface area of 4,073 cm^2 available for dermal contact and the mean body weight of 39.8 kg for the juvenile were calculated using information from EPA's *Child-Specific Exposure Factors Handbook* (EPA 2002a). Calculations are presented in Attachments E1-3 and E1-4. Remaining exposure factors are provided in Table 8-24.

Construction/Utility Workers. Exposure-relevant activities in which construction/utility workers may be engaged will typically include limited manual digging (substantial digging is typically done using mechanical equipment, which is likely to reduce the potential for exposure to soil), shoring excavation sidewalls, and removing and installing footings or utilities. In most instances, excavations are anticipated to be relatively shallow (i.e., 3 feet to 5 feet bgs). However, in situations that may require deeper excavations, such as the construction of additional buildings, excavation may be as deep as 10 feet. Due to the nature of the work, these receptors could be exposed to surface and subsurface soil during excavation work. Construction or utility work is expected to be of a relatively short-term periodic nature. For purposes of evaluating this receptor group, it is assumed that the construction/utility workers may access the site quarterly for two weeks. This results in an exposure frequency (EF) of 8 weeks per year or 40 days per year. Because activities will not generally involve purposeful contact with soil (as may occur with agricultural workers), soil ingestion rate is assumed to be equal to the occupational rate of 330 mg/day recommended for occupational settings (EPA 2002b). The remaining exposure factors for assessment of this receptor group are provided in Table 8-24.

Agricultural Workers. Agriculture in the area is a high yield, relatively mechanized process. It does not generally involve hand digging, harvesting, or manual irrigation. Nonetheless, such workers still spend a substantial amount of time on or near site soil, potentially resulting in exposures to soil. Water consumption during the course of agricultural work is very high. However, for potable purposes, clean water is provided to workers from off-site sources and is designated as such. Thus, ingestion of contaminated water is unlikely. However, irrigation systems may result in water aspiration that can facilitate dermal and inhalation exposure routes.

For the purposes of evaluating risk to this receptor group, key exposure factors for soil exposures include soil ingestion rate and skin contact area. The soil ingestion rate is assumed to be greater than that for a regular occupational worker because of the nature of the work activity. However, due to the typical mechanization of most agricultural equipment, expected soil ingestion rate would likely be lower than that for a child resident because of the latter's closer proximity to soil and expected behaviors such as playing or digging in soil that increase a child's soil ingestion rate. The value of 150 mg/day is the average between the expected soil ingestion rate for a worker in the occupational setting and the child resident. Exposed skin surface area is set at 5,700 square centimeters (cm^2) and assumes the worker is wearing shorts and short-sleeve shirt during seasonally hot weather. The inhalation rate of 1.5 m^3/hour is based on a mean rate for outdoor workers engaged in moderate activities (EPA 1997a). Remaining exposure factors for assessment of this receptor group are provided in Table 8-24.

Table 8-23: Summary of Incremental Lifetime Cancer Risks and Cumulative Noncancer Hazard Indices for Default Receptors Under RME and CTE Evaluations Using Cal-EPA Toxicity Information

Type	Residential		Industrial	
	RME	CTE	RME	CTE
Surface Soil - Including Background				
ILCR	9E-05	1E-05	2E-05	1E-06
B(a)P equiv.	39%	40%	46%	40%
arsenic	58%	57%	51%	24%
TCDD TEQ	3%	3%	3%	3%
HI	1	0.09	0.06	0.01
arsenic	10%	0%	21%	24%
iron	38%	–[a]	–[a]	–[a]
manganese	8%	22%	14%	–
vanadium	26%	74%	48%	61%
Surface Soil - Excluding Background				
ILCR	4E-05	5E-06	1E-05	5E-07
B(a)P equiv.	93%	93%	94%	93%
arsenic	–	–	–	–
TCDD TEQ	7%	7%	6%	7%
HI	0.7	0.003	0.003	<0.001
arsenic	–	–	–	–
iron	76%	–[a]	–[a]	–[a]
manganese	–	–	–	–
vanadium	–	–	–	–
Subsurface Soil - Including Background				
ILCR	9E-05	1E-05	2E-05	1E-06
B(a)P equiv.	39%	39%	45%	40%
arsenic	58%	57%	51%	56%
TCDD TEQ	3%	3%	3%	3%
HI	1	0.1	0.06	0.01
arsenic	10%	20%	21%	24%
iron	38%	–[a]	–[a]	–[a]
manganese	8%	15%	14%	–
vanadium	25%	49%	47%	60%
Subsurface Soil - Excluding Background				
ILCR	4E-05	5E-06	1E-05	5E-07
B(a)P equiv.	92%	91%	93%	91%
arsenic	–	–	–	–
TCDD TEQ	7%	7%	6%	7%
HI	1	0.004	0.005	<0.001
arsenic	–	–	–	–
iron	75%	–[a]	–[a]	–[a]
manganese	–	–	–	–
vanadium	–	–	–	–
Indoor Air - Vapor Emission from Soil				
ILCR	4E-06	1E-06	1E-06	2E-07
Hexachlorobenzene	95%	95%	95%	95%
HI	0.006	<0.001	<0.001	<0.001
Hexachlorobenzene	81%	–	–	–
Groundwater				
ILCR	1E-03	3E-04	Not Evaluated	Not Evaluated
arsenic	93%	93%		
HI	10	6	Not Evaluated	Not Evaluated
antimony	8%	12%		
arsenic	23%	14%		
manganese	10%	6%		
thallium	32%	44%		
vanadium	8%	10%		
Indoor Air - Vapor Emission from Groundwater				
ILCR	1E-07	3E-08	2E-08	4E-09
Chloroform	88%	88%	88%	88%
HI	<0.001	<0.001	<0.001	<0.001

Notes:

[a] Noncancer from iron cannot be estimated as the PRG is the maximum concentration of 100,000 mg/kg and not risk-based.

B(a)P = benzo(a)pyrene
CTE = central tendency exposure
EPC = exposure point concentration
HI = hazard index
ILCR = incremental lifetime cancer risk
mg/kg = milligrams per kilogram
PRG = preliminary remediation goal
RME = reasonable maximum exposure
TCDD = 2,3,7,8-tetrachlorodibenzo-p-dioxin
TEQ = toxicity equivalency quotient
– = not evaluated
< = less than
% = percent

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Table 8-24: Exposure Factors for Site-Specific Risk-Based Evaluation for All Scenarios

Parameter	Definition		Construction/Utility Worker-RME	Construction/Utility Worker-CTE	Escorted Visitor-RME		Escorted Visitor-CTE		Agricultural Worker-RME	Agricultural Worker-CTE	Recreational Visitor-RME		Recreational Visitor-CTE	
					Adult	Juvenile	Adult	Juvenile			Adult	Juvenile	Adult	Juvenile
IngR(s)	Ingestion Rate of Soils (mg/d)	(a)	330	165	100	100	50	50	150	100	100	100	50	50
FI(s)	Fraction Ingestion from Source-soils(unitless)	(b)	1.0	0.5	1.0	1.0	0.5	0.5	1.0	0.5	1.0	1.0	0.5	0.5
InhR	Inhalation Rate (m^3/hr)	(c)	2.5	1.3	1.0	1.0	0.83	0.58	1.5	1.1	3.2	1.9	1.6	1.2
PEF	Particlate Emission Factor (m^3/kg)	(d)	1.32E+09	1.32E+09	1.32E+09	1.32E+09	1.32E+09	1.32E+09	1.32E+09	1.32E+09	1.32E+09	1.32E+09	1.32E+09	1.32E+09
SA	Exposed Surface Area (cm^2)	(e)	3,300	3,300	5,700	4,073	5,700	4,073	5,700	3,300	5,700	4,073	5,700	4,073
AF	Adherence Factor (mg/cm^2)	(f)	0.300	0.140	0.07	0.2	0.010	0.040	0.448	0.117	0.084	0.250	0.012	0.039
ABS	Absorption Factor (unitless)	(g)	c-s	c-s	c-s	c-s	c-s	c-s	c-s	c-s	c-s	c-s	c-s	c-s
	arsenic; dioxins		0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
	cadmium		0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	VOCs; inorganics		0	0	0	0	0	0	0	0	0	0	0	0
	SVOCs		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	PAHs		0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
ET	Exposure Time (hr/d)	(h)	8	8	6.0	6.0	3.0	3.0	10	6	1	1	0.5	0.5
EF	Exposure Frequency (d/yr)	(i)	250	250	50	50	12	12	250	125	150	150	50	50
ED	Exposure Duration (yr)	(J)	3.0	0.5	20	10	9	9	25	6.6	20	10	9	9
CF	Conversion Factor (kg/mg)		1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06
BW	Body Weight (kg)	(k)	70	70	70	39.8	70	39.8	70	70	70	39.8	70	39.8
AT	Averaging Time (d):	(L)												
	Noncarcinogenic		1,095	183	7,300	3,650	3,285	3,285	9,125	2,409	7,300	3,650	3,285	3,285
	Carcinogenic		25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550	25,550
TCR	Target Cancer Risk		1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06
THQ	Target Hazard Quotient		1.0	1.0	1	1	1	1	1.0	1.0	1.0	1.0	1.0	1.0

NOTES

RME = reasonable maximum exposure
CTE = central tendency exposure
c-s = chemical specific
mg/d = milligrams per day
m^3/hr = cubic meters per hour
m^3/kg = cubic meters per kilogram
cm^2 = square centimeters
mg/cm^2 = milligrams per square centimeter
hr/d = hours per day
d/yr = days per year
kg/mg = kilogram per milligram

PAHs = polyaromatic hydrocarbons
SVOCs = semi-volatile organic compounds
VOCs = volatile organic compounds
EPA = Environmental Protection Agency
EFH = exposure factor handbook
m^3/day = cubic meter per day
PEF = particulate emission factor

[a] RME value for the construction worker taken from *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, December 2002b, OSWER 9355.4-24. CTE value of 165 mg/day assigned 1/2 the RME value. Ingestion rate* for escorted visitor (adult or juvenile) or recreational user (adult or juvenile) under the RME scenario is assumed to equal that of the adult resident. CTE value of 50 mg/day is recommended in EPA's Standard Default values (EPA 1991d). RME value for the agricultural woker is assumed to be half way between that for the adult occupational setting (100 mg/kg) and the child resident (200 mg/kg). The CTE value is set equal to the EPA Region 9 default value for occupational exposures.

[b] Assumes 100% of daily intake is from the contaminated source under the RME scenario and only 50 percent under the CTE scenario based on limited hours at the contaminated area.

[c] (Table 5-23 of EFH 1997a). RME value for construction worker is based on heavy activities during short-term exposures for outdoor workers whereas the CTE value is the hourly average. RME values for adult and juvenile escorted visitors assume light activities during short-term exposures. CTE values for the adult and juvenile visitor are based on daily inhalation rate of 20 m^3/day for the adult (EPA Region 9 default, 2004b) and a mean daily inhalation rate for males of 14 m^3/day. RME and CTE values for the agricultural worker are the hourly rates for outdoor workers involved with moderate and slow activities, respectively. RME and CTE values for the adult and juvenile recreational user assume the adult and child hourly rates involved with heavy and moderate activities, respectively.

[d] Default PEF for Region 9 PRGs (2004a)

[e] *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment [Dermal Guidance])* (EPA 2004c). RME and CTE values for the construction worker taken from Exhibit 3-5 for industrial exposures. RME and CTE values for the escorted visitor and recreational user include the adult value recommended in Exhibit 3-5 for adult residents. Value for juvenile is an age-weighted value for 6-16 year old males and females for exposure to head, hands, forearms and lower legs (Appendix C-1)(calculation in Table E1-1 of Attachment E1). CTE value for agricultural worker is equal to the adult industrial worker; RME was assumed equal to a resident with exposure to head, hands, forearms and lower legs.

[f] RME and CTE values the 95th percentile and geometric mean of weighted adherence factors presented in the EPA Dermal Guidance (2004c). Those for the construction worker and escorted visitor are taken from Exhibit 3-3, with values for the latter assumed to be the same as adult and child residents. RME and CTE values for the agricultural worker are set equal to values for farmers and those for the adult and juvenile recreational visitors are set equal to soccer players (Exhibit C-2).

[g] Chemical-specific values as presented in Exhibit 3-4 of the Dermal Guidance (EPA 2004c)

[h] RME and CTE value for construction worker assumes the entire 8-hour work day is spent at the site. RME value for the escorted visitor assumes a reasonable high-end value of 6 hours per visit;CTE value assigned ½ of RME or 3 hours. The RME and CTE values of 10 hours and 6 hours for the agricultural worker were assumed. RME value for the recreational user assumes an exposure of 1 hour; CTE value assigned ½ of RME or 0.5-hour.

[i] RME and CTE values for the construction worker and the RME value for the casual trespasser taken as the standard default value for industrial worker as presented in Region 9 PRGs (2004a). CTE value for casual trespasser assumed equal to that of an industrial worker and taken from Exhibit 3-5 of the Dermal Guidance (EPA 2004c).

[J] Duration of construction project assumed to be 3 years under the RME scenario and 6 months (0.5-year) under the CTE scenario. For the casual trespasser who is assumed to be a worker from a nearby facility, exposure duration would be similar to an industrial worker. Therefore, the RME value is the EPA Region 9 default value for the occupational worker. The CTE value for casual trespasser is the median tenure of occupational employees as presented in Table 15-158 of the Exposure Factors Handbook (1997a).

[k] Body weight for adult receptors is set equal to EPA Region 9 default. Value for juveniles is calculated from the mean body weights for males and females 6 through 15 years old presented in Tables 11-6 of the *Child-Specific Exposure Factors Handbook* (EPA 2002a).

[l] Averaging time for carcinogens assumes a lifetime of 70 years (x 365 days per year = 25,550 days). Averaging time for noncarcinogens considers only the period of exposure (i.e. ED x 365 days per year).

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Recreational Receptor. As previously noted, the long-term plans consist of developing the land for recreational use. The specific recreational use is not defined at this time. However, it is not unreasonable to believe that the area may be used as a nature park or fitness trail for use by local residents. Assuming that a combined use park is developed that allows for general nature observance and outdoor circuit fitness use by adults or juveniles age 6 to 16, individuals may engage in activities once per week (i.e., taking nature walks) to three times per week (i.e., those engaged in regular fitness programs). Key exposure factors that are associated with these recreational uses are EF (EF set at 150 days per year), surface soil IR (IR set at 100 mg/day), and inhalation rates (IR for fitness use set at 3.2 m^3/hour [EPA 1997a] for 1 hour per day). Remaining EFs for assessment of this receptor group are provided in Table 8-24.

8.6.3 Estimation of Site-Specific PRGs for Construction/Utility Worker, Escorted Visitor, Agricultural Worker and Recreational User

Cancer risks and His for the SSRBE were calculated in the same manner as described for the screening assessment. In the SSRBE, however, only those chemicals carried over from the RBS were evaluated in a site-specific (e.g., construction/utility worker, escorted visitor, agricultural worker or recreational user) context. Because the exposure parameters for the receptor groups differ from those used by EPA Region 9 to develop residential or industrial PRGs, site-specific PRGs were developed according to the model below.

8.6.3.1 Site-Specific PRG Model

The model used for estimating the site-specific PRGs via ingestion of soil, dermal contact with soil, and inhalation of particulates is shown below. This model is based on that used by EPA Region 9 for the development of PRGs.

$$PRG_{ss} = \frac{TCRxBWxAT}{EDxEFx\left[\left(CSF_o xIRSxFIxCF\right) + \left(CSF_o xSAxABSxAFxEVxCF\right) + \left(CSF_i xIRAxETx\left(\frac{1}{PEF}\right)\right)\right]}$$

Where:

PRG_{ss} = Site-specific PRG for specific receptors (mg/kg)
TCR = Target cancer risk for exposure to carcinogenic chemicals (unitless)
BW = Body weight (kg)
AT = Carcinogenic averaging time (days)
ED = Exposure duration (years)
EF = Exposure frequency (days per year)
CSFo = Oral cancer slope factor for carcinogenic chemicals (mg/kg-day)-1
IRS = Ingestion rate of soil (mg/day)
FI = Fraction ingestion from source (unitless)
CF = Conversion factor (kg/mg)
SA = Exposed skin surface area (cm2/event)
ABS = Dermal absorption factor (unitless)
AF = Adherence factor (mg/cm2)
EV = Event frequency (events per day)
CSFi = Inhalation cancer slope factor for carcinogenic chemicals (mg/kg-day)-1
IRA = Inhalation rate (m3/hour)
ET = Exposure time (hours/day)
PEF = Particulate emission factor (cubic meters per kilogram [m3/kg])

A similar model was used to estimate the soil PRGs for non-carcinogenic chemicals. The model shown below was used for estimating the non-carcinogenic PRGs.

$$PRG = \frac{THQ \times BW \times AT}{\frac{IRS \times FI \times EF \times ED \times CF}{RfD_o} + \frac{SA \times AF \times ABS \times EF \times ED \times EV \times CF}{RfD_o} + \frac{IRA \times ET \times EF \times ED \times \left(1/VF + 1/PEF\right)}{RfD_i}}$$

Where:

THQ = Target hazard quotient for exposure to non-carcinogenic chemicals (unitless)
RfDo = Oral reference dose for non-carcinogenic chemicals (mg/kg-day)
RfDi = Inhalation reference dose for non-carcinogenic chemicals (mg/kg-day)

8.6.3.2 Exposure Parameters

The exposure parameters used in the soil PRG equations were adapted primarily from the Exposure Factors Handbook (EPA 1997a) and Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final Guidance (EPA 2004a). Where applicable, default factors from EPA Region 9 PRGs were used. The exposure parameters are summarized in Table 8-24.

8.6.3.3 Incremental Toxicity Values (CSF and RfD)

Toxicity values are chemical-specific values derived by EPA that are health-protective, upper bound estimates of potential toxicity or carcinogenicity of chemicals. Site-specific PRGs are based on the toxicity (i.e., potential for carcinogenic or non-carcinogenic effects) of chemicals that may be ingested, inhaled, or dermally absorbed. RfDs for non-carcinogens and CSFs for carcinogens used in developing PRGs for each site-specific receptor under RME and CTE scenarios are presented in Table 8-25. The California EPA has assigned different toxicity values (RfDs and CSFs) for the three chemicals evaluated in the SWSRBE (arsenic, B[a]P equivalent concentration, and 2,3,7,8-TCDD TEQ). Values are presented inn Table E1-14 in Appendix E1.

8.6.3.4 Site-Specific PRGs

The exposure parameters listed in Section 8.6.3.2 and the toxicity values presented in Section 8.6.3.3 were inserted into the equations presented in Section 8.6.3.1. The resulting site-specific PRGs for site-specific receptors are presented in Table 8-26. EPCs at AA 3 are compared to the site-specific PRGs for both the RME and CTE scenarios in Tables 8-27 through 8-32 with results presented below. For the escorted visitor and recreational user, non-carcinogenic PRGs for the juvenile were used in the noncancer HI estimates since these were lower (i.e., more conservative) than those for the adult. Using California-approved toxicity information, site-specific PRGs are presented in Table E1-15 of Appendix E1, with risk results presented in Tables E1-16 through E1-21.

8.6.4 Evaluation of Site-Specific RBE Results

The maximum EPCs and RME EPCs for COPCs in surface and subsurface soils were compared to PRGs developed specifically for the site-specific receptors. Cumulative excess cancer risks and the HQ (i.e., the HI) were calculated for those COPCs having EPCs greater than site-specific PRGs. However, since reuse has not been defined for the site and in order to provide risk managers with an upper limit of risk estimates, the residential scenario has been evaluated as part of the site-specific

RBE. The results of the site-specific RBE (Tables 8-27 through 8-32) are discussed below. Table 8-34 summarizes those results.

8.6.4.1 CURRENT OR FUTURE ESCORTED VISITOR

Exposure for the escorted visitor is restricted to surface soil. Results are presented in Table 8-27.

Surface Soil (0-foot to 1-foot bgs). The SSRBE results for surface soil under the escorted visitor scenario are presented in Table 8-27. Based on the maximum detected concentration, arsenic was included in the risk estimate despite concentrations being within background levels. Using the EPC for calculation of risk estimates, the cumulative incremental cancer risk for the RME and CTE scenarios are $2x10^{-6}$ and $7x10^{-8}$, respectively. Seventy-two percent of this risk is due to B[a]P equivalent concentration, with less contribution from arsenic (20 percent) and 2,3,7,8-TCDD TEQ (8 percent). The RME cumulative incremental cancer risk, excluding background, is estimated at $2x10^{-6}$ with B[a]P equivalent concentration and 2,3,7,8-TCDD TEQ providing 90 percent and 10 percent of this risk. The noncancer hazard was calculated to be less than an HI of 1.0.

8.6.4.2 CONSTRUCTION/UTILITY WORKER

The construction worker was evaluated for potential exposure to surface soil and to subsurface soil. Results are presented in Tables 8-28 and 8-29, respectively.

Surface Soil (0-foot to 1-foot bgs). The SSRBE results for surface soil under the construction worker scenario are presented in Table 8-28. Based on the maximum detected concentration, arsenic was included in the risk estimate despite concentrations being within background levels. Using the EPC for calculation of risk estimates, the cumulative incremental cancer risk for the RME and CTE scenarios are $3x10^{-6}$ and $2x10^{-7}$, respectively. Only the RME estimate is within the risk management range of 10^{-6} to 10^{-4}. Sixty-eight percent of this risk is due to B[a]P equivalent concentration, with less contribution from arsenic (23 percent) and 2,3,7,8-TCDD TEQ (9 percent). The RME cumulative incremental cancer risk, excluding background, is estimated at $2x10^{-6}$ with B[a]P equivalent concentration and 2,3,7,8-TCDD TEQ providing 88 percent and 12 percent of this risk. The noncancer hazard was calculated to be less than an HI of 1.0.

Subsurface Soil (0-foot to 10 feet bgs). The SSRBE results for subsurface soil under the construction worker scenario are presented in Table 8-29. Based on the maximum detected concentration, arsenic was included in the risk estimate despite concentrations being within background levels. Results for subsurface soil are the same as those for surface soil. Using the EPC for calculation of risk estimates, the cumulative incremental cancer risk for the RME and CTE scenarios are $3x10^{-6}$ and $2x10^{-7}$, respectively. Only the RME estimate is within the risk management range of 10^{-6} to 10^{-4}. Sixty-six percent of this risk is due to B[a]P equivalent concentration, with less contribution from arsenic (21 percent) and 2,3,7,8-TCDD TEQ (13 percent). The RME cumulative incremental cancer risk, excluding background, is estimated at $3x10^{-6}$ with B[a]P equivalent concentration and 2,3,7,8-TCDD TEQ providing 84 percent and 16 percent of this risk. The noncancer hazard was calculated to be less than an HI of 1.0.

8.6.4.3 AGRICULTURAL WORKER

The agricultural worker was evaluated for potential exposure to surface soil and to subsurface soil. Results are presented in Tables 8-30 and 8-31, respectively.

Surface Soil (0-foot to 1-foot bgs). The SSRBE results for surface soil under the agricultural worker scenario are presented in Table 8-30. Based on the maximum detected concentration, arsenic was

included in the risk estimate despite concentrations being within background levels. Using the EPC for calculation of risk estimates, the cumulative incremental cancer risk for the RME and CTE scenarios are $2x10^{-5}$ and $7x10^{-7}$, respectively. Only the RME estimate is within the risk management range of 10^{-6} to 10^{-4}. Seventy-eight percent of this risk is due to B[a]P equivalent concentration, with less contribution from arsenic (16 percent) and 2,3,7,8-TCDD TEQ (6 percent). The RME cumulative incremental cancer risk, excluding background, remains at $2x10^{-5}$ with B[a]P equivalent concentration and 2,3,7,8-TCDD TEQ providing 92 percent and 8 percent of this risk. Without the contribution from background levels, the risk from exposure to surface soil remains within the risk management range of 10^{-6} to 10^{-4}. The noncancer hazard was calculated to be less than an HI of 1.0.

Subsurface Soil (0-foot to 10 feet bgs). The SSRBE results for subsurface soil under the agricultural worker scenario are presented in Table 8-31. Based on the maximum detected concentration, arsenic was included in the risk estimate despite concentrations being within the range of background levels.

Results for subsurface soil are similar to those for surface soil. Using the EPC for calculation of risk estimates, the cumulative incremental cancer risk for the RME and CTE scenarios are $3x10^{-5}$ and $7x10^{-7}$, respectively. Only the RME estimate is within the risk management range of 10^{-6} to 10^{-4}. Seventy-six percent of this risk is due to B[a]P equivalent concentration, with less contribution from arsenic (15 percent) and 2,3,7,8-TCDD TEQ (9 percent). The RME cumulative incremental cancer risk, excluding background, remains at $2x10^{-5}$ with B[a]P equivalent concentration and 2,3,7,8-TCDD TEQ providing 90 percent and 10 percent of this risk. Without the contribution from background levels, the risk from exposure to surface soil remains within the risk management range of 10^{-6} to 10^{-4}. The noncancer hazard was calculated to be less than an HI of 1.0.

8.6.4.4 Recreational User

Exposure for the recreational user is restricted to surface soil. Results are presented in Table 8-32.

Surface Soil (0-foot to 1-foot bgs). The SSRBE results for surface soil under the recreational user scenario are presented in Table 8-32. Based on the maximum detected concentration, arsenic was included in the risk estimate despite concentrations being within background levels. Using the EPC for calculation of risk estimates, the cumulative incremental cancer risk for the RME and CTE scenarios are $5x10^{-6}$ and $2x10^{-7}$, respectively. Only the RME estimate is within the risk management range of 10^{-6} to 10^{-4}. Sixty-nine percent of this risk is due to B[a]P equivalent concentration, with less contribution from arsenic (22 percent) and 2,3,7,8-TCDD TEQ (9 percent). The RME cumulative incremental cancer risk, excluding background, is estimated at $4x10^{-6}$ with B[a]P equivalent concentration and 2,3,7,8-TCDD TEQ providing 89 percent and 11 percent of this risk. This estimate remains above the 10^{-6} point of departure. The noncancer hazard was calculated to be less than an HI of 1.0.

8.6.4.5 Residential Use

Carcinogenic risks under a RME scenario for future potential residential use at AA 3 were previously reported in the RBS as $4x10^{-5}$ for both surface soil and subsurface soil (Tables 8-13 and 8-14). Under and average or CTE scenario, these risks decrease to $4x10^{-6}$ for both soil intervals. This risk is driven by the presence of B[a]P equivalent concentration (posing approximately two-thirds of the risk), arsenic (23 percent of the risk) and 2,3,7,8-TCDD TEQ (9 percent of the risk). The maximum detected concentration of arsenic was 4.6 mg/kg. With a background concentration (or more specifically, UCL) of 8.6 mg/kg, the level of arsenic at the site is within background levels. The contribution from background does not significantly affect the risk estimate as the carcinogenic risk

Table 8-25: Toxicity Values Used in Estimating Site-Specific PRGs

Chemical	SFo (mg/kg-d)	RfDo (1/(mg/kg-d))	SFi (mg/kg-d)	RfDi (1/(mg/kg-d))
Arsenic	1.50E+00	3.00E-04	1.51E+01	--
Benzo(a)pyrene Equivalent	7.30E+00	--	7.30E+00	--
2,3,7,8-TCDD TEQ	1.50E+05	--	1.50E+05	--

Notes:

Source: EPA Region 9 Preliminary Remediation Goals (PRG) Tables, dated October 2004

-- = toxicity value not available

EPA = Environmental Protection Agency

mg/kg-d = milligrams per kilograms per day

RfDi = Inhalation reference dose

RfDo = Oral reference dose

SFo = Oral slope factor

SFi = Inhalation slope factor

2,3,7,8-TCDD TEQ = 2,3,7,8-tetrachlorodibenzo-p-dioxin toxicity equivalent

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Table 8-26. Site-Specific Preliminary Remediation Goals Under the RME and CTE Scenarios

Reasonable Maximum Exposure (RME)

Chemical	Escorted Visitor			Construction/Utility Worker		Agricultural Worker		Recreational Visitor		
	RME PRGs			RME PRGs		RME PRGs		RME PRGs		
	Noncarcinogenic PRGs		Age-Adjusted Carcinogenic PRG	Noncarcinogenic PRG	Carcinogenic PRG	Noncarcinogenic PRG	Carcinogenic PRG	Noncarcinogenic PRGs		Age-Adjusted Carcinogenic PRG
	adult	juvenile						adult	juvenile	
Metals by Method 6010B (mg/kg)										
Arsenic	1.37E+03	7.00E+02	7.20E+00	8.52E+01	4.42E+00	1.35E+02	8.41E-01	4.47E+02	2.22E+02	2.58E+00
Semivolitile Organics (PAH-SIM) (mg/kg)										
Benzo(a)pyrene Equivalent	—	—	9.53E-01	—	7.12E-01	—	8.13E-02	—	—	3.92E-01
Dioxins and Furans (8290) (mg/kg)										
2,3,7,8-TCDD TEQ	—	—	7.21E-05	—	4.42E-05	—	8.42E-06	—	—	2.58E-05

Central Tendency Exposure (CTE)

Chemical	Escorted Visitor			Construction/Utility Worker		Agricultural Worker		Recreational Visitor		
	CTE PRGs			CTE PRGs		CTE PRGs		CTE PRGs		
	Noncarcinogenic PRGs		Age-Adjusted Carcinogenic PRG	Noncarcinogenic PRG	Carcinogenic PRG	Noncarcinogenic PRG	Carcinogenic PRG	Noncarcinogenic PRGs		Age-Adjusted Carcinogenic PRG
	adult	juvenile						adult	juvenile	
Metals by Method 6010B (mg/kg)										
Arsenic	2.39E+04	1.22E+04	2.10E+02	3.18E+02	9.89E+01	9.96E+02	2.34E+01	5.67E+03	2.93E+03	5.69E+01
Semivolitile Organics (PAH-SIM) (mg/kg)										
Benzo(a)pyrene Equivalent	—	—	2.79E+01	—	1.37E+01	—	2.96E+00	—	—	9.87E+00
Dioxins and Furans (8290) (mg/kg)										
2,3,7,8-TCDD TEQ	—	—	2.10E-03	—	9.90E-04	—	2.35E-04	—	—	5.69E-04

Notes:
-- = PRG not available
CAS = Chemical Abstract Service
mg/kg = milligrams per kilogram
PRG = preliminary remediation goal
2,3,7,8-TCDD TEQ = dioxin toxicity equivalent quotient based on the toxicity of 2,3,7,8-tetrachlorodibeno-p-dioxin

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Table 8-27: Site-Specific Risk-Based Evaluation of Surface Soil (0-foot to 1-foot bgs) for (Current/Future) Visitor (Adult/Juvenile) Receptor

								Preliminary Remediation Goals				Maximum Detect Evaluation		RME Evaluation						Background Comparison	CTE Evaluation					
								RME		CTE PRGs		Carcinogenic	Noncarcinogenic	Carcinogenic			Noncarcinogenic				Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect in Soil (mg/kg)[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG (mg/kg)[d]	Noncarcinogenic PRG (mg/kg)[d]	Carcinogenic PRG (mg/kg)[d]	Noncarcinogenic PRG (mg/kg)[d]	>PRG (ca)	>PRG (nc)	>PRG (ca)	Excess Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI	Max > Background?	>PRG (ca)	Excess Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI
Arsenic	33	33	100%	4.60E+00	3.16E+00	3.16E+00	6.86E+00	7.20E+00	7.00E+02	2.10E+02	1.22E+04	No	No	No	4.38E-07	20%	No	4.51E-03	100%	No	No	1.50E-08	20%	No	2.60E-04	100%
Benzo(a)pyrene Equivalent	7	33	21%	1.48E+00	–	1.48E+00	–	9.53E-01	–	2.79E+01	–	Yes	–	Yes	1.55E-06	72%	–	–	–	–	No	5.30E-08	72%	–	–	–
2,3,7,8-TCDD TEQ	9	9	100%	1.25E-05	–	1.25E-05	–	7.21E-05	–	2.10E-03	–	No	–	No	1.74E-07	8%	–	–	–	–	No	5.97E-09	8%	–	–	–
Cumulative Excess Cancer Risk/Hazard Index Including Background:															**2E-06**			**5E-03**				**7E-08**			**3E-04**	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:															**2E-06**			**–**				**6E-08**			**–**	

Notes:

– = no data or not applicable
% = percent
ca = carcinogenic
HI = hazard index
mg/kg = milligrams per kilogram
nc = noncarcinogenic
PRG = preliminary remediation goals
SSL = soil screening levels
EPC = exposure point concentration
HQ = hazard quotient
RME = reasonable maximum exposure
FOD = frequency of detection
> = greater than
max = maximum
CTE = central tendency exposure
UCL = upper confidence limit
TCDD = tetrachlorodibenzodioxin
TEQ = toxicity equivalency quotient
bgs = below ground surface

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Maximum EPC is the maximum detected concentration of an analyte.
[c] RME EPC is the minimum of either the 95% UCL of the arithmetic mean or the maximum EPC. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region 9 PRG table (EPA Region 9 2004b). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.
[f] Excess cancer risk = 1E-06 x (EPC / Carcinogenic PRG)
[g] HQ = EPC / Noncarcinogenic PRG
The B[a]P equivalent concentration is from Table 8-8.

Bolded chemicals have maximum detected concentrations exceeding site-specific PRGs.

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Table 8-28: Site-Specific Risk-Based Evaluation of Surface Soil (0-foot to 1-foot bgs) for (Future) Construction Worker Receptor

								Preliminary Remediation Goals				Maximum Detect Evaluation		RME Evaluation						Background Comparison	CTE Evaulation					
								RME		CTE PRGs		Carcinogenic	Noncarcinogenic	Carcinogenic			Noncarcinogenic				Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect in Soil (mg/kg)[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG (mg/kg)[d]	Noncarcinogenic PRG (mg/kg)[d]	Carcinogenic PRG (mg/kg)[d]	Noncarcinogenic PRG (mg/kg)[d]	>PRG (ca)	>PRG (nc)	>PRG (ca)	Excess Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI	Max > Background?	>PRG (ca)	Excess Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI
Arsenic	33	33	100%	4.60E+00	3.16E+00	3.16E+00	6.86E+00	4.42E+00	8.52E+01	9.89E+01	3.18E+02	Yes	No	No	7.15E-07	23%	No	3.70E-02	100%	No	No	3.19E-08	21%	No	9.92E-03	100%
Benzo(a)pyrene Equivalent	7	33	21%	1.48E+00	--	1.48E+00	--	7.12E-01	--	1.37E+01	--	Yes	--	Yes	2.08E-06	68%	--	--	--	--	No	1.08E-07	71%	--	--	--
2,3,7,8-TCDD TEQ	9	9	100%	1.25E-05	--	1.25E-05		4.42E-05	--	9.90E-04	--	No	--	No	2.84E-07	9%	--	--	--	--	No	1.27E-08	8%	--	--	--
Cumulative Excess Cancer Risk/Hazard Index Including Background:															3E-06			4E-02				2E-07			1E-02	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:															2E-06			--				1E-07			--	

Notes:

-- = no data or not applicable
% = percent
ca = carcinogenic
HI = hazard index
mg/kg = milligrams per kilogram
nc = noncarcinogenic
PRG = preliminary remediation goals
SSL = soil screening levels
EPC = exposure point concentration
HQ = hazard quotient
RME = reasonable maximum exposure
FOD = frequency of detection
> = greater than
max = maximum
CTE = central tendency exposure
UCL = upper confidence limit
TCDD = tetrachlorodibenzodioxin
TEQ = toxicity equivalency quotient
bgs = below ground surface

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Maximum EPC is the maximum detected concentration of an analyte.
[c] RME EPC is the minimum of either the 95% UCL of the arithmetic mean or the maximum EPC. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] SSLs for the protection of groundwater from EPA Region IX PRG table (EPA Region IX 2004b). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.
[f] Excess cancer risk = 1E-06 x (EPC / Carcinogenic PRG)
[g] HQ = EPC / Noncarcinogenic PRG
The B[a]P equivalent concentration is from Table 8-8.

Bolded chemicals have maximum detected concentrations exceeding site-specific PRGs.

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Table 8-29: Site-Specific Risk-Based Evaluation of Subsurface Soil (0-foot to 10 feet bgs) for (Future) Construction Worker Recepto

Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect in Soil (mg/kg)[b]	95% UCL	EPC[c]	Background Concentration	Preliminary Remediation Goals: RME: Carcinogenic PRG (mg/kg)[d]	Preliminary Remediation Goals: RME: Noncarcinogenic PRG (mg/kg)[d]	Preliminary Remediation Goals: CTE PRGs: Carcinogenic PRG (mg/kg)[d]	Preliminary Remediation Goals: CTE PRGs: Noncarcinogenic PRG (mg/kg)[d]	Maximum Detect Evaluation: Carcinogenic: >PRG (ca)	Maximum Detect Evaluation: Noncarcinogenic: >PRG (nc)	RME Evaluation: Carcinogenic: >PRG (ca)	RME Evaluation: Carcinogenic: Excess Cancer Risk[f]	RME Evaluation: Carcinogenic: % Contribution to Risk	RME Evaluation: Noncarcinogenic: >PRG (nc)	RME Evaluation: Noncarcinogenic: HQ[g]	RME Evaluation: Noncarcinogenic: % Contribution to HI	Background Comparison: Max > Background?	CTE Evaluation: Carcinogenic: >PRG (ca)	CTE Evaluation: Carcinogenic: Excess Cancer Risk[f]	CTE Evaluation: Carcinogenic: % Contribution to Risk	CTE Evaluation: Noncarcinogenic: >PRG (nc)	CTE Evaluation: Noncarcinogenic: HQ[g]	CTE Evaluation: Noncarcinogenic: % Contribution to HI
Arsenic	42	42	100%	4.63E+00	3.20E+00	3.20E+00	6.86	4.42E+00	8.52E+01	9.89E+01	3.18E+02	Yes	No	No	7.23E-07	21%	No	3.75E-02	100%	No	No	3.23E-08	19%	No	1.00E-02	100%
Benzo(a)pyrene Equivalent	7	33	21%	1.48E+00	--	1.58E+00	--	7.12E-01	--	1.37E+01	--	Yes	--	Yes	2.22E-06	66%	--	--	--	--	No	1.15E-07	69%	--	--	--
2,3,7,8-TCDD TEQ	11	11	100%	1.29E-05	--[h]	1.87E-05	--	4.42E-05	--	9.90E-04	--	No	--	No	4.23E-07	13%	--	--	--	--	No	1.89E-08	11%	--	--	--
Cumulative Excess Cancer Risk/Hazard Index Including Background:															**3E-06**			**4E-02**				**2E-07**			**1E-02**	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:															**3E-06**			**--**				**1E-07**			**--**	

Notes:

-- = no data or not applicable
% = percent
ca = carcinogenic
HI = hazard index
mg/kg = milligrams per kilogram
nc = noncarcinogenic
PRG = preliminary remediation goals
SSL = soil screening levels
EPC = exposure point concentration
HQ = hazard quotient
RME = reasonable maximum exposure
FOD = frequency of detection
> = greater than
max = maximum
CTE = central tendency exposure
UCL = upper confidence limit
TCDD = tetrachlorodibenzodioxin
TEQ = toxicity equivalency quotient
bgs = below ground surface

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Maximum EPC is the maximum detected concentration of an analyte.
[c] RME EPC is the minimum of either the 95% UCL of the arithmetic mean or the maximum EPC. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region 9 PRG table (EPA Region 9 2004b). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.
[f] Excess cancer risk = 1E-06 x (EPC / Carcinogenic PRG)
[g] HQ = EPC / Noncarcinogenic PRG
[h] A 95% UCL was not calculated as only 5 of the 25 detected congeners had 11 detections, and none of the 5 congeners contributed significantly to the TCDD TEQ.

Bolded chemicals have maximum detected concentrations exceeding site-specific PRGs.

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Table 8-30: Site-Specific Risk-Based Evaluation of Surface Soil (0-foot to 1-foot bgs) for Future Agricultural Worker Recepto

Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect in Soil (mg/kg)[b]	95% UCL	EPC[c]	Background Concentration	Preliminary Remediation Goals: RME: Carcinogenic PRG (mg/kg)[d]	Preliminary Remediation Goals: RME: Noncarcinogenic PRG (mg/kg)[d]	Preliminary Remediation Goals: CTE PRGs: Carcinogenic PRG (mg/kg)[d]	Preliminary Remediation Goals: CTE PRGs: Noncarcinogenic PRG (mg/kg)[d]	Maximum Detect Evaluation: Carcinogenic: >PRG (ca)	Maximum Detect Evaluation: Noncarcinogenic: >PRG (nc)	RME Evaluation: Carcinogenic: >PRG (ca)	RME Evaluation: Carcinogenic: Excess Cancer Risk[f]	RME Evaluation: Carcinogenic: % Contribution to Risk	RME Evaluation: Noncarcinogenic: >PRG (nc)	RME Evaluation: Noncarcinogenic: HQ[g]	RME Evaluation: Noncarcinogenic: % Contribution to HI	Background Comparison: Max > Background?	CTE Evaluation: Carcinogenic: >PRG (ca)	CTE Evaluation: Carcinogenic: Excess Cancer Risk[f]	CTE Evaluation: Carcinogenic: % Contribution to Risk	CTE Evaluation: Noncarcinogenic: >PRG (nc)	CTE Evaluation: Noncarcinogenic: HQ[g]	CTE Evaluation: Noncarcinogenic: % Contribution to HI
Arsenic	33	33	100%	4.60E+00	3.16E+00	3.16E+00	6.86	8.41E-01	1.35E+02	2.34E+01	9.96E+02	Yes	No	Yes	3.75E-06	16%	No	2.33E-02	100%	No	No	1.35E-07	20%	No	3.17E-03	100%
Benzo(a)pyrene Equivalent	7	33	21%	1.48E+00	--	1.48E+00	--	8.13E-02	--	2.96E+00	--	Yes	--	Yes	1.82E-05	78%	--	--	--	--	No	4.99E-07	73%	--	--	--
2,3,7,8-TCDD TEQ	9	9	100%	1.25E-05	--	1.25E-05	--	8.42E-06	--	2.35E-04	--	Yes	--	Yes	1.49E-06	6%	--	--	--	--	No	5.34E-08	8%	--	--	--
Cumulative Excess Cancer Risk/Hazard Index Including Background:															**2E-05**			**2E-02**				**7E-07**			**3E-03**	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:															**2E-05**			**--**				**6E-07**			**--**	

Notes:

-- = no data or not applicable
% = percent
ca = carcinogenic
HI = hazard index
mg/kg = milligrams per kilogram
nc = noncarcinogenic
PRG = preliminary remediation goals
SSL = soil screening levels
EPC = exposure point concentration
HQ = hazard quotient
RME = reasonable maximum exposure
FOD = frequency of detection
> = greater than
max = maximum
CTE = central tendency exposure
UCL = upper confidence limit
TCDD = tetrachlorodibenzodioxin
TEQ = toxicity equivalency quotient
bgs = below ground surface

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Maximum EPC is the maximum detected concentration of an analyte.
[c] RME EPC is the minimum of either the 95% UCL of the arithmetic mean or the maximum EPC. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] SSLs for the protection of groundwater from EPA Region 9 PRG table (EPA Region 9 2004b). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.
[f] Excess cancer risk = 1E-06 x (EPC / Carcinogenic PRG)
[g] HQ = EPC / Noncarcinogenic PRG
[h] The B[a]P equivalent concentration is from Table 8-8.

Bolded chemicals have maximum detected concentrations exceeding site-specific PRGs.

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Table 8-31: Site-Specific Risk-Based Evaluation of Subsurface Soil (0-foot to 10 feet bgs) for (Future) Agricultural Worker Receptor

Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect in Soil (mg/kg)[b]	95% UCL	EPC[c]	Background Concentration	Preliminary Remediation Goals: RME: Carcinogenic PRG (mg/kg)[d]	Preliminary Remediation Goals: RME: Noncarcinogenic PRG (mg/kg)[d]	Preliminary Remediation Goals: CTE PRGs: Carcinogenic PRG (mg/kg)[d]	Preliminary Remediation Goals: CTE PRGs: Noncarcinogenic PRG (mg/kg)[d]	Maximum Detect Evaluation: Carcinogenic: >PRG (ca)	Maximum Detect Evaluation: Noncarcinogenic: >PRG (nc)	RME Evaluation: Carcinogenic: >PRG (ca)	RME Evaluation: Carcinogenic: Excess Cancer Risk[f]	RME Evaluation: Carcinogenic: % Contribution to Risk	RME Evaluation: Noncarcinogenic: >PRG (nc)	RME Evaluation: Noncarcinogenic: HQ[g]	RME Evaluation: Noncarcinogenic: % Contribution to HI	Background Comparison: Max > Background?	CTE Evaluation: Carcinogenic: >PRG (ca)	CTE Evaluation: Carcinogenic: Excess Cancer Risk[f]	CTE Evaluation: Carcinogenic: % Contribution to Risk	CTE Evaluation: Noncarcinogenic: >PRG (nc)	CTE Evaluation: Noncarcinogenic: HQ[g]	CTE Evaluation: Noncarcinogenic: % Contribution to HI
Arsenic	42	42	100%	4.63E+00	3.20E+00	3.20E+00	6.86	8.41E-01	1.35E+02	2.34E+01	9.96E+02	Yes	No	Yes	3.80E-06	15%	No	2.36E-02	100%	No	No	1.36E-07	18%	No	3.21E-03	100%
Benzo(a)pyrene Equivalent	7	33	21%	1.48E+00	--	1.58E+00	--	8.13E-02	--	2.96E+00	--	Yes	--	Yes	1.94E-05	76%	--	--	--	--	No	5.33E-07	71%	--	--	--
2,3,7,8-TCDD TEQ	11	11	100%	1.29E-05	--[h]	1.87E-05	--	8.42E-06	--	2.35E-04	--	Yes	--	Yes	2.22E-06	9%	--	--	--	--	No	7.97E-08	11%	--	--	--
Cumulative Excess Cancer Risk/Hazard Index Including Background:															**3E-05**			**2E-02**				**7E-07**			**3E-03**	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:															**2E-05**			--				**6E-07**			--	

Notes:

-- = no data or not applicable
% = percent
ca = carcinogenic
HI = hazard index
mg/kg = milligrams per kilogram
nc = noncarcinogenic
PRG = preliminary remediation goals
SSL = soil screening levels
EPC = exposure point concentration
HQ = hazard quotient
RME = reasonable maximum exposure
FOD = frequency of detection
> = greater than
max = maximum
CTE = central tendency exposure
UCL = upper confidence limit
TCDD = tetrachlorodibenzodioxin
TEQ = toxicity equivalency quotient
bgs = below ground surface

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Maximum EPC is the maximum detected concentration of an analyte.
[c] RME EPC is the minimum of either the 95% UCL of the arithmetic mean or the maximum EPC. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] SSLs for the protection of groundwater from EPA Region 9 PRG table (EPA Region 9 2004b). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.
[f] Excess cancer risk = 1E-06 x (EPC / Carcinogenic PRG)
[g] HQ = EPC / Noncarcinogenic PRG
[h] A 95% UCL was not calculated as only 5 of the 25 detected congeners had 11 detections, and none of the 5 congeners contributed significantly to the TCDD TEQ.

Bolded chemicals have maximum detected concentrations exceeding site-specific PRGs.

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Table 8-32: Site-Specific Risk-Based Evaluation of Surface Soil (0-foot to 1-foot bgs) for (Future) Adult/Juvenile Recreational Recepto

								Preliminary Remediation Goals				Maximum Detect Evaluation		RME Evaluation						Background Comparison	CTE Evaluation					
								RME		CTE PRGs		Carcinogenic	Noncarcinogenic	Carcinogenic			Noncarcinogenic				Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size[a]	Frequency of Detection	Maximum Detect in Soil (mg/kg)[b]	95% UCL of Arithmetic Mean (mg/kg)	EPC (mg/kg)[c]	Background Concentration (mg/kg)	Carcinogenic PRG (mg/kg)[d]	Noncarcinogenic PRG (mg/kg)[d]	Carcinogenic PRG (mg/kg)[d]	Noncarcinogenic PRG (mg/kg)[d]	>PRG (ca)	>PRG (nc)	>PRG (ca)	Excess Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI	Max > Background?	>PRG (ca)	Excess Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI
Arsenic	33	33	100%	4.60E+00	3.16E+00	3.16E+00	6.86	2.58E+00	2.22E+02	5.69E+01	2.93E+03	Yes	No	Yes	1.22E-06	22%	No	1.42E-02	100%	No	No	5.55E-08	24%	No	1.08E-03	100%
Benzo(a)pyrene Equivalent	7	33	21%	1.48E+00	--	1.48E+00	--	3.92E-01	--	9.87E+00	--	Yes	--	Yes	3.77E-06	69%	--	--	--	--	No	1.50E-07	66%	--	--	--
2,3,7,8-TCDD TEQ	9	9	100%	1.25E-05	--	1.25E-05	--	2.58E-05	--	5.69E-04	--	No	--	No	4.86E-07	9%	--	--	--	--	No	2.20E-08	10%	--	--	--
Cumulative Excess Cancer Risk/Hazard Index Including Background:															**5E-06**			**1E-02**				**2E-07**			**1E-03**	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:															**4E-06**			**--**				**2E-07**			**--**	

Notes:

-- = no data or not applicable
% = percent
ca = carcinogenic
HI = hazard index
mg/kg = milligrams per kilogram
nc = noncarcinogenic
PRG = preliminary remediation goals
SSL = soil screening levels
EPC = exposure point concentration
HQ = hazard quotient
RME = reasonable maximum exposure
FOD = frequency of detection
> = greater than
max = maximum
CTE = central tendency exposure
UCL = upper confidence limit
TCDD = tetrachlorodibenzodioxin
TEQ = toxicity equivalency quotient
bgs = below ground surface

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Maximum EPC is the maximum detected concentration of an analyte.
[c] RME EPC is the minimum of either the 95% UCL of the arithmetic mean or the maximum EPC.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] SSLs for the protection of groundwater from EPA Region 9 PRG table (EPA Region 9 2002). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachat
[f] Excess cancer risk = 1E-06 x (EPC / Carcinogenic PRG)
[g] HQ = EPC / Noncarcinogenic PRG
The B[a]P equivalent concentration is from Table 8-8.

Bolded chemicals have maximum detected concentrations exceeding site-specific PRGs.

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Table 8-33: Summary of Incremental Lifetime Cancer Risks and Cumulative Noncancer Hazard Indices for RME and CTE Evaluations

Type	Residential (Draft)		Residential (Draft Final)		Industrial (Draft)		Industrial (Draft Final)		Visitor (Draft)		Visitor (Draft Final)		Construction Worker (Draft)		Construction Worker (Draft Final)		Agricultural Worker (Draft)		Agricultural Worker (Draft Final)		Recreational User (Draft)		Recreational User (Draft Final)	
	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE
Surface Soil - Including Background																								
ILCR	2.E-05	6.E-06	4E-05	4E-06	2E-05	3E-07	1E-05	5E-07	1E-06	6E-08	2E-06	7E-08	2E-06	1E-07	3E-06	2E-07	1E-05	5E-07	2E-05	7E-07	3E-06	1E-07	5E-06	2E-07
B(a)P equivalents	67%	33%	68%	66%	89%	67%	73%	68%	58%	67%	72%	72%	67%	70%	68%	71%	75%	72%	78%	73%	68%	65%	69%	66%
arsenic	33%	66%	23%	24%	11%	33%	19%	23%	42%	33%	20%	20%	33%	30%	23%	21%	25%	28%	16%	20%	32%	35%	22%	24%
TCDD TEQ	--	--	9%	10%			8%	9%	--	--	8%	8%			9%	8%	--	--	6%	8%	--	--	9%	10%
HI	1.E+00	1.E-07	1.E+00	9.E-02	6.E-02	1.E-02	6.E-02	1.E-02	3.E-03	3.E-04	5.E-03	<0.001	4.E-02	1.E-02	4.E-02	1.E-02	2.E-02	3.E-03	2.E-02	3.E-03	7.E-03	6.E-04	1.E-02	1.E-03
arsenic	10%	19%	10%	0%	21%	22%	21%	20%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
iron	38%	--	38%	-- a	--	--	-- a	-- a	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
manganese	8%	16%	8%	24%	17%	18%	17%	16%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
vanadium	25%	48%	25%	72%	46%	55%	46%	50%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Surface Soil - Excluding Background																								
ILCR	2.E-05	2.E-06	3E-05	3E-06	2E-05	2E-07	8E-06	4E-07	8E-07	4E-08	2E-06	6E-08	1E-06	7E-08	2E-06	1E-07	1E-05	3E-07	2E-05	6E-07	2E-06	8E-08	4E-06	2E-07
B(a)P equivalents	100%	100%	88%	87%	100%	100%	90%	88%	100%	100%	90%	90%	100%	100%	88%	89%	100%	100%	92%	90%	100%	100%	89%	87%
arsenic	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TCDD TEQ	--	--	12%	13%	--	--	10%	12%	--	--	10%	10%	--	--	12%	11%	--	--	8%	10%	--	--	11%	13%
HI	7.E-01	5.E-09	7.E-01	3.E-03	--	--	3.E-03	2.E-04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
arsenic	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
iron	77%	--	76%	-- a	--	--	-- a	-- a	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Subsurface Soil - Including Background																								
ILCR	3.E-05	6.E-06	4E-05	4E-06	2E-05	3E-07	1E-05	5E-07	--	--	--	--	2E-06	1E-07	3E-06	2E-07	1E-05	5E-07	3E-05	7E-07	--	--	--	--
B(a)P equivalents	64%	32%	66%	65%	86%	64%	71%	67%	--	--	--	--	62%	65%	66%	69%	71%	67%	76%	71%	--	--	--	--
arsenic	32%	65%	23%	24%	10%	32%	19%	22%	--	--	--	--	38%	35%	21%	19%	29%	33%	15%	18%	--	--	--	--
TCDD TEQ	--	--	9%	10%	--	--	8%	9%	--	--	--	--	--	--	13%	11%	--	--	9%	11%	--	--		
HI	1.E+00	1.E-01	1.E+00	1.E-01	6.E-02	1.E-08	6.E-02	1.E-02	--	--	--	--	5.E-02	1.E-02	4.E-02	1.E-02	3.E-02	4.E-03	2.E-02	3.E-03	--	--	--	--
arsenic	10%	19%	10%	19%	21%	22%	20%	20%	--	--	--	--	100%	100%	100%	100%	100%	100%	100%	100%	--	--		
iron	37%	--	37%	-- a	--	--	-- a	-- a	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
manganese	8%	16%	8%	16%	17%	17%	16%	16%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
vanadium	25%	48%	25%	49%	47%	54%	46%	49%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Subsurface Soil - Excluding Background																								
ILCR	2.E-05	2.E-06	3E-05	3E-06	2E-05	2E-07	8E-06	4E-07	--	--	--	--	1E-06	7E-08	3E-06	1E-07	1E-05	3E-07	2E-05	6E-07	--	--	--	--
B(a)P equivalents	100%	100%	86%	85%	100%	100%	89%	87%	--	--	--	--	100%	100%	84%	86%	100%	100%	90%	87%	--	--	--	--
arsenic	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TCDD TEQ	--	--	12%	13%	--	--	10%	12%	--	--	--	--	--	--	16%	14%	--	--	10%	13%	--	--		
HI	7.E-01	7.E-03	7.E-01	4.E-03	--	--	3.E-03	2.E-04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
arsenic	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
iron	75%	--	75%	-- a	--	--	-- a	-- a	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Indoor Air - Vapor Emission from Soil																								
ILCR	--	--	4E-06	9E-07	--	--	8E-07	1E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	--	--	98%	98%	--	--	98%	98%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HI	--	--	0.006	<0.001	--	--	<0.001	<0.001	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Groundwater																								
ILCR	3.E-04	1.E-04	3E-04	5E-05	--	--	Not Evaluated		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
arsenic	83%	85%	76%	77%	--	--	--	--	--	--	--	--	--	--			--	--			--	--		
HI	8.E+00	5.E+00	7.E+00	6.E+00	--	--	Not Evaluated		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
antimony	12%	14%	11%	12%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
arsenic	15%	17%	14%	14%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
thallium	41%	47%	44%	44%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
vanadium	15%	2%	11%	10%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Indoor Air - Vapor Emission from Groundwater																								
ILCR	--	--	4E-07	1E-07	--	--	9E-08	2E-08	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	--	--	98%	98%	--	--	98%	98%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HI	--	--	<0.001	<0.001	--	--	<0.001	<0.001	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTES:

[a] Non-cancer from iron cannot be estimated as the PRG is the maximum concentration of 100,000 mg/kg and not risk-based.

-- = not evaluated
B(a)P = benzo(a)pyrene
CTE = central tendency exposure
EPC = exposure point concentration
HI = hazard index
ILCR = incremental lifetime cancer risk
PRG = preliminary remediation goal
RME = reasonable maximum exposure
TCDD = 2,3,7,8-tetrachlorodibenzo-p-dioxin
TEQ = toxicity equivalency quotient
% = percent
> = greater than

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Table 8-34: Summary of Incremental Lifetime Cancer Risks and Cumulative Noncancer Hazard Indices for RME and CTE Evaluations Using Cal-EPA Toxicity Information

Type	Residential (Draft)		Residential (Draft Final)		Industrial (Draft)		Industrial (Draft Final)		Visitor (Draft)		Visitor (Draft Final)		Construction Worker (Draft)		Construction Worker (Draft Final)		Agricultural Worker (Draft)		Agricultural Worker (Draft Final)		Recreational User (Draft)		Recreational User (Draft Final)	
	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE
Surface Soil - Including Background																								
ILCR	2.E-05	6.E-06	9E-05	1E-05	2.E-05	3.E-07	2E-05	1E-06	1E-06	6E-08	5E-06	2E-07	2E-06	1E-07	8E-06	4E-07	1E-05	5E-07	5E-05	2E-06	3E-06	1E-07	1E-05	6E-07
B(a)P equivalents	67%	33%	39%	40%	89%	67%	46%	40%	58%	67%	47%	47%	67%	70%	42%	45%	75%	72%	55%	48%	68%	65%	43%	40%
arsenic	33%	66%	58%	57%	11%	33%	51%	24%	42%	33%	51%	51%	33%	30%	55%	52%	25%	28%	43%	49%	32%	35%	54%	57%
TCDD TEQ	--	--	3%	3%			3%	3%	--	--	3%	3%			3%	3%	--	--	2%	3%	--	--	3%	3%
HI	1.E+00	1.E-07	1.E+00	9.E-02	6.E-02	1.E-02	6.E-02	1.E-02	3.E-03	3.E-04	5.E-03	<0.001	4.E-02	1.E-02	4.E-02	1.E-02	2.E-02	3.E-03	2.E-02	3.E-03	7.E-03	6.E-04	1.E-02	1.E-03
arsenic	10%	19%	10%	0%	21%	22%	21%	24%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
iron	38%	--	38%	--a	--	--	--a	--a	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
manganese	8%	16%	8%	22%	17%	18%	14%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
vanadium	25%	48%	26%	74%	46%	55%	48%	61%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Surface Soil - Excluding Background																								
ILCR	2.E-05	2.E-06	4E-05	5E-06	2E-05	2E-07	1E-05	5E-07	8E-07	4E-08	3E-06	9E-08	1E-06	7E-08	4E-06	2E-07	1E-05	3E-07	3E-05	9E-07	2E-06	8E-08	4E-06	2E-07
B(a)P equivalents	100%	100%	93%	93%	100%	100%	94%	93%	100%	100%	94%	94%	100%	100%	93%	94%	100%	100%	96%	95%	100%	100%	89%	87%
arsenic	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TCDD TEQ	--	--	7%	7%	--	--	6%	7%	--	--	6%	6%	--	--	7%	6%	--	--	4%	5%	--	--	11%	13%
HI	7.E-01	5.E-09	7.E-01	3.E-03	--	--	3.E-03	<0.001	--	--	<0.001	<0.001	--	--	<0.001	<0.001	--	--	<0.001	<0.001	--	--	--	--
arsenic	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
iron	77%	--	76%	--a	--	--	--a	--a	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Subsurface Soil - Including Background																								
ILCR	3.E-05	6.E-06	9E-05	1E-05	2E-05	3E-07	2E-05	1E-06	--	--	--	--	2E-06	1E-07	9E-06	4E-07	1E-05	5E-07	6E-05	2E-06	--	--	--	--
B(a)P equivalents	64%	32%	39%	39%	86%	64%	45%	40%	--	--	--	--	62%	65%	43%	46%	71%	67%	55%	49%	--	--	--	--
arsenic	32%	65%	58%	57%	10%	32%	51%	56%	--	--	--	--	38%	35%	53%	50%	29%	33%	41%	48%	--	--	--	--
TCDD TEQ	--	--	3%	3%	--	--	3%	3%	--	--	--	--	--	--	4%	4%	--	--	3%	4%	--	--		
HI	1.E+00	1.E-01	1.E+00	1.E-01	6.E-02	1.E-08	6.E-02	1.E-02	--	--	--	--	5.E-02	1.E-02	4.E-02	1.E-02	3.E-02	4.E-03	2.E-02	3.E-03	--	--	--	--
arsenic	10%	19%	10%	20%	21%	22%	21%	24%	--	--	--	--	100%	100%	100%	100%	100%	100%	100%	100%	--	--		
iron	37%	--	38%	--a	--	--	--a	--a	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
manganese	8%	16%	8%	15%	17%	17%	14%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
vanadium	25%	48%	25%	49%	47%	54%	47%	60%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Subsurface Soil - Excluding Background																								
ILCR	2.E-05	2.E-06	4E-05	5E-06	2E-05	2E-07	1E-05	5E-07	--	--	--	--	1E-06	7E-08	4E-06	2E-07	1E-05	3E-07	3E-05	9E-07	--	--	--	--
B(a)P equivalents	100%	100%	92%	91%	100%	100%	93%	91%	--	--	--	--	100%	100%	91%	92%	100%	100%	94%	93%	--	--	--	--
arsenic	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TCDD TEQ	--	--	7%	7%	--	--	6%	7%	--	--	--	--	--	--	9%	8%	--	--	6%	7%	--	--	--	--
HI	7.E-01	7.E-03	7.E-01	4.E-03	--	--	5.E-03	<0.001	--	--	--	--	--	--	<0.001	<0.001	--	--	<0.001	<0.001	--	--	--	--
arsenic	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
iron	75%	--	75%	--a	--	--	--a	--a	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Indoor Air - Vapor Emission from Soil																								
ILCR	--	--	4E-06	1E-06	--	--	1E-06	2E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	--	--	95%	95%	--	--	95%	95%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HI	--	--	0.006	<0.001	--	--	<0.001	<0.001	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Groundwater																								
ILCR	3.E-04	1.E-04	1E-03	3E-04	--	--	Not Evaluated		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
arsenic	83%	85%	93%	93%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HI	8.E+00	5.E+00	1.E+01	6.E+00	--	--	Not Evaluated		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
antimony	12%	14%	8%	12%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
arsenic	15%	17%	23%	14%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
thallium	41%	47%	10%	6%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
vanadium	15%	2%	32%	44%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Indoor Air - Vapor Emission from Groundwater																								
ILCR	--	--	1E-07	3E-08	--	--	2E-08	4E-09	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	--	--	88%	88%	--	--	88%	88%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HI	--	--	<0.001	<0.001	--	--	<0.001	<0.001	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTES:

[a] Non-cancer from iron cannot be estimated as the PRG is the maximum concentration of 100,000 mg/kg and not risk-based.

-- = not evaluated
B(a)P = benzo(a)pyrene
CTE = central tendency exposure
EPC = exposure point concentration
HI = hazard index
ILCR = incremental lifetime cancer risk
PRG = preliminary remediation goal
RME = reasonable maximum exposure
% = percent
> = greater than
TCDD = 2,3,7,8-tetrachlorodibenzo-p-dioxin
TEQ = toxicity equivalency quotient

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estimate decreases to $3x10^{-5}$. Under CTE, the carcinogenic risk estimate excluding background decreases to $3x10^{-6}$. B[a]P equivalent concentration and 2,3,7,8-TCDD TEQ remain the risk drivers.

Noncarcinogenic hazards were previously reported as a HI of 1 in both surface soil and subsurface soil intervals. Included in this estimate are risks from metals that are present at background levels, including most notably, vanadium, arsenic, manganese and antimony. Excluding the contribution from background, the noncarcinogenic HI decreases to 0.7 for both soil intervals. Iron is the main contributor to this noncarcinogenic hazard estimate.

8.6.4.6 Industrial Use

Carcinogenic risks under a RME scenario for future industrial use at AA 3 were reported in the RBS as $1x10^{-5}$ for both surface soil and subsurface soil (Tables 8-15 and 8-16). Under and average or CTE scenario, these risks decrease to $5x10^{-7}$ for both soil intervals. This risk is driven by the presence of B[a]P equivalent concentration (73 percent of the risk), arsenic (20 percent of the risk) and 2,3,7,8-TCDD TEQ (8 percent of the risk). The maximum detected concentration of arsenic was 4.6 mg/kg. With a background concentration of 6.86 mg/kg, the level of arsenic at the site is within the range of background levels. Excluding the contribution from background has little effect on the risk estimate; the carcinogenic risk estimate decreases to $8x10^{-6}$. Under CTE, the carcinogenic risk estimate excluding background decreases to $4x10^{-7}$. B[a]P equivalent concentration and 2,3,7,8-TCDD TEQ remain the risk drivers.

Noncarcinogenic hazards were previously reported as a HI of 0.1 in both surface soil and subsurface soil intervals. Included in this estimate are risks from metals that are present at background levels. Excluding the contribution from background, the noncarcinogenic HI decreases below 0.01 for both soil intervals.

8.6.4.7 Site-Specific Risk-Based Evaluation Summary

Table 8-33 summarizes the results of the site-specific risk assessment. Included are the risk estimates for residential and industrial uses of the site that were detailed in the RBS.

The evaluation of six site-specific surface soil scenarios (including the default residential and industrial scenarios) resulted in ILCRs under the RME scenario that ranged from $2x10^{-6}$ to $4x10^{-5}$. The excess cancer risk estimate of $4x10^{-5}$ for the residential surface soil scenario, which includes the contribution from arsenic, is within the EPA established risk management range of 10^{-6} to 10^{-4}. Surface soil ILCRs for the construction worker, visitor, recreational user, and agricultural worker scenarios, excluding the background arsenic contribution, are $2x10^{-6}$, $2x10^{-6}$, $4x10^{-6}$, and $2x10^{-5}$, respectively. Only the residential site-specific scenario evaluation resulted in a noncancer hazard equal to the target noncancer hazard of 1; HIs for all other scenarios are less than 1.

The site-specific excess cancer risk estimates for subsurface soil under the RME scenario range from $3x10^{-6}$ to $4x10^{-5}$. The residential subsurface soil scenario including the contribution from arsenic results in an excess cancer risk estimate of $4x10^{-5}$, which is within the risk management range of 10^{-6} to 10^{-4}. When background levels of arsenic are excluded, the excess cancer risk decreases to $3x10^{-5}$, which is within the risk management range of 10^{-6} to 10^{-4}. Subsurface soil ILCRs for the construction worker and agricultural worker scenarios, excluding the background arsenic contribution, are $3x10^{-6}$ and $2x10^{-5}$, respectively. The residential scenario evaluation (detailed in the RBS) resulted in a noncancer hazard equal to the target noncancer hazard of 1; all other scenarios are less than 1.

Risks are also presented using California-EPA toxicity values (Table 8-34). The evaluation of surface soil exposure under the RME scenario resulted in cumulative lifetime cancer risks (or

ILCRs) of $5x10^{-6}$ for the escorted visitor, $8x10^{-6}$ for the construction worker, $5x10^{-5}$ for the agricultural worker, and $1x10^{-5}$ for the recreational user. The estimated ILCRs from subsurface soil exposure increases slightly for both the construction/utility worker (ILCR = $9x10^{-6}$) and the agricultural worker (ILCR = $6x10^{-5}$). Risk estimates that utilize California-modified toxicity values are approximately 2½ times higher than when estimated using EPA Region 9 PRGs. The main reason for this increase is that California assigns a higher (i.e., more toxic) slope factor for arsenic. Without the contribution of background metals, the ILCRs decrease approximately 50 percent to 70 percent because arsenic is present at background levels and is not included in the cancer risk estimates.

8.7 UNCERTAINTY ANALYSIS

By design, this risk assessment has been developed to be protective, rather than accurately predictive. As a result, the risk assessment is believed to represent a substantial overestimation of cancer risk and noncancer hazard. This section presents a discussion of some of the uncertainties inherent in the risk assessment with focus on key factors believed to influence the risk assessment process and application to risk management activities. Uncertainties involved in each major step of the risk assessment process (i.e., exposure assessment, toxicity assessment, and risk characterization) are discussed separately below.

8.7.1 Uncertainties in Data Assessment

Nondetect concentrations with value of greater than 2 x maximum detected concentration: Calculation of the 95 percent UCL does not include non-detect results with quantitation limits two times the maximum detected concentration. Such results are excluded from the database. This practice is based on the discussion of unusually high sample quantitation limits in Section 5.3.2 of RAGS Part A (EPA 1989a). This situation (sample quantitation limits [SQLs] exceeding twice the highest detect) occurs when either the maximum detected concentration is closer to the method detection limit than the SQL, or the detection of another chemical interfered with the quantitation of the chemical in question. Over 500 sample results from surface soil, subsurface soil and groundwater were removed. If the chemical is truly present at the reporting limit, the risks could be under-estimated. If the chemical is truly not present, the result of removing the sample result probably has little effect in the final risk estimates.

For infrequently detected chemicals, maximum detected concentrations were used as the EPCs. The removal of non-detected results has no effect on final estimates since the EPCs continue to be based on the maximum detected concentrations. However, if the chemical is truly present at the reporting limit, the risks could be under-estimated because the maximum detected concentration is not truly the highest concentration in the data set. For chemicals with greater than 11 detections, UCLs of the mean were calculated; if a chemical is truly present at the reporting limit, the exclusion of non-detected results could under-estimate the resulting UCL.

Chemicals with Minimum Reporting Limits above the Screening Criteria: When a chemical was both detected and not detected in a sample medium, a proxy concentration of one-half the reporting limit was assigned when calculating exposure point concentrations (such as the 95 percent UCL). If an analyte was not detected in the sample medium, then it was not included as a COPC in the risk assessment. Several chemicals were not detected in surface soil or groundwater media with all of their reporting limits greater than the screening criteria. Because these chemicals were not detected and therefore not evaluated as a COPC, potential risks/hazards would be underestimated if any of these chemicals is truly present at the reporting limit. These chemicals are listed in Section 8.2.2.

For the surface soil, only hexachlorobenzene had a range of reporting limits that were greater than the screening criterion for 100 percent of the samples. Because the range of reporting limits is at most four times the screening criterion or $1x01^{-6}$, the cancer risk estimate could potentially be underestimated by 4 $x10^{-6}$. This additional risk from hexachlorobenzene, if truly present at the reporting limit, could at most represent only a 15 percent increase over the existing risk estimate.

For groundwater, the following non-detect chemicals had reporting limits that exceeded the screening criterion for that chemical. Most non-detect chemicals listed below had ranges of reporting limits that were greater than the screening criterion for all samples.

- 1,1,1,2-tetrachloroethane
- 1,1,2,2-tetrachloroethane
- 1,1,2-trichloroethane
- 1,2,3-trichloropropane
- 1,2,4-trichlorobenzene
- 1,2-dichloroethane
- 1,2-dichloropropane
- 1,4-dichlorobenzene
- 2,4,6-trichlorophenol
- 3,3'-dichlorobenzidine
- 3-nitroaniline
- 4-nitroaniline
- 4,6-dinitro-2-methylphenol
- benzene
- bis(2-chloroethyl)ether
- bromodichloromethane
- Carbazole
- carbon tetrachloride
- Chloroethane
- cis-1,3-dichloropropene
- trans-1,3-dichloropropene
- Dibromochloromethane
- Hexachlorobenzene
- Hexachlorobutadiene
- Hexachloroethane
- Nitrobenzene
- n-nitrosodo-n-propylamine
- Pentachlorophenol
- Perchlorate
- tetrachloroethene
- trichloroethene
- vinyl chloride

8.7.2 Uncertainties in Exposure Assessment

Uncertainty in the exposure assessment is a function of several factors. Such factors include but are not limited to; the completeness/representativeness of the site data, identification of COPCs, assumptions regarding actual current and/or future site land use, identification of relevant receptor groups and activities, and even the extent to which certain chemicals are physiologically retained and transferred to target organs of the selected receptors.

Judgmental Sampling: For this site investigation, the data that have been collected are believed to be reasonably representative of current site conditions. Several samples have been collected in a judgmental (i.e., biased) fashion over a period of three years at different depths in order to characterize the extent of contamination. The biased sampling procedures are likely to overestimate exposure and associated risk. COPCs have been selected based on prior knowledge of the site (i.e., use for construction debris disposal) and an understanding of conditions that are likely to influence chemical fate and transport.

Land Use Considerations: For this evaluation, assumptions have been made to both ensure conservatism and attempt to realistically characterize current and future site use. Conservativeness is embodied in the RBS that compares EPCs to residential land use. This assumption overestimates risk but provides useful information to facilitate reasonable land use considerations. The RBS evaluated alternate receptor scenarios. This evaluation is more likely to identify reasonably realistic risk given assumptions of receptor activities. Overall, therefore, selection and evaluation of the land uses in the risk assessment will tend, in general, to overestimate risks.

Receptor Selection and Exposure Factors: Receptor groups have been selected to be consistent with generic and site-specific land uses. Therefore, the risk assessment has assumed that relevant receptor groups consist of residential and industrial receptors. All of the exposure factors that are used to characterize chemical intake are conservatively developed to ensure that, if anything, the risk is overestimated. Alternatively, the risk assessment has assumed that construction/utility workers, recreational users, visitors, and agricultural workers are relevant to a characterization of site-specific risks. Thus, these receptor groups have been evaluated with exposure factors that are somewhat less conservative but more realistic than the RBS. For instance, despite the fact that current construction work activities result in reduced exposures (i.e., direct contact is minimized with the use of machinery), risk to the receptor has been evaluated using many exposure factors that are recommended as default factors by the EPA to ensure protectiveness in the risk assessment. Because many of the exposure factors used in the evaluation have been developed to ensure protectiveness, the tendency for risk to be overestimated is unlikely.

Exposure Point Concentrations: The EPC seeks to quantify with confidence the "average" exposure condition. The inherent variability of sample collection, sample analysis, and environmental distributions can complicate the determination of an EPC representing that average exposure. EPA guidance allows the use of the "lesser" of the maximum detected concentration and the 95 percent UCL. When samples are collected defining a data set and when the variability among the observations is great, the 95 percent UCL will likely be greater than the maximum concentration. Defaulting to the lesser of the two concentrations helps to minimize the overestimation of risk, but does not eliminate the potential to overestimate the risk based on the "average" exposure condition. The EPC could, in fact, yield an over- or underestimate of risk depending on the truly underlying distribution of the data/chemical concentrations.

Chemicals with Minimum Reporting Limits Above the Screening Criteria. When a chemical was both detected and not detected in a sample medium, a proxy concentration of one-half the reporting limit was assigned when calculating EPCs (such as the 95 percent UCL). If an analyte was not detected in the sample medium, then it was not included as a COPC in the risk assessment. Except for hexachlorobenzene in surface soil (where 100 percent of the reporting limits exceeded the screening criterion), the percentage of reporting limits for non-detected chemicals in soil was quite low (i.e., generally 2 to 20 percent with that for 3,3'-dichlorobenzidine at approximately 41 percent). Thus, the likelihood of these non-detected chemicals to be present at levels exceeding respective screening criteria (and therefore potentially affecting risk estimates to a significant degree) is considered low. Hexachlorobenzene was detected in subsurface soil and was therefore evaluated as a COPC for that soil interval. Numerous nondetected chemicals in groundwater had all of their reporting limits greater than screening criteria. Because these chemicals were not detected and therefore not evaluated as a COPC, potential risks/hazards would be underestimated if any of these chemicals is truly present at the reporting limit.

Uncertainty Associated with Secondary Pathways Not Evaluated. Secondary pathways such as ingestion of homegrown produce were not evaluated in this assessment. Because secondary

pathways are not quantitatively evaluated and because some of the chemicals detected have the potential to bioaccumulate in plants, potential risks could be underestimated. The inorganic chemicals detected in the soil medium were compared to published bioconcentration factors for soil to plant transfer (BCFp) (Bechtel Jacobs Company 1998). No inorganic chemical detected in the soil medium at AA 3 had a BCFp greater than 1, therefore, bioaccumulation of these inorganic chemicals in plants (i.e., foodstuffs) is unlikely. Any organic chemical with a log octanol-water partitioning coefficient (Kow) of greater than 3 is conventionally assumed to have the potential to bioaccumulate in the foodchain (Garten and Trabalka 1983; Thomann 1995). The chemicals in the 0-foot to 10 feet bgs depth interval for soil with a log Kow of greater than 3 are:

- bis(2-ethylhexyl)phthalate
- fluoranthene
- 2,3,7,8-TCDD
- hexachlorobenzene
- pyrene

Several chemicals detected in groundwater have a log Kow of greater than 3:

- bis(2-ethylhexyl)phthalate
- butyl benzyl phthalate
- acenaphthene
- anthracene
- benz(a)anthracene
- benzo(a)pyrene
- benzo[b]fluoranthene
- benzo(g,h,i)perylene
- chrysene
- dibenz[a,h]anthracene
- fluoranthene
- fluorene
- indeno(1,2,3-cd)pyrene
- naphthalene
- phenanthrene
- pyrene

All of these chemicals were infrequently detected such that the likelihood of foodstuffs being watered with groundwater contaminated with these chemicals is low.

Use of Default Particulate Emission Factors. While it is true that activity-specific PEFs may be developed to characterize risk during site-specific activities, the extent to which any activity dominates an exposure scenario is limited by the frequency of occurrence relative to other exposure routes (i.e., oral, dermal). In this assessment, the default PEF was used and the result on the risk estimate could be an over- or underestimate based on the actual PEF value that would result from any site-specific activities.

With the possible exception of the construction worker, it is not reasonably anticipated that the receptor would be exposed to particulates via inhalation over that which is assumed based on the default PEF. The degree to which risks are potentially underestimated is slight since soil ingestion and dermal contact lead to most of the chemical intake for the construction worker.

In summary, based on the assessment of sampling, land use, receptor selection, and associated activities and exposure factors, the exposure assessment is believed to overestimate the risk.

Uncertainty in Indoor Air Evaluation. Evaluation of the soil gas migration-indoor air pathway suggests little potential for cancer risk and noncancer hazard estimates to exceed 10^{-6} and 1, respectively. The use of the J&E Model to estimate chemical concentrations from subsurface soil or groundwater to indoor air includes uncertainty in several areas:

1. The model assumes homogeneity of soil within a horizon. Therefore, selected site-specific values for various soil parameters may fail to provide an accurate measure of the soil variability.
2. The model evaluates building characteristics that, while remaining mostly constant, makes assumptions about the design of a building (e.g., height of the room, air-exchange rate) that is not yet planned for the site.
3. The model cannot assess the likelihood that a building will be constructed at all on the site, or the likelihood that it will be constructed atop or near the area of contamination.

In 2005, an assessment was conducted on the uncertainty of the J&E Model on vapor intrusion calculations (Weaver 2005). The study identified a range for all soil and building parameters used in the J&E Model, and systematically evaluated how the sensitivity of each variable magnitude affects the resulting risk (instead of indoor air concentration as used for AA 3) as compared to the results using the defaults. One finding is that the air exchange rate in the building is the most sensitive factor, with the low-high values of 0.1 to 1.5 exchanges per hour changing the risk from the default situation by -83 percent to 150 percent. The next four most sensitive factors are water-filled porosity (-54 percent to 65 percent), mixing height of the air space in the building (-25 percent to 50 percent), depth to contaminant source (-20 percent to 35 percent) and soil porosity (-35 percent to 33 percent). When the variability of all parameters are considered simultaneously (9 parameters evaluated in all), the overall risk deviated from that of the default situation by -98 percent to 1,258 percent. Interactions among parameters such as multipliers or divisors of each other produce a synergistic effect that is not explained by the variability if individual parameters are used alone. Risks using the default settings may overestimate risk (or, as is used at AA 3, indoor air concentration) by a factor of 2, or may underestimate the potential risk by a factor of 13.

A site-specific quantitative evaluation of the uncertainty of the J&E Model at AA 3 is likely to provide a similar result, with the exception that the air-exchange rate used for a residential setting (0.5 per hour) and the industrial setting (1.0 per hour) are greater than the default value of 0.25 per hour in the Model. For the residential setting, an air exchange rate of 0.5 per hour is approximately the 25th percentile of rates measured in California residences (Cal-EPA 2004c). This value was used in the site-specific calculation of hexachlorobenzene (risk driver) concentration of 0.0147 $\mu g/m^3$ in indoor air. Substituting other values for the air exchange rate such as the lowest value evaluated above (0.1 per hour), the 10th percentile of rates in California residences (0.31 per hour) or 90th percentile (1.95 per hour) suggests that indoor hexachlorobenzene concentrations may be potentially overestimated by a factor of 2 to 5 or underestimated by a factor of 4. For the industrial setting, air exchange rate is not likely to be lower than 1.0 per hour because it is the minimum ventilation requirement pursuant to the 2001 Energy Efficiency Standards for Nonresidential Buildings (California Energy Commission 2001, as reported by Cal-EPA 2004). Indoor hexachlorobenzene concentrations for the industrial setting could be underestimated by a factor of approximately 2.

The evaluation for risks associated with direct soil exposure (including ingestion, dermal contact, and inhalation of particulates and vapors in ambient air) utilizes the (95 percent to 99 percent) UCL of the mean soil concentration (or MDC, whichever is lower) and assumes that exposure could occur anywhere within the site where soil is accessible at the EPC. The same cannot be said of indoor air. Because the location of a residence is stationary, the risk for potential future residents from exposure to vapors in indoor air at the MDC can only be realized if a future residential home is built on an area that is impacted by the VOC in soil at the maximum detected concentration. Thus, the use of MDCs as EPCs for the indoor air scenario presents a "low probability exposure scenario" that, while possible, is not likely to occur. Hexachlorobenzene was detected in only one of nine subsurface soil samples further supporting this "low-probability exposure scenario" concept.

While the use of the J&E Model at AA 3 may either overestimate risks from the inhalation of indoor VOCs by a factor of 2 to 5 or underestimate the risk by a factor of 13, its application assumes a building atop or near the location of the single hexachlorobenzene detection. Thus, a larger overestimation of risks lies in the low likelihood or probability of that occurrence.

8.7.3 Uncertainties in Toxicity Assessment

Toxicity assessment involves the selection of noncancer toxicity indices (i.e., RfDs) and cancer slope factors.

Reference Doses: RfDs are developed using animal data that must be applied to human receptors for the risk assessment. The process typically involves application of several uncertainty factors and modifying factors to animal test data that lower the RfD, given extrapolation from animal tests to human health risk assessment. For instance, uncertainty factors of 10 are often applied to animal data to reduce a threshold dose ten-fold to arrive at the RfD. This application of the UFs is likely to overestimate non-carcinogenic toxicity as noted by Dourson et. al. (1997).

Cancer Slope Factors: CSFs developed by the EPA are conservative and represent the upper bound limit (i.e., 95 percent UCL) on the probability of a cancer response occurring. Thus, the actual carcinogenic risk due to exposure to selected chemicals is likely to be lower than the actual risk experienced by the receptor. One other source of uncertainty in the toxicity assessment lies in extrapolating experimental carcinogenic observations at high doses to the low doses experienced by the human population of interest. Because there is no empirical way to detect risks below the 5 percent to 10 percent range, assumptions must be made about the shape of the dose-response curve in the low dose region (Rodricks 1992). Because the standard default is to assume that all carcinogens have a linear no-threshold dose-response curve, the cancer potency for carcinogenic COPCs (i.e., arsenic and B[a]P) is likely overestimated.

Surrogate Toxicity Data: When a chemical does not have a toxicity factor, the available toxicity factor for a similar chemical may be used. The use of surrogate toxicity data (i.e., toxicity data used in lieu of COPC toxicity information) introduces uncertainty to the toxicity assessment. In many cases, toxicity values obtained under one route of exposure (i.e., oral) are used to represent toxicity values for another exposure route. When this is done, an effort is made to conservatively assume that the toxicity value is at least as conservative as that of the surrogate. There are biological data supporting the theory that toxic responses in animals are similar to those in humans. However, the variability in responses to contaminant exposure can be largely due to species differences in pharmacokinetic mechanisms such as absorption, distribution, metabolism, and excretion (Rodricks 1992). The use, therefore, of surrogate toxicity data on the part of EPA for development of toxicity data will typically likely overestimate risk.

Chemicals with Non-IRIS Toxicity Values. Pursuant to the EPA OSWER Directive 9285.7-53 (EPA 2003e), the current hierarchy for human toxicity values is:

- Tier 1 – EPA's IRIS
- Tier 2 – EPA's PPRTVs
- Tier 3 – Other Toxicity Values including Cal-EPA Toxicity Values

The primary source of toxicity information is EPA IRIS. When a toxicity value is not available in IRIS, other sources of toxicity information can be considered in accordance with EPA Guidance (EPA 2003c); these additional sources are often considered "provisional." In this assessment, the Region 9 PRGs for several chemicals were based on provisional toxicity values to derive site-specific PRGs. The chemicals with provisional RfDs (for noncancer risk) include:

- aluminum
- chloroform
- copper
- iron
- methylisobutyl ketone
- trichloroethylene
- barium
- cobalt
- cis-1,2-dichloroethene
- methylene chloride
- n-nitrosodiphenylamine
- vanadium

The chemicals with provisional CSFs (cancer risk) include:

- cobalt
- methyl tert butyl ether
- trichloroethylene

Because the provisional toxicity values are not final IRIS values, the overall effect on the risk estimates in this risk assessment, could be over- or underestimates. Including these chemicals with provisional values in this assessment, would overestimate the risks based on current Navy policy.

Chemicals with Updated or Revised Toxicity Values (California) – Naphthalene: In this assessment, naphthalene was evaluated as a non-carcinogenic chemical. Recently, California has listed naphthalene as a carcinogen. Estimates of cancer risk in this assessment are potentially underestimated without the evaluation of naphthalene as a carcinogen.

Chemicals with Updated or Revised Toxicity Values (California). Several chemicals evaluated in this assessment have been assigned different toxicity values by the State of California. Chemicals include arsenic, beryllium, lead, manganese, mercury, nickel, selenium, benzene, methylene chloride, bis(2-ethylhexyl)phthalate, hexachlorobenzene, phenol, benzo[a]pyrene and 2,3,7,8-TCDD. Toxicity values for these chemicals are considered Tier 3 values under the EPA hierarchy (EPA 2003a) but are peer reviewed and as such, the State of California does not consider theses toxicity values as provisional. EPA Region 9 provides PRGs for some of these chemicals but assigns them as "California (or Cal-) modified" (EPA Region 9 2004a). The substitution of these California-approved toxicity values increased final risk estimates primarily due to arsenic.

<u>Arsenic.</u> Slope factors listed in IRIS for arsenic are 1.5 $(mg/kg/day)^{-1}$ and 15 $(mg/kg/day)^{-1}$ for oral and inhalation exposure routes, respectively. However, the slope factors developed by California

(Cal-EPA 2004a) differ from those endorsed by the EPA with values of 9.5 $(mg/kg/day)^{-1}$ and 12 $(mg/kg/day)^{-1}$ for oral and inhalation exposure routes, respectively, suggesting that Cal-EPA cancer estimates are approximately 10 times greater than those of the EPA.

Different approaches used to establish the CSFs for the EPA and Cal-EPA explain the principal differences in the derivation of the associated slope factors. For instance, the EPA data set depends in large part on a single well documented and studied sample population located in Taiwan (Tseng 1984). This approach, though limited to the evaluation of skin cancer, provides the benefit of relatively controlled evaluations within a well studied population. Alternatively, Cal-EPA, in an attempt to evaluate the potential for internal cancers due to arsenic exposures re-assessed not only the Tseng data sets, but also several other data sets associated with potential exposure to various groups of potentially exposed individuals in a broader compliment of geographical locations and exposure scenarios. While the assessment of these many groups is likely to provide sufficient protection via the development of the associated slope factor, the pooling of various populations and cancer types likely results in a higher variation of tumor incidences or cancer responses that may lead to a higher slope factor, suggesting that the Cal-EPA slope factor is overly protective.

In addition, the inclusion of many data sets that demonstrate different internal cancers suggests that the evaluation may have included differential carcinogenic modes of action in the same numerical analyses. It is uncertain as to whether this would result in an overestimate of the slope factor but it is clear that isolation of a causal relationship between cancer incidence and exposures are confounded.

Chemicals Without Toxicity Values: The RBS compares COPCs to EPA Region 9 PRGs and quantitates risk/hazard. The EPA develops PRGs based on cancer risk and/or noncancer hazard toxicity values (i.e., cancer slope factors and/or RfDs). Most of the chemicals that have been detected and are noted as COPCs have such toxicity values. However, some detected chemicals do not have PRGs. Exclusive of essential nutrients, chemicals from the current soil data that do not have EPA Region 9 PRGs due to lack of toxicity values are listed below:

- benzo(g,h,i)perylene
- phenanthrene
- PHC as diesel fuel
- PHC as gasoline
- PHC as motor oil

2-Methylnaphthalene does not have a Region 9 soil PRG but it does have non-cancer RfD in the EPA's IRIS, which was used to derive receptor-specific PRGs in this evaluation.

Chemicals detected in groundwater that do not have EPA Region 9 PRGs due to a lack of toxicity values are:

- PHC as diesel fuel
- PHC as motor oil
- bis(2-chloroethoxy)methane
- phenanthrene
- PHC as gasoline
- benzo(g,h,i)perylene
- butyl benzyl phthalate

Nitrate does not have a Region 9 tap water PRG but it does have a risk based level in the EPA's IRIS which was used in this evaluation. It should be noted that the IRIS level is not calculated in the same manner as other tap water PRGs in that it is based on exposure to an infant whereas EPA Region 9 noncarcinogenic tap water PRGs are based on exposure as an adult.

While the lack of toxicity values for the above COPCs imparts additional uncertainty into the SRA, overall the degree of uncertainty affecting the risk assessment results for AA 3 is expected to be minimal.

Uncertainty Associated with the Use of the Toxicity Equivalency Approach for Dioxins: The cancer risk from TCDD TEQs is estimated by summing the individual cancer estimates for each dioxin and dibenzofuran congener. The risk calculations for all congeners (with the exception of TCDD) are determined using estimated cancer slope factors based on the assumption of toxicity equivalence to 2,3,7,8 TCDD. While the approach is an estimation procedure that depends on assumed toxicity of dioxin like chemicals, it is generally understood that when the actual toxicity data is absent for each dioxin congener, it is a potentially better methodology to estimate cancer risk in potentially exposed populations. Nonetheless, despite its general acceptance in the scientific community, the methodology does assume additivity of like cancer effects derived from chemicals of similar structures. Thus, based on its use in the risk assessment, cancer risks associated with potential exposure to dioxins, as presented by the TEQ approach, may be somewhat overestimated.

Uncertainty Associated with the Use of the Toxicity Equivalency Approach for Carcinogenic PAHs: The cancer risk from B[a]P equivalent concentration is estimated by summing the individual cancer estimates for each carcinogenic PAH. The risk calculations for additional carcinogenic PAHs use estimated cancer slope factors based on the assumption of toxicity equivalence to B[a]P. While the approach is an estimation procedure that depends on assumed toxicity of these additional carcinogenic PAHs, the absence of actual toxicity data for each chemical requires the use of this methodology to estimate cancer risk in potentially exposed populations. Nonetheless, despite its general acceptance in the scientific community, the methodology does assume additivity of like cancer effects derived from chemicals of similar structures. Thus based on its use in the risk assessment, cancer risks associated with potential exposure to carcinogenic PAHs, as presented by the B[a]P equivalency method, may be somewhat overestimated.

8.7.4 Uncertainties in Estimation of Site-Related Risk

EPA guidance indicates that carcinogenic risks and HQs resulting from various multiple chemicals should be considered additive (EPA 1989a). In the absence of supporting data for synergy or antagonism, the assumption of additivity could overestimate or underestimate potential cancer risk or HQs for receptors.

Definition of Site-Related Metals. A site-related release of a metal was identified when the maximum detected concentration exceeded the background level. The finding of a single sample result from background areas that slightly exceeds the reported background level (e.g., arsenic) may happen by chance, especially with an increasing number of samples (Gibbons 1991).

As noted in the preceding text, arsenic is a predominant COPC that has been included in its entirety in the estimation of risk associated with site-related activities. Arsenic is also a common naturally occurring element found in soil similar to that of the site. The arsenic concentrations detected are consistent with background concentrations at El Toro. Additionally, the maximum detected concentrations and EPCs of arsenic in surface soil and subsurface soil are below the Station-wide average. Therefore, the inclusion of the contribution of naturally occurring arsenic tends to overestimate risk to both default and site-specific receptors.

Uncertainty Associated with the Exclusion of Chemicals Screened Out During Tier1A: The evaluation of residential and industrial receptors in the Tier 1A includes all chemicals. However, the screening process of Tier 1A eliminated chemicals that were below residential criteria that are based

on a cancer risk of 1E-06 or a non-cancer target hazard index of 1. Although the summed risk from these chemicals may exceed the target cancer and noncancer levels, residential cancer risk estimate for AA3 is 3E-05 to 4E-05 such that the exclusion of these screened chemicals in the SSRBE has little effect on cancer risk estimates. To verify this claim, the residential cancer risk associated with these screened out chemicals in surface soil was determined to be approximately 7E-09 (using either USEPA or Cal-modified toxicity values). This risk value is 5 orders of magnitude lower than the risk associated with chemicals that did not screen out (i.e., chemicals carried through to the SSRBE). For subsurface soils, the residential cancer risk is also 3E-05 to 4E-05. The cancer risk estimate for screened out chemicals is approximately 6E-07, approximately 2 orders of magnitude lower. This same relationship between risks from screened out chemicals to all chemicals is expected to be similar for other receptors. Thus, for carcinogens, the exclusion of chemicals in the Tier 1B SSRBE has little effect on the final cancer risk estimates for site-specific receptors.

For non-cancer hazards excluding background metals, the residential (child) HIs are approximately 0.7 for both surface soil and subsurface soil. The residential HI for chemicals which were screened out also is approximately 0.7 such that non-cancer hazard estimates for other receptors in the SSRBE may be underestimated by as much as 100 percent. However, given that the non-cancer HIs for construction workers, agricultural workers and recreational users are 0.04 or lower, the potential underestimation of non-cancer hazards by 100 percent in this instance bear no significant effect; the inclusion of screened out chemicals in the non-cancer HIs would remain below the target HI of 1.

Further verification that the exclusion of screened out chemicals in the SRBE had little to no impact can be inferred from residential noncancer hazard estimates using maximum detected concentrations. Using these maximum concentrations, the residential HI of 2 for both surface and subsurface are approximately 50 percent greater than when using EPCs. Thus, HI estimates for construction workers, agricultural workers and recreational users that are approximately an order of magnitude lower or more than those for the resident would not increase to above 1 if chemicals screened out during Tier 1A were included.

8.8 CONCLUSIONS

The Tier 1A RBS results for the residential and the industrial receptor are within the 10^{-4} and 10^{-6} range for cancer and noncancer results did not exceed 1.

The results of the site-specific risk assessments, including the removal of chemicals determined to be within background levels, are listed below:

- The surface soils (0-foot to 1-foot bgs) health risk for a residential reuse scenario is estimated to be $4x10^{-5}$. Most of the risk is from B[a]P equivalent concentration (68 percent) with less contribution from arsenic (23 percent) and 2,3,7,8-TCDD TEQ (9 percent). Arsenic is present at background levels. The removal of the arsenic contribution decreases the excess cancer risk to $3x10^{-5}$, as B[a]P equivalent concentration and 2,3,7,8-TCDD TEQ remain primary contributors.
- The subsurface soils (0-foot to 10 feet bgs) residential scenario health risk is estimated at $4x10^{-5}$. As with surface soil, most of the risk is from subsurface soil is due to B[a]P equivalent concentration (66 percent) with less contribution from arsenic (23 percent) and 2,3,7,8-TCDD TEQ (9 percent). When arsenic is excluded because it is present at background levels, the excess cancer risk decreases to $3x10^{-5}$.
- The evaluation of volatile chemicals in subsurface soil that may migrate into future buildings resulted in ILCRs for future on-site residents (ILCR = $4x10^{-6}$) that were within the risk management range of 10^{-6} to 10^{-4}. For future on-site industrial workers, excess cancer risks were

less than $1x10^{-6}$. Noncancer HIs were less than 1. The evaluation of volatile chemicals in groundwater that may migrate into future buildings resulted in ILCRs for the resident and industrial worker were less than $1x10^{-6}$. As with soil, noncancer HIs were less than 1. Much of the risk estimates from subsurface soil are due to hexachlorobenzene, while those from groundwater are due to chloroform. Hexachlorobenzene was detected in 1 or 9 subsurface soil samples. Chloroform was detected in 2 of 111 groundwater samples.

- For human health groundwater pathway evaluation, the ILCR estimates for the RME and CTE scenarios were $3x10^{-4}$ and $5x10^{-5}$, respectively. Arsenic accounted for approximately three-fourths of the risk. Depending on the assumed exposure scenario, the HI was between 7 and 6. The primary contributors to the noncancer hazard estimate are the metals antimony, arsenic, chromium, thallium, and vanadium. The maximum detected concentration of arsenic and the EPC exceed the current MCL of 10 μg/L. Arsenic concentrations in groundwater are within the ambient concentrations reported at other groundwater wells at former MCAS El Toro.
- The risk estimates for other site-specific receptor scenarios assuming the RME scenario range from $2x10^{-6}$ (visitor–surface soil scenario) to a maximum of $2x10^{-5}$ (agriculture worker surface soil scenario). In all cases B[a]P equivalent concentration contributes to a significant portion of the risk estimate. Because B[a]P equivalent concentration is the main contributor to the cancer risk estimate, the exclusion of arsenic due to its presence at background levels does not substantially reduce the final risk estimates for these receptors very much. However, the carcinogenic PAHs that comprise the B[a]P equivalent concentration were detected in only 1 to 7 of 33 surface samples.
- None of the site-specific surface and subsurface soil scenario evaluations resulted in noncancer hazards that exceeded the target noncancer hazard of 1.

The substitution of Cal-EPA toxicity values increased risk estimates by a factor of 2½. The reason for this increase is that the State of California considers arsenic to be approximately an order of magnitude more toxic than does EPA Region 9.

Based on risk estimates and the uncertainty assessment, which indicates a predominance of overestimation, no further evaluation is necessary for AA 3.

9. SCREENING RISK ASSESSMENT - ECOLOGICAL

9.1 SRA PROCESS

The SRA assesses the risks to ecological receptors from exposure to chemicals present at AA 3, former MCAS El Toro, California. The SRA was conducted according to the screening-level guidance presented in the EPA Ecological *Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final* (EPA 1997b), CNO ERA policy memo (DON 1999), *Navy Guidance for Conducting Ecological Risk Assessments*, (NFESC, 2001), and the *Final Work Plan Removal Site Evaluation, Anomaly Area* 3 (Earth Tech 2002a) finalized in August 2002.

9.1.1 Objectives

The purpose of this section is to present the results of Tier 1, Steps 1 and 2 of the SRA conducted at AA 3 and to provide a basis for follow-on BERA steps (Tier 2, Step 3a). A draft version of the BERA is also provided in Section 9.3.

The approach of the SRA was essentially in accordance with the RSE Work Plan (Earth Tech 2002a); however, certain terminologies, sequence of screening steps and selection of representative species have been revised and/or updated in response to EPA Region 9 comments on the draft SRA (Earth Tech 2003a) conducted for this site and the ecological RBS conducted for other sites at former MCAS El Toro. The responses to both sets of Region 9 comments are presented in Appendix E2.10.

9.1.2 Navy and EPA ERA Process

A full ERA is an eight-step process. It is organized around the framework suggested by the EPA Risk Assessment Forum (EPA 1998a). The presentation of this SRA has been structured according to U.S. Navy policy (DON 1999) and it fulfills both the requirements of an EPA SRA (Figure 9-1) and a U.S. Navy Tier 1 ERA (Figure 9-2). The tiered approach is framed so that it facilitates (1) frequent interactions and concurrence among the Navy and regulatory agencies, (2) risk management decisions at each specific decision point and provides criteria for exiting from or proceeding with the assessment, (3) consistency with the EPA Superfund Guidance (EPA 1997b), and (4) consistency and integration with the Navy IRP.

The Navy Tier 1 SRA uses existing data and conservative assumptions regarding contaminant exposure in a two-step process to determine if additional ERA work is warranted for the site. The process represents a screening-level ERA and can be described in two steps (Figure 9-3). Step 1 is equivalent to Step 1 of the EPA ERA process (Figure 2-1) and includes a site description, habitat assessment, pathway identification/problem formulation, and toxicity evaluation. The goal of this step is to describe the ecological setting of the site and to determine whether complete ecological exposure pathways are present. Step 2 of the Navy Tier 1 ERA process is equivalent to Step 2 of the EPA ERA process. First, exposure is estimated based on conservative assumptions. Then, risk is estimated by comparing the media-specific EPCs to conservative, screening-level, media-specific benchmark values. At this point, a scientific management decision point (SMDP) is made to determine if the exit criteria for Tier 1, Step 2 have been met.

These criteria are as follows:

1. There is adequate information to conclude that ecological risks are negligible and therefore there is no need for additional assessment or remediation on the basis of ecological risk.
2. The information is not adequate to make a decision at this point, and the ERA process will continue to Step 3.
3. The information indicates a potential for adverse ecological effects, and a more thorough assessment is warranted.

9.1.3 Documentation

Pursuant to the Navy policy, the Tier 1 SRA will include two components: (1) documentation of all discussions, negotiations, and subsequent concurrence among the Navy and the regulators and (2) a SRA report.

For the AA 3 SRA, an initial line of communication with the regulators was established when the draft RSE Work Plan, including the proposed SRA process (in accordance with the EPA and Navy protocols) for the site was submitted to the regulators for review and comments. After their review comments were addressed, a final Work Plan was issued. The SRA that is presented in this report was conducted in accordance with the BCT-concurred Final RSE Work Plan (Earth Tech 2002a).

A *Draft Screening Ecological Risk Assessment, Removal Site Evaluation, Anomaly Area 3* (Earth Tech 2003a) was submitted to the BCT on 13 May 2003 for their review and comment. The report presented the representative species selected for the site and the exposure parameters that were used for the ecological assessment, and SRA risk estimates. A working draft of the BERA was also presented in the draft report.

The regulatory agency comments on the draft SRA were incorporated and are presented in this Draft RI document as Appendix E2.10.

9.1.4 Relevant Soil Data Set for SRA

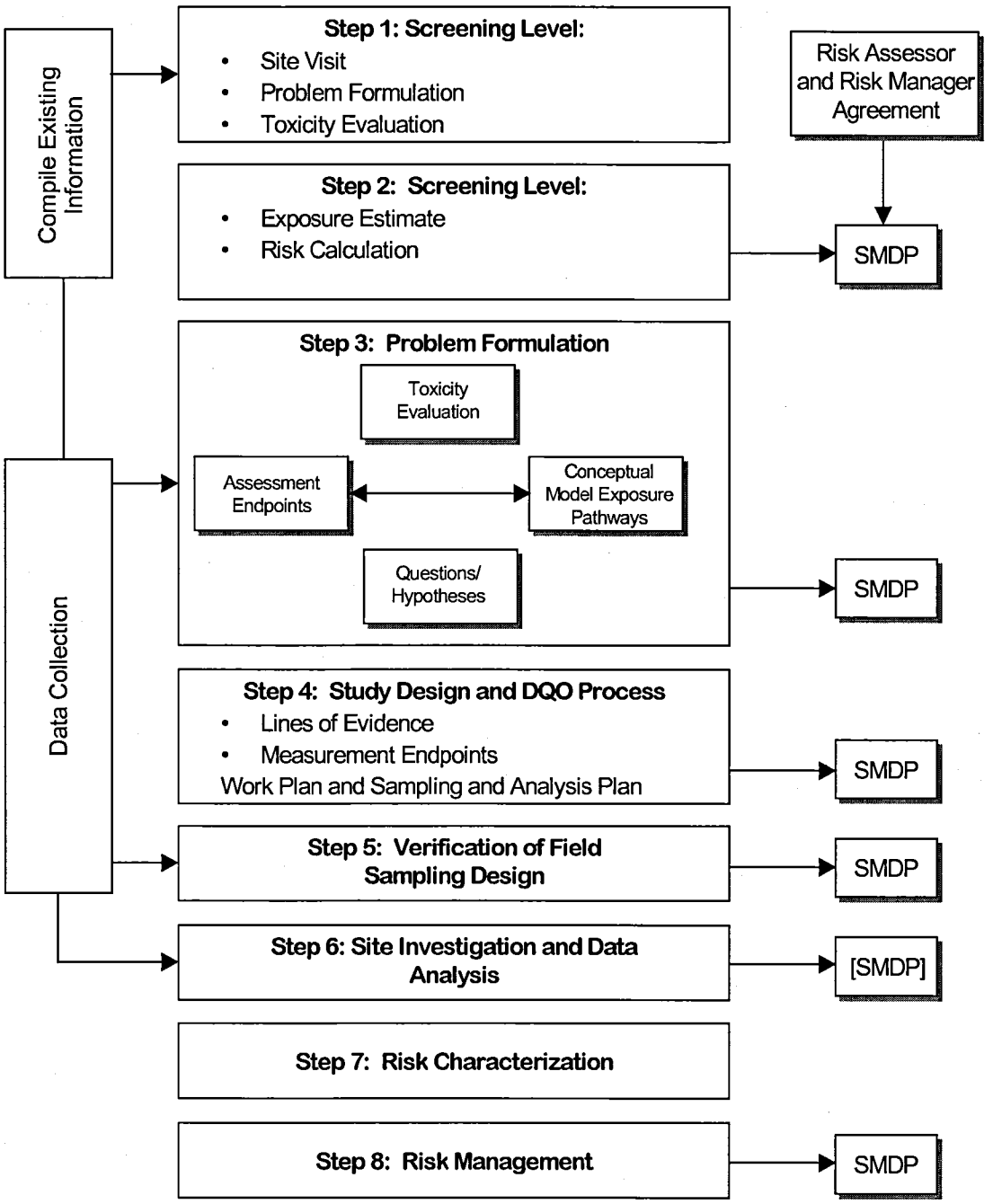
Surface soil samples (0-foot to 1-foot bgs) that were collected as part of the RSE investigation field activities and trench samples collected between 1-foot and 6 feet bgs were used to represent the exposure zone for SRA purposes. Details of the surface soil sample collection and analysis are presented in Appendix B of this report.

Twenty percent of the analytical data were selected for U.S. Navy IRP Level IV data validation; 80 percent of the analytical data were selected for U.S. Navy IRP Level C data validation (DON 1998). None of the data was assigned an "R" qualifier (data rejected); therefore, all data were useable for the risk evaluation.

9.2 SRA Process – Tier 1, Step 1 – Screening-Level Problem Formulation

Tier 1, Step 1 of this SRA is divided into several sections that help define the problem at the screening level. An abbreviated site ecological description is given in Section 9.2.1. Chemicals of potential ecological concern (COPECs), as well as assessment endpoints, measurement endpoints, representative species, exposure pathway analysis, the development of a CSM, and toxicity evaluation, are identified in Sections 9.2.2 through 9.2.7, respectively.

Figure 9-1: EPA Superfund Eight-Step Ecological Risk Assessment Process



Notes: SMDP = scientific management decision point
DQO = data quality objective

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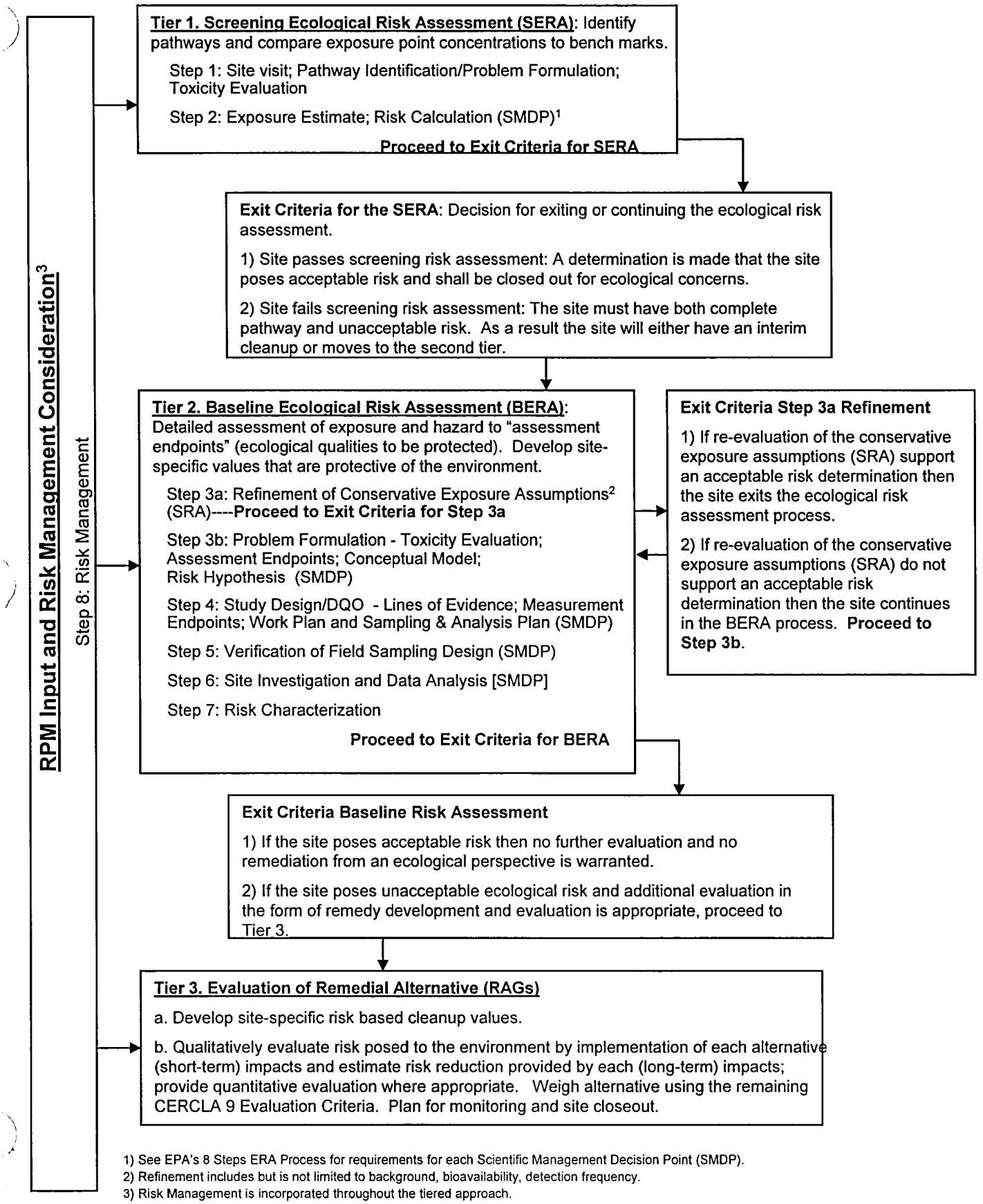
Figure 9-2: Three-Tiered Navy Approach to Ecological Risk Assessment



1) See EPA's 8 Steps ERA Process for requirements for each Scientific Management Decision Point (SMDP).
2) Refinement includes but is not limited to background, bioavailability, detection frequency.
3) Risk Management is incorporated throughout the tiered approach.

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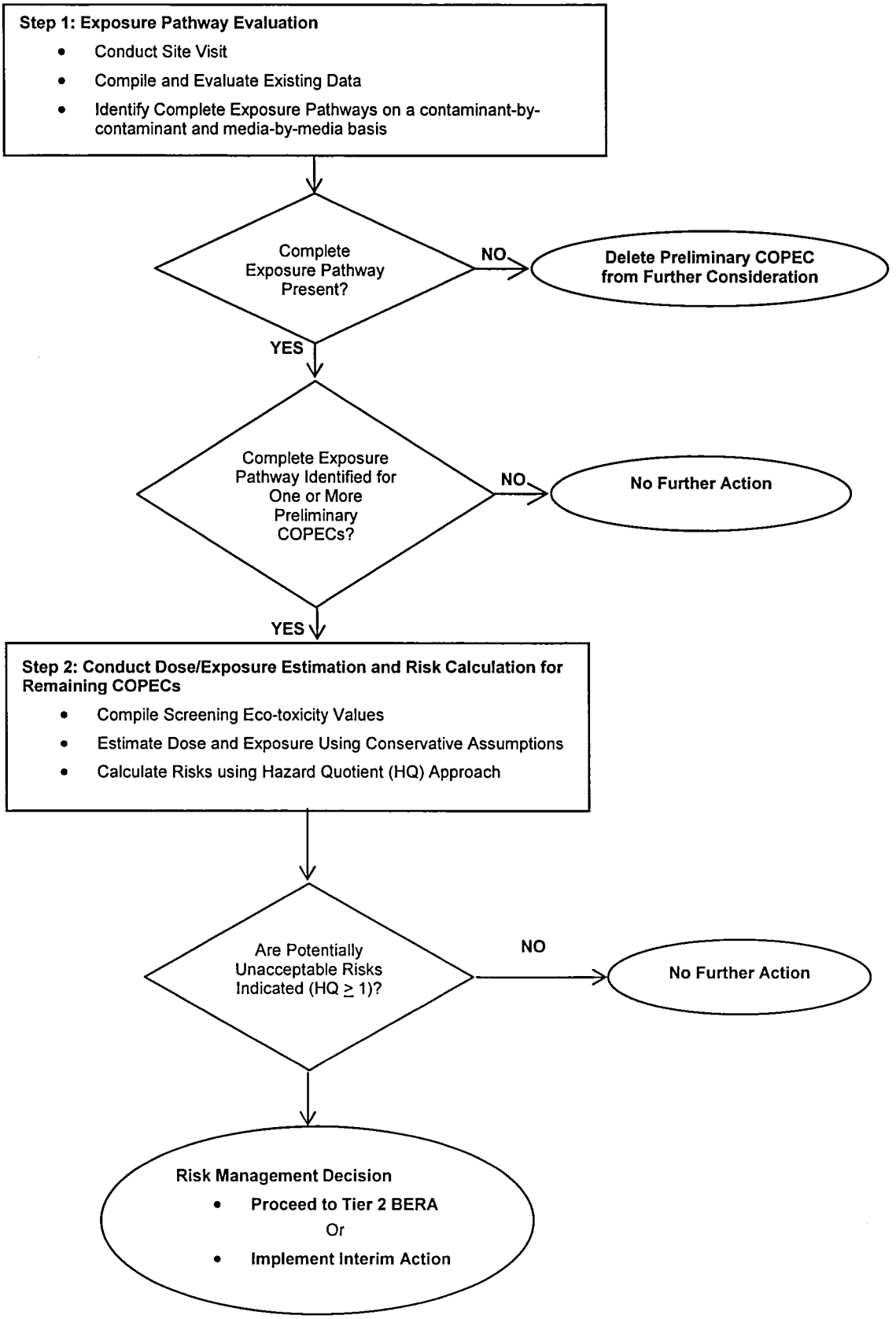

Figure 9-3: The Tier 1 Screening Risk Assessment Process

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9.2.1 Ecological Setting

Historically, AA 3 was used as a source of borrow material. Records indicate that some of the borrow pits and trenches were backfilled with construction debris and later covered with an average of 4.5 feet of fill soil (isolated areas had 2 feet of soil cover). Exploratory trenching results of the RSE investigation indicate that the site is covered with a minimum of 3 feet of fill soil.

Based on a review of historical aerial photographs and topographic maps, placement of construction debris occurred between 1972 and 1988. Interviews with former Station personnel indicate that construction debris generated during the construction of the IDW management area at IRP Site 3 were placed at AA 3.

A two-phase BSR was conducted at AA 3 (an area of approximately 9 acres, including area of debris placement [5.15 acres] and surrounding habitat) during October 2002 and June 2003 to provide biological input to the screening-level problem formulation for an ERA in accordance with the legal requirements set forth under Section 7 of the Endangered Species Act of 1973, (19 United States Code [U.S.C.] 1536(c), 50 Code of Federal Regulations [CFR] 402). A complete report of the BSR is presented in Section 5.5 of this Report and relevant excerpts in the context of using this information for the ERA purposes are presented below.

The spring/summer habitat BSR was performed at AA 3 to identify plant and wildlife species that were not identified during the mid-winter survey. Species not observed, but having potential to be on-site, are listed in Table 5-6 (plants) and Table 5-7 (wildlife). These tables list special status species known from comparable habitats within the region and summarize their natural history, agency status, and occurrence probability on-site.

Eighty-five plant species were observed, with 40 of these (47 percent) being exotic or non-native species (Table 5-6). Most of the plant species observed were typical for the southern California habitats and disturbed areas. No listed or otherwise sensitive plant species were documented on the site. Three listed plant species, which have the potential for being on-site, were not found and/or the site did not have appropriate habitat. One listed species is presumed to be extinct locally. Twenty other plant species, of lesser sensitivity have the potential to be found on-site of which, 7 were determined to be absent based on the survey and 13 have a low probability of being present, primarily because of the disturbed nature of the site.

A total of 2 reptiles, 1 amphibian, 37 avian, and 6 mammalian species were documented on the site. A complete listing of those species documented is attached (Table 5-7). Figure 5-14 presents the results of the assessment.

Most of the site (5.15 acres within AA 3) is "ruderal" vegetation (OCHCS 4.6) (Figure 5-14). Agua Chinon Wash is located along the southeast boundary of the site. It is represented on the USGS quadrangle map as a broken blue line, indicating that it is an intermittent stream. A USGS gauging station is located on the stream approximately 1,000 feet downstream from the southeast corner of the site (USGS Station Number 11048200). Gauging records show that the stream flows in response to precipitation events with long periods of no-flow during the year. Along Agua Chinon Wash outside the southeastern boundary of the landfill is a riparian habitat which supports Mulefat Scrub (OCHCS 7.3) with scattered large black willows. These willow trees are in a few patches and do not cover enough of the area to match OCHCS descriptions of Southern Willow Scrub or Southern Black Willow forest. Open patches of Mulefat Scrub extend onto the project site itself in a few areas along the southeastern boundary. The area of Mulefat Scrub within AA 3 is 0.08-acre. For purposes of the ERA for wildlife exposed to sediment, the intermittent stream channel located outside and parallel to

the southeastern boundary, measuring 800 linear feet from the outfall point (upgradient) to the bridge (downgradient), was included. This occupies an area of 72,000 square feet (0.67-hectare) and includes four sediment samples taken which represent sediment exposure at AA 3.

A form of CSS occurs on a hillside off-site to the northwest, and degraded CSS, mixed with non-native grassland, occurs on a fill slope to the east, crossing the northeastern corner of the site and extending off-site to the south and southeast. The CSS off-site to the north matches OCHCS description of Southern Cactus Scrub (OCHCS 2.4). Degraded CSS matches the mixed sage scrub grassland (OCHCS 2.8.5).

9.2.1.1 Wetlands and Waters of the U.S.

Hydrology. The field survey covered all low areas, swales, and drainage ways where water could pond or flow. One part of the site, the head cut drainage way at the southeastern boundary, potentially meets Federal criteria as waters of the U.S. and California criteria as a jurisdictional streambed (see Figure 5-14). The OHWM, indicated by sediment deposits and small banks cut by running water, are about 5 feet apart over a distance of about 70 feet, a total of 350 square feet (less than 0.01-acre) of potentially Federally jurisdictional waters of the U.S.

None of AA 3 meets all three Federal criteria as a wetland. The head cut drainage way meets the hydrology and vegetation wetland criteria. The soil criterion could not be evaluated due to the origin and texture of soils on the site. If involved in this Federal action, the CDFG, at its discretion, may consider the head cut drainage way a wetland, based on indicators of the hydrology criterion alone.

Agua Chinon Wash is located along the southeast boundary of the site. It is represented on the USGS quadrangle map as a broken blue line, indicating that it is an intermittent stream. A USGS gauging station is located on the stream approximately 1,000 feet downstream from the southeast corner of the site (USGS Station Number 11048200). Gauging records show that the stream flows in response to precipitation events with long periods of no-flow during the year.

Soil. Soil on the AA3 is fill material, and in the drainage way showing OHWMs, soil is composed of fine sand. Sandy soil generally does not show hydric indicators even where it is native on a site. Because of the sandy soil texture and because the soil is not native to the site, no attempt was made to find indicators of hydric soil.

Vegetation. Plants growing in the low-lying areas on the AA 3 surface are generally weedy native and non-native upland species, including red brome grass (*Bromus madritensis ssp. rubens*), tocalote (*Centaurea melitensis*), sweetclover (*Melilotus sp.*), and Spanish clover (*Lotus purshianus*). None of these species is ranked as FAC, FACW, or OBL; therefore, these depressions do not meet the criterion for hydrophytic vegetation. Garland daisy (*Chrysanthemum coronarium*) is overwhelmingly dominant along the swale near the northeastern boundary; this species also is not ranked as FAC, FACW, or OBL; therefore, the swale does not meet the criterion for hydrophytic vegetation.

The Agua Chinon Wash is located off-site, adjacent to the southeast boundary of the site. It is represented on the USGS quadrangle map as a broken blue line, indicating that it is an intermittent stream. A USGS gauging station is located on the stream approximately 1,000 feet downstream from the southeast corner of the site (USGS Station Number 11048200). The watershed at the gauging station is approximately 2.85 square miles). Gauging records show that the stream flows in response to precipitation events with long periods of no water during the year.

The riparian habitat located along Agua Chinon Wash, adjacent to AA3, includes areas of mulefat scrub and scattered black willows. Mulefat has a wetland indicator status of "facultative wetland" (FACW) meaning that it is usually associated with a wetland (67 percent to 99 percent probability). Black willow is an obligate wetland species and is almost always associated with wetlands. Mulefat habitat extends into a small area along the head cut drainage area at the southeast boundary of the site (Figure 5-14).

9.2.1.2 Sensitive Resources

Flora. Based on the field survey and on the habitats of listed threatened and endangered plants known from the region, it can be concluded that no listed plant species occur on the project site itself (see Table 5-8).

Habitat. CSS is considered a sensitive habitat by several resource agencies. Most of this habitat is located off-site. Only a small amount of the CSS, in the form of Mixed Sage Scrub Grassland (0.18-acre), is within the limits of AA 3 and none appears to be within the estimated extent of debris placement (Figure 5-14).

Wetland resources are also considered sensitive because of their scarcity in semi-arid southern California, their value to wildlife, and recent loss of this habitat from urbanization, agriculture, and flood control projects. The Mulefat Scrub wetland is considered sensitive wetland habitats. Mulefat Scrub is only considered sensitive where it occurs in a wetland landscape position (i.e., along drainages and not on level pads). There is a very limited area of this habitat on-site, which limits its significance.

Wetlands and Waters of the U.S. One part of the site, the head cut drainage way at the southeastern boundary, potentially meets Federal criteria as waters of the U.S., and California criteria as a jurisdictional streambed (Figure 5-14). The OHWM, indicated by sediment deposits and small banks cut by running water, are about 5 feet apart over a distance of about 70 feet, so that a total of 350 square feet (less than 0.01-acre) of potentially Federally jurisdictional waters of the U.S. is present on this site. No other part of the anomaly area, meets criteria as waters of the U.S.

Any remedial planning should include avoiding disturbance of mule fat scrub and black willow habitat (on-site or off-site) to the extent possible. Disturbance of such habitat during remediation will require a wetland permit from the Army Corps of Engineers and the State of California.

Wildlife. No listed or sensitive species were observed on the study site. One listed and one sensitive bird species and a sensitive mammal were documented adjacent to the site. These are discussed under the following species accounts and locations are depicted in Figure 5-14. A female Cooper's hawk was noted flying over an adjacent area but was not nesting on, or near, the study site. The likelihood of other listed or sensitive species being present is detailed in Table 5-9.

9.2.2 Identification of Chemicals of Potential Ecological Concern

COPECs for the SRA are selected from chemicals detected in surface soil (0-foot to 6 feet), sediment and surface water. The analytical suite was limited to assess potential surface soil estimated risk from past activities that took place on-site. The chemical groups of analytes for the SRA include metals, TPH, VOCs, SVOCs, and dioxins/furans.

Dioxin congeners were evaluated on the basis of TEQ relative to 2,3,7,8-TCDD (Van den Berg et al., 1998). The EPA has assigned TEFs relative to 2,3,7,8-TCDD for highly chlorinated dibenzo-n-

dioxins (CDDs) and highly chlorinated dibenzo-n-furans (CDFs). The maximum concentration of each detected dioxin congener and the full reporting limit of each non-detected dioxin congener was multiplied by the congener-specific TEF for birds to calculate 2,3,7,8-TCDD TEQs. The TCDD TEQs for mammals were calculated in a similar way using mammal TEF values.

9.2.2.1 SURFACE SOIL

Surface soil data used in the SRA include soil samples collected from the exposure zone (0-foot to 6 feet bgs). Petroleum hydrocarbons were detected in soil from 0-foot to 6 feet bgs; however, toxicity values do not exist to assess their potential for risk to the ecological receptors. Instead, these petroleum hydrocarbons were assessed using their toxic constituents (PAH and benzene, toluene, ethylbenzene, and total xylenes [BTEX]) that have toxicity reference values (TRVs).

Some inorganic chemicals are needed in relatively high concentrations for normal metabolism, growth, and reproduction. Most organisms regulate the levels of these physiological electrolytes in tissues. Metals that were eliminated as potential COPECs in soil, sediment, and surface water because they are essential nutrients include sodium, potassium, calcium, magnesium, and iron.

Chemicals detected in surface soil (i.e., 0-foot to 6 feet bgs), sediment, and surface water at sampling locations were considered preliminary COPECs, provided that the analytical results were determined to be usable in the data validation process. Analytes not detected in site media were eliminated as COPECs. However, an initial screen compared the maximum reporting limits in soil and sediment to Oak Ridge National Laboratory (ORNL) values for lower trophic level species in soil (i.e., 0-foot to 6 feet bgs) and sediment to assess if there were any COPECs with reporting limits above screening concentrations. Surface water maximum reporting limits were compared to California Toxics Rule Water Quality Criteria values (CalTox) (EPA 2000d) for the protection of aquatic life for this screening.

Twelve chemicals detected in surface soil, including mercury, molybdenum, selenium, thallium, 1,2,4-trichlorobenzene, 1,4-dichlorobenzene, 2,4,5-trichlorophenol, 2,4,6-trichlorophenol, 2,4-dinitrophenol, 4-nitrophenol, hexachlorocyclopentadiene, and pentachlorophenol, had at least one maximum reporting limit that was higher than the respective ecological screening values (Appendix E2.1). Molybdenum, thallium, 1,2,4-trichlorobenzene, 1,4-dichlorobenzene, 2,4,5-trichlorophenol, 2,4,6-trichlorophenol, 2,4-dinitrophenol, 4-nitrophenol, dibenzofuran, n-nitrosodiphenylamine, hexachlorocyclo-pentadiene, and pentachlorophenol were not detected in any samples and should be given further consideration beyond this SRA because at least one of the maximum reporting limit was above the screening value. All other analytes not detected in soil samples in at least one of the samples used in the SRA did not have screening criteria available for this comparison (see Appendix E2.1).

The list of soil COPECs considered in the SRA is presented in Table 9-1. Other chemicals may have been detected at depths greater than 6 feet bgs at AA 3; however, any chemical detected only at depths greater than 6 feet bgs was not included in the SRA.

Table 9-1: Maximum Concentrations of COPECs Detected in Exposure Zone Soil (0- foot to 6 feet bgs)

COPEC	Maximum Soil Concentration
VOCs (µg/kg dry weight)	
Acetone	100
Methylene chloride	9.2
PAHs (µg/kg dry weight)	

Table 9-1: Maximum Concentrations of COPECs Detected in Exposure Zone Soil (0- foot to 6 feet bgs)

COPEC	Maximum Soil Concentration
Anthracene	44
Benzo[a]anthracene	730
Benzo(a)pyrene	1,030
Benzo[b]fluoranthene	1,790
Benzo(g,h,i)perylene	440
Benzo[k]fluoranthene	510
Chrysene	870
Dibenz[a,h]anthracene	97
Fluoranthene	1,000
Indeno(1,2,3-cd)pyrene	460
Phenanthrene	290
Pyrene	960
SVOCs (µg/kg dry weight)	
Bis(2-Ethylhexyl)phthalate	70
Diethylphthalate	225
Hexachlorobenzene	150
Phenol	936
Metals (mg/kg dry weight)	
Aluminum	15,800
Antimony	2.1
Arsenic	4.63
Barium	187
Beryllium	0.31
Cadmium	1
Chromium	15.8
Cobalt	7.6
Copper	10.8
Lead	20.7
Manganese	289
Mercury	0.069
Nickel	13.7
Selenium	1.1
Silver	2
Vanadium	44.1
Zinc	57.1
Dioxins/Furans (pg/g dry weight)	
Total 2,3,7,8-TCDD TEQ (Bird)[1]	35.3
Total 2,3,7,8-TCDD TEQ (Mammal)[1]	18.5

Notes:
[1] TEQ value calculated based on TEFs for birds and mammals respectively.
µg/kg = micrograms per kilogram
COPEC = chemical of potential ecological concern
mg/kg = milligrams per kilogram
PAH = polynuclear aromatic hydrocarbon
pg/g = picograms per gram
SVOC = semivolatile organic compound
TCDD = tetrachlorodibenzodioxin
TEQ = toxicity equivalency quotient
VOC = volatile organic compound

9.2.2.2 SEDIMENT

Four sediment samples were collected from the bottom of the Agua Chinon Wash. The Wash is ephemeral and benthic organisms are not usually present. Therefore, sediment data were evaluated using both benthic and terrestrial receptor screening values to evaluate potential risk.

No organic chemicals other than TPH mixtures were detected in the Wash sediments. TPH as a mixture, lacks a sediment ecological screening value and was not assessed quantitatively. Nineteen inorganic chemicals were detected in the Wash sediments. Mercury was detected in one out of four samples and the reporting limits exceeded its screening value; therefore, mercury will be assessed in the SRA. Beryllium and thallium were not detected in sediment and did not have screening criteria available for this comparison (see Appendix E2.1). The list of sediment COPECs considered in the SRA is presented in Table 9-2.

Table 9-2: Maximum COPEC Concentrations Detected in Sediment

COPEC	Maximum Exposure Point Concentration (mg/kg dry weight)
Metals	
Aluminum	3,050
Arsenic	1.8
Barium	110
Cadmium	0.26
Chromium	4.4
Cobalt	2
Copper	2.5
Lead	1.9
Manganese	130
Mercury	0.006
Nickel	2.8
Selenium	0.17
Vanadium	13.9
Zinc	13.5

Notes:
COPEC = chemical of potential ecological concern
mg/kg = milligrams per kilogram

9.2.2.3 SURFACE WATER

Two surface water samples were collected for the SRA. Water at the site is ephemeral, so an aquatic community is usually not present in the area of AA 3. Copper was not detected in either of the two surface water samples; however, it was assessed further since the reporting limit exceeded its screening value. All other analytes not detected in surface water in at least one of the two samples did not have screening criteria available for this comparison (see Appendix E2.1).

The list of surface water COPECs considered in the SRA is presented in Table 9-3.

Table 9-3: Maximum COPEC Concentrations Detected in Surface Water

COPEC	Maximum Exposure Point Concentration (µg/L total)
Metals	
Aluminum	87,500
Arsenic	34.2
Barium	871
Beryllium	2.7
Cadmium	6.4
Chromium	83.5
Cobalt	31.5
Lead	28.2
Manganese	1,070
Nickel	78.5
Vanadium	227
Zinc	286

NOTES:
COPEC = chemical of potential ecological concern
µg/L total = micrograms per liter, unfiltered

9.2.3 Assessment Endpoints

Assessment endpoints are "explicit expressions of the actual environmental value that is to be protected" (EPA 1992b). Assessment endpoints are critical to problem formulation, because they link the risk assessment to management concerns and are central to developing the CSM (EPA 1997b).

According to EPA guidance (EPA 1997b), the assessment endpoint for any SRA is an adverse effect on an ecological receptor. Ecological receptors are defined as plant and animal populations, communities, habitats, or sensitive environments. More specifically, the assessment endpoints for the SRA included the protection and maintenance (survival, growth, and reproduction) of:

- aquatic life in surface water
- benthic organisms in sediments
- terrestrial plants
- soil invertebrates
- local herbivorous birds
- local omnivorous birds
- local carnivorous birds
- local omnivorous mammals
- local insectivorous mammals
- local carnivorous mammals

9.2.3.1 Measures of Effects

Measurement endpoints (measures of effects) corresponding to the survival and reproductive effects were identified for the representative species or their surrogates.

Surface soil screening values for lower trophic level species included ecological soil screening levels (EcoSSLs) (EPA 2003b) and ORNL plant toxicological benchmarks (Efroymson et al. 1997a) and

soil invertebrate toxicological benchmarks (Efroymson et al. 1997b). Other soil screening values (i.e., EPA Region 4) have not been approved for use in EPA Region 9.

Adverse effects of exposure to COPECs on the survival and reproduction/development of the representative bird and mammal species or their surrogates were obtained from peer-reviewed publications. Measurement endpoints were NOAELs for ingestion of each COPEC in chronic feeding studies conducted on the same representative species or a related species. This information was used to develop an exposure concentration below which adverse effects are not expected to occur (TRV). When no toxicity test data were available for a particular representative animal, surrogate animal data were used to generate the TRVs.

Measures of effects provide the actual measurements used to evaluate ecological risk and are selected to represent mechanisms of toxicity and exposure pathways. Measures of exposure generally include measured or modeled concentrations of chemicals in water, sediment, soil, birds, and/or mammals. Measures of effects include laboratory toxicity study results and field observations. The specific measurement endpoints identified for the SRA are all quantitative comparisons between COPEC concentrations and RBS values or chronic daily intakes and NOAEL-based TRVs.

Final assessment and measurement endpoints are summarized in Table 9-4.

9.2.4 Selection of Representative Species

Consistent with the Navy policy, the ecological receptors selected for a Tier 1 SRA

- Reflect important ecosystem components at the site;
- Are representative of major trophic levels at the site;
- Can serve as surrogates for "important" ("important" means species valued by regulators for reasons other than that species ecological importance) species; and
- Are species for which adequate exposure information is available.

9.2.4.1 Terrestrial Wildlife

A number of terrestrial wildlife species have been identified from the affected area. Several species must be selected to represent exposure characteristics of the flora and fauna of the area, both present and future.

The Navy policy states that the selection of the representative species must begin with identification of trophic levels associated with different habitats. Then, based on the identification, a surrogate species that is representative of the broader trophic levels should be chosen. Since the identification of the representative receptors involves professional judgment and depends on the assessment endpoints (Section 9.2.3) identified for the site, the Navy encourages seeking regulatory concurrence on the use of the ecological receptors for the site.

Table 9-4: Summary of Assessment and Measurement Endpoints

Receptor of Concern	Exposure Pathway	Assessment Endpoint *	Testable Hypothesis	Measures of Effect	Data Available
Plants	Root uptake of chemicals in soil	Protection and maintenance (survival, growth and reproduction) of plants	H_0: The concentration of chemicals in surface soil does not exceed a level known to be toxic to plants.	Compare concentration of chemicals in soil to risk-based soil benchmark concentrations developed to protect plant growth and reproduction.	Site-specific chemical data for surface soil or groundwater from potentially impacted locations
Soil invertebrates	Uptake of chemicals in soil	Maintenance (survival, growth and reproduction) of soil invertebrates	H_0: The concentration of chemicals in surface soil does not exceed a level known to be toxic to soil invertebrates.	Compare concentration of chemicals in soil to risk-based soil benchmark concentrations developed to protect growth and reproduction of soil invertebrates.	Site-specific chemical data for surface soil from potentially impacted locations
Small omnivorous mammals (represented by deer mouse)	Ingestion of chemicals accumulated in plants, soil invertebrates and from soil	Protection and maintenance (survival, growth and reproduction) of small omnivorous mammal populations	H_0: The ingestion of bioaccumulative chemicals in soil, sediment, and plants, and surface soil invertebrates does not exceed a level known to be toxic to mice.	Compare modeled COPEC chronic intake concentrations in representative small mammal species to determine exceedance of no-effect-level thresholds based on TRVs.	Site-specific chemical data for surface soil from potentially impacted locations
Small insectivorous mammals (represented by ornate shrew)	Ingestion of chemicals accumulated in soil invertebrates, insects, and from soil	Protection and maintenance (survival, growth and reproduction) of small insectivorous mammal populations	H_0: The ingestion of bioaccumulative chemicals in surface soil, sediment and soil invertebrates does not exceed a level known to be toxic to ornate shrews.	Compare modeled COPEC chronic intake concentrations in representative mammal species to determine exceedance of no-effect-level thresholds based on TRVs.	Site-specific chemical data for surface soil from potentially impacted locations
Carnivorous mammals (represented by long-tailed weasel)	Ingestion of chemicals accumulated in small mammals, birds, and from soil	Protection and maintenance (survival, growth and reproduction) of carnivorous mammal populations	H_0: The ingestion of bioaccumulative chemicals in small mammals, birds, soil and sediment does not exceed a level known to be toxic to the long-tailed weasel.	Compare modeled COPEC chronic intake concentrations in representative mammal species to determine exceedance of no-effect-level thresholds based on TRVs.	Site-specific chemical data for surface soil from potentially impacted locations
Small herbivorous birds (represented by mourning dove)	Ingestion of chemicals accumulated in plants and from soil	Protection and maintenance (survival, growth and reproduction) of herbivorous bird populations	H_0: The ingestion of bioaccumulative chemicals in plants and surface soil does not exceed a level known to be toxic to birds.	Compare modeled COPEC chronic intake concentrations in representative bird species to determine exceedance of No-effect-level thresholds based on TRVs.	Site-specific chemical data for surface soil from potentially impacted locations

Table 9-4: Summary of Assessment and Measurement Endpoints

Receptor of Concern	Exposure Pathway	Assessment Endpoint *	Testable Hypothesis	Measures of Effect	Data Available
Small insectivorous birds (represented by western meadowlark)	Ingestion of chemicals accumulated in soil invertebrates, insects, and from soil	Protection and maintenance (survival, growth and reproduction) of insectivorous bird populations	H_0: The ingestion of bioaccumulative chemicals in surface soil, sediment, and soil invertebrates does not exceed a level known to be toxic to western meadowlarks	Compare modeled COPEC chronic intake concentrations in representative bird species to determine exceedance of no-effect-level thresholds based on TRVs.	Site-specific chemical data for surface soil from potentially impacted locations
Small omnivorous birds (represented by spotted towhee)	Ingestion of chemicals accumulated in plants, soil invertebrates, and from sediment	Protection and maintenance (survival, growth and reproduction) of omnivorous bird populations	H_0: The ingestion of bioaccumulative chemicals in sediment invertebrates and surface soil does not exceed a level known to be toxic to birds.	Compare modeled COPEC chronic intake concentrations in representative bird species to determine exceedance of no-effect-level thresholds based on TRVs.	Site-specific chemical data for surface soil from potentially impacted locations
Carnivorous birds (represented by red-shouldered hawk)	Ingestion of chemicals accumulated in small mammals, birds, and from soil	Protection and maintenance (survival, growth and reproduction) of raptor populations	H_0: The ingestion of bioaccumulative chemicals in birds, small mammals, surface soil, and sediment does not exceed a level known to be toxic to birds.	Compare modeled COPEC chronic intake concentrations in representative bird species to determine exceedance of no-effect-level thresholds based on TRVs.	Site-specific chemical data for surface soil from potentially impacted locations
Small herbivorous birds and mammals (represented by mourning dove)	Ingestion of chemicals accumulated in phreatophytic plants from groundwater	Protection and maintenance (survival, growth and reproduction) of herbivorous bird and mammal populations	H_0: The ingestion of bioaccumulative chemicals in plants does not exceed a level known to be toxic to birds.	Compare modeled COPEC chronic intake concentrations in representative bird species to determine exceedance of no-effect-level thresholds based on TRVs.	Site-specific chemical data for shallow groundwater from potentially impacted locations
Aquatic life	Uptake of chemicals in surface water by aquatic organisms	Protection and maintenance (survival, growth and reproduction) of aquatic organisms	H_0: The concentration of chemicals in surface water does not exceed a level known to be toxic to aquatic organisms.	Compare concentration of chemicals in surface water to risk-based surface water benchmark concentrations developed to protect survival, growth, and reproduction of aquatic organisms.	Site-specific chemical data for surface water from potentially impacted locations

Table 9-4: Summary of Assessment and Measurement Endpoints

Receptor of Concern	Exposure Pathway	Assessment Endpoint *	Testable Hypothesis	Measures of Effect	Data Available
Benthic organisms	Uptake of chemicals in site sediments by benthic organisms	Protection and maintenance (survival, growth and reproduction) of benthic organisms	H_0: The concentration of chemicals in surface sediment does not exceed a level known to be toxic to benthic organisms.	Compare concentration of chemicals in surface sediment to risk-based sediment benchmark concentrations developed to protect survival, growth, and reproduction of benthic organisms.	Site-specific chemical data for surface sediment from potentially impacted locations

Notes:
* Assessment endpoints identified for evaluation in the SRA are based on the parameters used to derive toxicity benchmarks (see Measurement Endpoint column) and are not intended to imply measurement of these parameters in the field.
COPEC = chemical of potential ecological concern
H_0 = null hypothesis
TRV = toxicity reference value

The selection of the representative species for the Tier 1 SRA was based on the following ecological and species-specific selection criteria:

Ecological Importance. This includes those species that affect the structure and function of existing habitats, communities, or ecosystems (e.g., key members of the local food web). The representative species are major intermediate components in the food web; if a population of a pivotal species is disrupted, there could be consequences throughout the food web, resulting in an ecosystem balance disruption.

Body Size. Species of small body size are preferred, because they are likely to be more affected by a given exposure. Due to their higher metabolic demands, small species tend to eat more food per unit body weight per day than do larger animals.

Active Area. Species with small site use areas or home ranges are likely to be more affected by contamination at the site because a higher percentage of their foraging may occur in contaminated areas. EPA screening guidance requires the assumption that the site use factor (SUF) is 1.

Feeding Guild. Certain methods of finding, processing, and consuming food present a higher risk of exposure than do others. For example, the ash-throated flycatcher forages by swooping from a hunting perch to catch insects of the air, whereas the western meadow lark and spotted towhee forage on the ground, where they are more likely to contact soil contaminants (Ehrlich et al. 1988).

Diet. Species with a specialized diet are likely to be more affected by a given contaminant exposure pathway and changes in food species changes density because they have fewer food alternatives.

Fecundity. Species having small litter or egg clutch sizes and fewer litters or clutches per year are likely to be more impacted by adverse effects on reproductive success.

Resident or Nesting Species. Resident or nesting species are likely to be more affected by contamination at the site because they may spend more time in the contaminated area per year.

Generally, representative species selection is based largely on the species' ecological importance and their habits that tend to lead to maximum exposure to soil pathways. It is assumed that the evaluation of risk to these maximally exposed species will represent risk to other species that are less exposed to soil pathways (i.e., leaf gleaning birds), thus protecting all species. Using the selection criteria discussed above, the animals listed in Table 5-7 were examined to identify appropriate representative terrestrial species. In consideration of all of the exposure-related factors, species identified in Table 5-7, and discussions with the regulators, seven species were selected as representative terrestrial wildlife species (Table 9-5). These species included some that may not be documented at the site; however, they are known to exist in the area. The seven species (four birds and three mammals) represent ground-feeding herbivores, insectivores, and predators.

Table 9-5: Selected Representative Terrestrial Wildlife Species for the SRA

Common Name	Scientific Name	Justification (Critical Ecosystem Role)
Ornate shrew	*Sorex ornatus*	Insectivore
Deer mouse	*Peromyscus maniculatus*	Omnivore (classified as herbivore for SRA)
Long-tailed weasel	*Mustela frenata*	Carnivore
Western meadowlark	*Sturnella neglecta*	Omnivore (classified as insectivore for SRA)
Spotted towhee	*Pipilo maculates*	Omnivore
Mourning dove	*Zenaida macroura*	Herbivore
Red-shouldered hawk	*Buteo lineatus*	Carnivore

Notes:
SRA = screening risk assessment

The selected terrestrial representative species at the site include the following:

The **ornate shrew** (*Sorex ornatus*) is a small (5.85 grams), insectivorous mammal (Brown et al. 1996). Because of its small size and high metabolism, it consumes a large amount of food for its size (1.119 grams/day), thus maximizing its exposure to site chemicals. Several subspecies of the ornate shrew are considered threatened or endangered in parts of its range, although no threatened or endangered populations are found in the area of the site. Ornate shrews prefer mesophytic communities with dense cover and an abundant litter layer. They build dome-shaped nests made of dead plant material and paper scraps, usually on top of the soil surface below driftwood or planks situated above the high tide line (WESCO 1986). The ornate shrew is assumed to forage in all habitats at the site. An ecological profile of this species is presented in Appendix E2.2. For the SRA, the ornate shrew is assumed to be completely insectivorous.

The **deer mouse** (*Peromyscus maniculatus)* ranges in length from 7.1 cm to 10.2 cm (Burt and Grossenheider 1976) with weights ranging from 18.3 grams to 20.9 grams (Schlessinger and Potter 1974). The deer mouse nests in burrows in the ground, in trees, stumps, and buildings. They inhabit nearly all types of dry-land habitats within their range: short grass prairies, grass-sage communities, CSS, sand dunes, wet prairies, upland mixed and cedar forests, deciduous forests, and ponderosa pine forests (Holbrook 1979; Kaufman and Kaufman 1989; Ribble and Samson 1987; Wolff and Hurlbutt 1982).

Deer mice eat seeds, arthropods, some green vegetation, roots, fruits, and fungi as available (Johnson 1961; Menhusen 1963; Whitaker 1966). An ecological profile of this species is presented in Appendix E2.2. The deer mouse is assumed to forage in all habitats at the site. For the SRA, the deer mouse is assumed to be completely herbivorous.

The **long-tailed weasel** (*Mustela frenata*) adult weights range from 80 grams to 450 grams (Baker 1983). For the purposes of the SRA, a mean weight of 265 grams is used. Weasels are found in temperate and tropical habitats in North and Central America. They inhabit crop fields and small wooded areas and will burrow and nest in hollow logs, rock piles, and under barns. Weasels sometimes take over the burrow of one of their prey (Baker 1983).

Weasels are strictly carnivorous but may ingest some soil while feeding. They prey on mammals up to rabbit size, and also take a few birds and other animals by piercing the prey's skull with its canines and killing it (Burt and Grossenheider 1976). An ecological profile of this species is presented in Appendix E2.2. For the SRA, the long-tailed weasel is assumed to be completely predatory and forage in all habitats at the site.

The **mourning dove** (*Zenaida macroura*) has a weight that ranges from 115 grams to 140 grams, with a mean weight of 119 grams (Dunning 1993). Mourning doves can be found in the desert (near water) to open woodland, agricultural areas with scattered trees, and suburbs. They will nest in the fork of a horizontal tree branch, on the ground, on the deserted nest of other species, or anywhere else providing solid support (Ehrlich et al. 1988). Since the mourning dove's diet consists of seeds, including waste grain from cultivated fields (Ehrlich et al. 1988), incidental ingestion of soil will occur. An ecological profile of this species is presented in Appendix E2.2. For the SRA, the mourning dove is assumed to be completely herbivorous and forage in all habitats at the site.

The **western meadowlark** (*Sturnella neglecta)* is a medium-sized (94 grams) bird that measures about 11 inches long and has a 5-inch tail (Dunn 1998). The western meadowlark's feeding habits are marked by seasonal differences in their main staples. They eat grain during winter and early spring, insects late spring and summer, and weed seeds in fall (Lanyon 1994). The feeding habits allow for an assumption of maximal exposure to COPECs. An ecological profile of this species is presented in Appendix E2.2. For the SRA, the western meadowlark is assumed to be completely insectivorous and represents birds that feed in the open areas of the site.

The **spotted towhee** body weight ranges from 32.1 gram to 52.3 grams and ranges in length from 18 cm to 20 cm (Clench and Leberman 1978). In California, the spotted towhee can be found in chaparrals and other shrub habitats and in open stands of riparian, hardwood, hardwood-conifer, and lower-elevation conifer habitats (Dobkin 2003). During the spring and summer, the spotted towhee's diet consists of approximately 50 percent insects, with the remainder including seeds, other invertebrates, berries, and acorns (Martin et al. 1961). It forages by scratching and gleaning in litter and foliage, sometimes by plucking seeds and fruits from plants, and on rare occasions fly-catching (Davis 1957). An ecological profile of this species is presented in Appendix E2.2. For the SRA, the spotted towhee is assumed to be completely omnivorous and represents birds that feed in the thickets of riparian habitat.

The **red-shouldered hawk** has a mean body weight of 559 grams and maximum weight of 720 grams (Hartman 1961). Adults are 41 cm in length and have a 102 cm wingspan (Robbins et al. 1966). The typical habitat for the red-shouldered hawk includes dense riparian deciduous cover, bordered by foraging areas (edges, swamps, marshes, and wet meadows). In the western Sierra Nevada foothills, it can be found foraging in successional stages of valley foothill hardwood and valley foothill hardwood-conifer habitats (Polite 2003). The red-shouldered hawk searches for prey from its perches on trees, snags, and posts. It primarily feeds on small mammals, snakes, lizards, amphibians, small or young birds, and large insects (Polite 2003). An ecological profile of this species is presented in Appendix E2.2. For the SRA, the red-shouldered hawk is assumed to be

completely predatory and forage in all habitats at the site. A summary of the SRA exposure characteristics that were used for the representative species is presented in Table 9-6.

Table 9-6: Summary of SRA Species-Specific Exposure Factors for Wildlife

Factor	Value	Reference
Ornate shrew		
Minimum body weight (BW) (kg)	0.0041	Brown et al. (1996)
Maximum food intake (mg/day, dry weight)	1,317	Deavers and Hudson (1981); Nagy (2001)
Water Intake (mL/day)	1.0	EPA (1993)
Diet partition factor	6% (soil)	EPA (2005) [d]
	0% (plant) 100% (invertebrates)	Derived from DOI (2002)
Deer mouse		
Minimum body weight (BW) (kg)	0.0183	Derived from Schlesinger and Potter (1974)
Maximum food intake (mg/day, dry weight)	3,491 [a]	Nagy (2001)
Water Intake (mL/day)	2.9[b]	EPA (1993)
Diet partition factor	2% (soil)	EPA (2005) using vole as surrogate
	100% (plant) 0% (animal)	SRA Assumption[c]
Long-tailed weasel		
Minimum body weight (BW) (kg)	0.080	Baker (1983)
Maximum food intake (mg/day, dry weight)	24973 [a]	Nagy (2001)
Water Intake (mL/day)	30 [b]	EPA (1993)
Diet partition factor	3 % (soil) 0% (plant) 100% (animal)	Beyer et al., 1994 (similar to fox)
	0.00 (plants) 0.97 (animal) (vertebrates)	Derived from Burt and Grossenheider (1976)
Western Meadowlark		
Minimum body weight (BW) (kg)	0.0741	Lanyon (1994)
Maximum food intake (mg/day, dry weight)	16,003 [a]	Nagy (2001)
Water Intake (mL/day)	12.1 [b]	EPA (1993)
Diet partition factor	9.3% (soil)	Beyer et al., (1994) using turkey as surrogate
	0% (plants) 100% (invertebrates)	SRA Assumption [c]
Spotted towhee		
Minimum body weight (kg)	0.0321	Clench and Leberman (1978) Nagy (2001)
Maximum food intake (mg/d, dry wt)	9,399 [a]	

Table 9-6: Summary of SRA Species-Specific Exposure Factors for Wildlife

Factor	Value	Reference
Water intake (mL/day)	6.9 [b]	EPA (1993)
	9.3% (soil)	Beyer et al., (1994) using turkey as surrogate
Diet Partition Factor	0.00 (plants) 100% (invertebrates)	SRA Assumption [c]
	0.0321	Clench and Leberman (1978)
Mourning Dove		
Minimum body weight (BW) (kg)	0.115	Dunning (1993) Nagy (2001)
Maximum food intake (mg/day, dry weight)	18,414 [a]	
Water Intake (mL/day)	14.2 [b]	EPA (1993)
	9.3% (soil)	EPA (2005) [d]
Diet Partition Factor	100% (plants) 0% (animal)	Derived from Erlich et al. (1988)
	0.115	Dunning (1993)
Red-Shouldered Hawk		
Minimum body weight (kg)	0.398	Hartman (1961) (Nagy 2001)
Maximum food intake (mg/d, dry wt)	66,576 [a]	
Water intake (mL/day)	40 [b]	EPA (1993)
	2.0% (soil)	Derived from Beyer et al. (1994)
Diet Partition Factor	0.00 (plants) 100% (animal) (mammals)	Derived from Polite (2003)
	0.398	Hartman (1961)

Notes:
[a] Dry weight food intake estimated based on algorithm given in Nagy (2001).
[b] Water intake estimated based on algorithm given in EPA (1993).
[c] Conservative Tier I assumption of maximum food intake of the one food item with the highest contamination.
% = percent
EPA = Environmental Protection Agency
ha = hectare
kg = kilograms
mg = milligrams
mg/d = milligrams per day
mL = milliliter
SRA = screening risk assessment
wt = weight

9.2.4.2 Lower Trophic Level Species

Potential effects to plants were assessed by comparison of surface soil chemical concentrations to general soil screening values developed to protect all plants. Potential risk to specific plant species was not assessed.

The **earthworm** (*Eisenia fetida*) was chosen to represent terrestrial invertebrates for purposes of food chain modeling because of its small size and range, its position as a decomposer in the food web, and its soil contact and diet. It is also a prey species for many small carnivorous animals, such as the deer mouse. In addition, the earthworm serves as a conservative surrogate for other terrestrial invertebrate food species, such as insects. It is assumed that the earthworm is maximally exposed to soil contaminants because of its burrowing habit and ingestion of soil. Other invertebrates would be

less exposed to site soil contaminants than the earthworm. Earthworm bio-concentration factor values are used to model food chain exposure concentrations.

Potential effects to aquatic and benthic organisms were assessed by comparison of surface water or sediment chemical concentrations to general surface water or sediment screening values developed to protect all aquatic life and benthos. Potential risk to specific species was not assessed.

9.2.5 Exposure Pathway Analysis

Soil (0-foot to 6 feet bgs), surface water, and sediment have been chosen as the media of concern for AA 3. Exposure pathways differ in importance from species to species and from site to site. For example, sites with minimum habitat value may be used by species that tolerate human disturbance of natural habitats.

The major terrestrial pathways chosen for analysis in this ERA are as follows:

- Uptake of chemicals in surface soil by plants (via roots) and soil invertebrates
- Uptake of chemicals in groundwater by deep-rooted plants (phreatophytes)
- Ingestion of contaminated surface soil by animals (mammals and birds)
- Ingestion of contaminated plants by animals (deer mouse and mourning dove)
- Ingestion of contaminated soil invertebrates by animals (ornate shrew, spotted towhee, and western meadowlark)
- Ingestion of contaminated prey by predators (long-tailed weasel and red-shouldered hawk)
- Uptake of contaminants in water by aquatic organisms
- Uptake of contaminants in sediment by benthic organisms

Factors used to estimate COPEC intake values for ecological animal receptors are referred to as exposure factors. Defining exposure factors is essential to estimating COPEC intake values. Factors such as species morphology, physiology, and behavior influence how individuals are exposed to COPECs and how much of a given COPEC in a given medium is taken in by an individual representative species. Characteristics of representative species that are used to estimate exposure are presented in Appendix E2.2 and summarized in Table 9-6. Uncertainties associated in applying these exposure factors in equations to calculate intake values are a complex issue; uncertainties are discussed in Section 9.3.3.

The most conservative species-specific exposure factors are used to estimate Tier 1 exposure:

- Assume weight is at the low end of the range and food intake is at the high end of the range,
- Assume 100 percent bioavailability of COPECs,
- Assume the most sensitive life stage is present on the site,
- Assume species is present year-round,
- Use maximum concentration of contaminant in exposure media,
- Assume SUF is 1.

Body Weight (BW). The lowest of the adult male and female body weights is used to estimate exposure because it is the most conservative assumption.

Food Intake (FI)/Day. The daily diet, in milligram of organic matter eaten per day, determined on a dry-weight basis, for an individual of maximum size.

SUF. The site use factor is defined as:

Equation 1: Site Use Factor

$$SUF = \frac{Area\ of\ Surface\ Soil\ Contamination}{Site\ Use\ Area\ of\ Animal}$$

This factor permits consideration of less than full-time exposure for animals with site use areas exceeding the area of contamination. When the site use area of the receptor is less than the size of the site, it is assumed that the animal occupies the site 100 percent of the time, and the SUF is equal to 1. It is assumed that these receptors are continuously exposed to site contaminants.

Diet Partitioning Factor. The diet of animal receptors may be defined by three major exposure pathways:

- Direct ingestion of soil—soil ingestion (SI),
- Ingestion of contaminated plant materials—plant ingestion (PI),
- Ingestion of contaminated animal prey—animal ingestion (AI).

For Tier 1 screening assessment, the conservative assumption is that the diet consists entirely of the most contaminated diet fraction. This is assumed to be soil invertebrates for the ornate shrew, western meadowlark, and spotted tohee; seeds and vegetation for the deer mouse and mourning dove, and contaminated mammals for the long-tailed weasel and red-shouldered hawk.

9.2.5.1 Chemical-Specific Exposure Factors

Exposure of representative species also depends, to some extent, on chemical-specific factors, such as solubility or tendency to bio-accumulate (Appendix E2.3).

Soil-to-Plant Bio-concentration Factor (BCF_p). BCF_p values are used to convert chemical concentrations in soil to concentrations in plant biomass resulting from plant root uptake. This factor is used to estimate the concentration of a COPEC that bio-accumulates in plants grown in contaminated soil over one growing season. This factor is also used to model concentrations of COPECs through plants to herbivores. Use of this factor assumes that plant root uptake for a specific chemical is equal for all plants.

BCF_p values are obtained from the literature or derived from a chemical-specific octanol/water partition coefficient (K_{ow}) by the method of Travis and Arms (1988) as refined by EPA (2003). Some degree of uncertainty is associated with the use of this factor, especially for perennial plants. For the most part, however, animals feed on portions of the plants that are renewed annually (i.e., foliage, seeds, and fruit).

Groundwater-to-Plant Bio-concentration BCF_p values are used to convert total chemical concentrations in soil to concentrations in plant biomass resulting from plant root uptake. The soil-water partition equation (EPA 1996, Pg. 36, Equation 22) is used to estimate the total soil concentration from the pore water (groundwater) concentration. The total soil concentration is used with the BCF_p to estimate plant uptake of site chemicals.

Equation 2: Total Soil COPC Concentration from Groundwater

$$C_s = C_p \text{ X } kd + (\Theta_w / Pb)$$

Where:

C_s = Total soil concentration (mg or µg/kg)

C_p = Pore water (groundwater) concentration (mg or µg/L)

Kd = Soil/water partition coefficient (L/kg) = K_{oc} X f_{oc} for organics

K_{oc} = Organic carbon - water partition coefficient (cm_3/gm)

F_{oc} = Organic carbon fraction in soil (default = 0.006 [6 percent])

Θ_w = Water-filled soil porosity (default = 0.3 [30 percent] L_{water}/L_{soil})

Pb = dry soil bulk density (default = 1.5 kg/L)

Soil-to-Invertebrate Bio-concentration Factor (BCF_i). BCF_i values are derived from studies of earthworm uptake and are used to convert chemical concentrations in soil to concentrations in invertebrate biomass resulting from both ingestion and integument sorption. This factor is used to estimate the concentration of a COPEC that bio-accumulates in invertebrates living in contaminated soil.

The primary terrestrial exposure pathways potentially present at the site for both plant and animal receptors are contaminated soil pathways, including uptake from soil by plants and invertebrates and ingestion of soil and contaminated food by higher trophic level organisms, such as birds and mammals.

Prey-to-Predator Bio-concentration Factor (BTF_a). BTF_a values were used to estimate chemical concentrations in predators that eat prey living on potentially contaminated areas of the site. The factor was used to model concentrations of COPEC's through prey to their predators. The BTF_a values are obtained from the literature or derived from chemical-specific K_{ow}s by the method of Travis and Arms (1998) as refined by Birak et al. (2001).

9.2.6 Development of Conceptual Site Model

9.2.6.1 Surface Soil

Three potential pathways exist for ecological receptors to come into contact with surface soil chemicals. Terrestrial wildlife are expected to incidentally ingest surface soil as part of normal feeding activities; therefore, this pathway is considered complete and is evaluated quantitatively. Terrestrial wildlife ingest plant parts (i.e., leaves, seeds, roots) and soil invertebrates that may have taken up COPECs from the soil into their body tissues; therefore, ingestion of contaminated food is

considered a complete exposure pathway and is evaluated quantitatively. Mammal and bird predators may eat contaminated prey. Burrowing mammals may contact subsurface soil (0-foot to6 feet bgs), although the majority of exposure to COPECs is through ingestion of food.

Inhalation of contaminated dust is expected to be insignificant because the site is well vegetated and dust generation is minimal. Ecological receptors are not expected to come into contact with subsurface soil (soil below 6 feet); therefore, this exposure pathway is considered incomplete.

9.2.6.2 SEDIMENT

Two potential pathways exist for ecological receptors to come into contact with sediment in the Agua Chinon Wash. Benthic organisms may live within or on bottom sediments of the Agua Chinon Wash so that it is not possible to separate exposure by ingestion of food or sediment and dermal/gill contact. These exposure pathways are lumped together into total "uptake" for risk evaluation. Benthic organisms are limited due to the brief time surface water is available, and this pathway is not assessed. Terrestrial riparian species may be exposed to COPECs in dry sediments in the Wash throughout most of the year, and Wash sediments were assessed as a separate terrestrial soil pathway. Although the samples were collected from the Wash bottom, the exposure was assumed to occur throughout the mulefat scrub habitat that occupies the banks adjacent to the stream (approximately 0.67 hectare).

9.2.6.3 SURFACE WATER

Three potential pathways exist for ecological receptors to come into contact with surface water in the Agua Chinon Wash. Aquatic organisms may live in the ephemeral surface water of the Agua Chinon Wash, so that it is not possible to separate exposure by ingestion of water and dermal/gill contact. These exposure pathways are lumped together into total "uptake" for risk evaluation. Although water does not normally persist in the Wash long enough to support an aquatic community, it is screened against chronic water quality criteria. Water is not available for terrestrial species to drink for a long enough period to be a significant exposure concern.

9.2.6.4 GROUNDWATER

Groundwater is generally considered beyond the reach of ecological receptors unless it discharges to the surface. The shallowest groundwater at the site was measured in wells MW 05 and MW 08 at a depth of approximately 26.2 feet bgs. Figure 6-1 presents several cross sections prepared for the site and demonstrates that groundwater does not intersect the bottom of Agua Chinon Wash, thus the Wash is a losing stream in the vicinity of AA 3. Because groundwater does not reach the surface on the site or in the immediate area (see geologic cross section, Figure 6-1), the groundwater pathway is considered incomplete for all animal ecological receptors.

Certain plants have adapted to arid conditions by developing the ability to send a tap root through anaerobic subsurface soil to the level of the saturated zone. The depth of root penetration varies with species. Plants that supplement their water supply by utilizing groundwater are grouped as phreatophytes. "Phreatophyte" is a functional grouping and not a taxonomic grouping. Phreatophytes also have the normal feeder roots located in the top 6 inches of soil. These surface roots are generally widespread in desert adapted shrubs so they can quickly absorb light and infrequent rain that does not penetrate deeply into desert soil. Therefore, phreatophytes may obtain necessary minerals from both surface soil and saturated soil at the water table.

The relationships between analytes in the site media and potential exposure pathways to ecological receptors are summarized in the CSM presented in Figures 9-4 and 9-5.

9.2.7 Toxicity Evaluation

The toxicity evaluation consists of identification of screening benchmark concentrations for surface soil. Maximum detected analytes in site surface soil were screened initially against EcoSSLs (EPA 2003a) and ORNL soil screening values based on the protection of plants (Efroymson et al. 1997a) and soil invertebrates (Efroymson et al. 1997b). These are based on toxicity studies of plants and soil invertebrates and are used to predict adverse effects on lower trophic level ecological receptors. HQs were also calculated for each COPEC to compare estimates of chronic daily intake (for mammals and birds) to TRVs (see Section 9.3.2 for further details).

NOAEL-based TRVs based on laboratory feeding studies of birds and mammals were used to calculate HQs for soil COPECs. A TRV is a dosage (for animals, in milligram of contaminant per kilogram of body weight per day [mg/kg-day]) of a chemical believed to have no effect on the long-term health of the representative species. TRVs are specific for each chemical, receptor, and exposure route (e.g., ingestion, inhalation). The TRV of a chemical is equivalent to the exposure-specific, literature-derived NOAEL of that chemical for a particular plant or animal species of concern as published in the peer-reviewed toxicology literature.

The potential for adverse effects to be caused by exposure to site chemicals was evaluated based on toxicity experiments conducted, for the most part, in the laboratory and reported in scientific literature. Acceptable TRVs were developed from NOAELs for ingestion of each COPEC in chronic feeding studies conducted on the same representative species or a related species. The primary source of TRVs was the "TRV-low level," which was developed by the Navy as part of a regional approach for conducting ERAs (Engineering Field Activity West [EFAW] 1998), in cooperation with the EPA Region 9 Biological Technical Assistance Group. The TRVs used by EPA (2003b) to develop EcoSSLs were used in this risk assessment for the few chemicals for which they are available. For chemicals lacking EcoSSLs or not listed in the Navy document, NOAELs were taken from peer-reviewed toxicology literature. Because the toxicity information sought was not always available in the literature, extrapolations were sometimes required. The three general categories of extrapolations were: (1) taxonomic extrapolations, (2) endpoint extrapolations, and (3) chemical extrapolations. Use of these extrapolations sometimes required the application of uncertainty factors in generating TRVs, as described below.

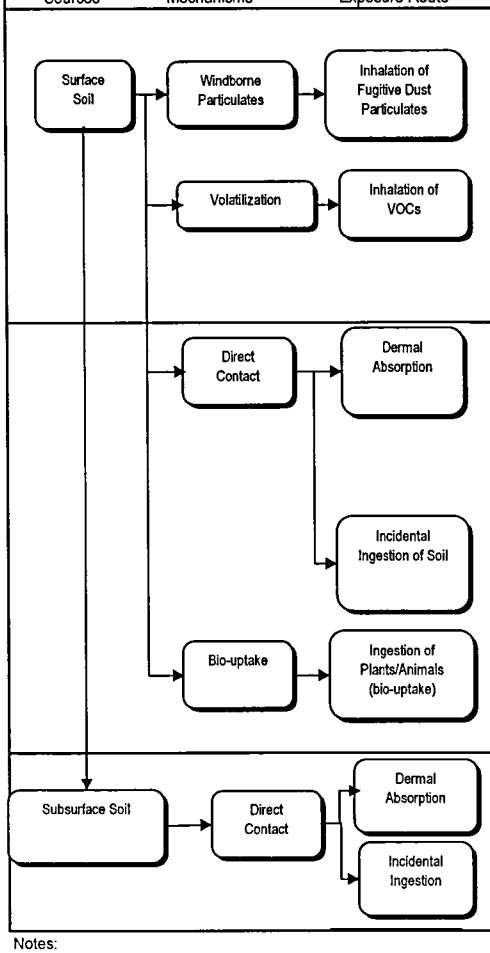
9.2.7.1 Taxonomic Extrapolation

Taxonomic extrapolation assumes that toxicological effects reported for one species can be used to predict the toxicological effects in a taxonomically related species. These assumptions have proven valid in extrapolations used to estimate toxicity in aquatic species (EPA 1989b). Although little is known about extrapolations to assess risk to terrestrial plant and animal species, the paucity of specific toxicity data mandates such extrapolations. As an example of the use of taxonomic extrapolation, an uncertainty factor of 10 is assigned to toxicity data derived from laboratory rats if the species of concern is a bird. This assumes that birds are always more sensitive to organic chemicals than mammals. This is considered conservative because among chemicals with measured toxicity in both birds and mammals, birds are sometimes more sensitive and sometimes less sensitive than mammals.

9.2.7.2 Endpoint Extrapolation

If NOAEL endpoint values were not available, LOAEL values were multiplied by 0.1 to estimate a surrogate NOAEL, as specified by EPA (1997b). If chronic studies were not available, sub-chronic study results were multiplied by 0.5 to estimate chronic results. Additional adjustments of TRVs to account for other sources of uncertainty are not recommended in the EPA (1997b) guidance.

Figure 9-4. Conceptual Site Model for Anomaly Area 3 and Agua Chinon Wash - Surface Soil (0-foot to 6 feet bgs)



Terrestrial Ecological Receptors[1]	Rationale
Insignificant	Inhalation of contaminated dust is expected to be insignificant because the site is well vegetated and dust generation is minimal.
Incomplete	VOCs may volatilize into soil air spaces from soil and migrate to the soil surface where they may be emitted to the atmosphere, exposing all receptors. However, VOCs were not detected in the soil column therefore, this exposure pathway is considered incomplete.
Insignificant	Dermal absorption of surface soil contaminants is potentially complete for ecological receptors, but scientific data to estimate exposure of wildlife is lacking, so the pathway is not evaluated quantitatively. Soil invertebrates ingested as food by wildlife are assumed to take up soil COPECs through the skin. Exposure to COPECs by dermal absorption by wildlife is expected to be insignificant compared to exposure by ingestion pathways.
Potentially Complete	Terrestrial wildlife are expected to incidentally ingest surface soil as part of normal feeding activities, therefore, this pathway is considered complete and is evaluated quantitatively.
Potentially Complete	Terrestrial wildlife ingest plant parts (i.e., leaves, seeds, roots) and soil invertebrates that may have taken up COPECs from the soil into their body tissues, therefore, ingestion of contaminated food is considered a complete exposure pathway and is evaluated quantitatively.
Potentially Complete	Burrowing mammals may contact subsurface soils although the majority of exposure to COPECs is through ingestion of food. For risk assessment purposes surface soil was considered the soil interval from the surface to six feet.

Notes:
(1) Future conditions are assumed to be similar to current conditions for ecological receptors. No future scenarios are run.
COEPC = chemical of potential ecological concern
VOC = volatile organic compound

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Figure 9-5. Conceptual Site Model for Anomaly Area 3 and Agua Chinon Wash - Sediment, Surface Water and Groundwater

Pathway	Contributing Sources	Transport Mechanisms	Exposure Route	Ecological Receptor: Aquatic Organisms	Ecological Receptor: Terrestrial Riparian Species	Rationale
Surface Water Runoff to Agua Chinon Wash	Wash Sediment	Direct Contact	Incidental Ingestion of Sediment	**Complete**	**Complete**	Benthic organisms may live within or on bottom sediments of Agua Chinon Wash so that it is not possible to separate exposure by ingestion of food or sediment and dermal/gill contact. These exposure pathways are lumped together into total "uptake" for risk evaluation. Benthic organisms are limited due to brief time surface water is available, however sediment chemicals are compared to sediment screening levels for completeness. Terrestrial riparian species may be exposed to COPECs in dry sediments throughout most of the year, therefore, sediment chemicals are also screened against soil screening values for the protection of plants and invertebrates.
			Dermal Contact with Sediment	**Complete**	Potentially complete but not evaluated	Benthic organisms live within or on bottom sediments so that it is not possible to separate exposure by ingestion of food or sediment and dermal/gill contact. These exposure pathways are lumped together into total "uptake" for risk evaluation. Scientific information needed to assess dermal uptake in terrestrial ecological receptors is lacking but exposure is expected to be insignificant compared to food-chain pathways.
			Ingestion of Plants/Animal (bio-uptake)	Insignificant	**Complete**	Terrestrial riparian species may eat food that has taken up COPECs from sediment in Agua Chinon Wash.
Surface Water	Runoff from Surface Soil	Overland Flow	Uptake from Surface Water	**Complete**	Insignificant	Aquatic organisms may live the ephemeral surface water of Agua Chinon Wash so that it is not possible to separate exposure by ingestion of water and dermal/gill contact. These exposure pathways are lumped together into total "uptake" for risk evaluation. Although water does not normally persist in the wash long enough to support an aquatic community it is screened against chronic water quality criteria. Water is not available for terrestrial species to drink for a long enough period to be a significant exposure concern.
Groundwater	Subsurface Soil	Groundwater Flow Movement	Uptake of Chemicals in Groundwater by Plants	Incomlete	**Complete**	Certain plants (Phreatophytes) have developed long tap roots and mechanisms to utilize water from the saturated zone at depth. When surface soil are dry they rely on groundwater and may take up chemicals dissolved in groundwater. Therefore this pathway is complete for certain plants. Animals that eat plant parts (i.e., seeds, leaves, stems, and roots) may be exposed to chemicals in groundwater.
		NO Discharge to Surface Water				

Notes:
COEPC = chemical of potential ecological concern

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9.2.7.3 CHEMICAL EXTRAPOLATION

Chemical extrapolation assumes that a chemical of similar physical and chemical properties to a COPEC may serve as a surrogate for that COPEC. For mammals, laboratory toxicity tests for naphthalene and B[a]P were used to represent toxicity of the less toxic and more toxic PAHs respectively. For birds, only toxicity data for phenanthrene is available. This LOAEL was used to develop a bird toxicity value for the low-toxicity PAHs by dividing the LOAEL by 10 to estimate a NOAEL. This NOAEL was divided by 10 again to estimate the TRV for high-toxicity PAHs such as B[a]P. Thus, it is assumed that B[a]P is at least 10 times more toxic than phenanthrene.

9.2.7.4 ALLOMETRIC CONVERSIONS OF TRVS

General TRVs for birds and mammals must be converted to TRVs specific to each regional, site-specific receptor of concern (EFAW 1998). This extrapolation of data based on body scaling is called allometric conversion. For example, when there are available toxicological data and dose levels for mice, but toxicity data and dose levels are needed for the rat, an allometric conversion estimates a similar dose level for the fox. The underlying assumption of allometric conversions is that a given effect on a species of small mammals is similar to the effect on a larger species of mammals, per unit body weight. Although several allometric conversion equations are available in the literature, Sample and Arenal (1999) is used for conversion of mammalian TRVs:

$$\text{Dose}_{\text{receptor}} = \text{Dose}_{\text{test organism}} (\text{Body Weight}_{\text{test organism}} / \text{Body Weight}_{\text{receptor}})^{0.06}$$

The equation from Mineau, et al. (1996) is used for conversion of avian TRV's:

$$\text{Dose}_{\text{receptor}} = \text{Dose}_{\text{test organism}} (\text{Body Weight}_{\text{test organism}} / \text{Body Weight}_{\text{receptor}})^{-0.14}$$

The equation from Mineau, et al. (1996) is used for conversion of avian TRV's:

$$\text{Dose}_{\text{receptor}} = \text{Dose}_{\text{test organism}} (\text{Body Weight}_{\text{test organism}} / \text{Body Weight}_{\text{receptor}})^{-0.14}$$

Allometric equations generally follow the form:

$$Y = aM^b$$

Y is some variable of structure or function and is dependent (following a power law equation) on body mass, *M*, and *a* and *b* are taxon-specific empirical factors. Weight-specific metabolism in mammals scales with an exponent of 1/3, while biological rates (for example, respiratory rate) generally scale with an exponent of –1/4. In a review by Sample and Arenal (1999), the scaling factor for mammal toxicity was revised to 0.06 (1-0.94). Mineau et al. (1996) showed that use of mammal-derived scaling factors underestimated the toxicity of a COPEC in birds, especially small birds. Based on empirical data from 10 species of birds and 37 chemicals, an average scaling factor of 1.14 is estimated for birds. However, scaling factors for the majority of chemicals evaluated (29 of 37) were not significantly different from 1. A scaling factor of 1 was therefore considered most appropriate for interspecies extrapolation among birds. Lindstedt (1987, in Mineau et al. 1996) notes that "throughout toxicology and the issues related to interspecies extrapolation, dose and exposure are nearly always "fixed" and are independent of both body mass and physiological time." For this reason, the allometric conversion proposed in Sample et al. (1996), based on weight-specific metabolism, is recommended.

When extrapolating bird toxicity from mammalian study results, only an uncertainty factor of 10 is applied and there is no adjustment for size.

Final TRVs used in the SRA for mammals and birds are presented in Appendix E2.4.

9.2.8 SRA Process - Tier 1, Step 2 – Exposure Estimation and Risk Characterization

This section presents the methods and results of Tier 1, Step 2 of the SRA process. This step comprises a quantitative risk analysis, with the potential for adverse effects to ecological receptors being estimated using very conservative assumptions. This section is divided into five subsections: exposure estimation (Section 9.2.9); risk calculations (Section 9.2.10); uncertainty analysis (Section 9.2.11); risk characterization (Section 9.2.12); and Tier 1, Step 2 exit criteria (Section 9.2.13).

9.2.9 Exposure Estimation

Exposure of representative species occurs in different ways, depending on the physical and behavioral characteristics of the organism. Plants take up COPECs from the soil by absorption through the roots. Soil invertebrates can be exposed by absorption across the skin and through ingestion of soil. The two mechanisms cannot be conveniently separated; therefore, soil invertebrate exposure (represented by the earthworm) is considered the combined uptake. Some COPECs must be dissolved in pore water before they can cross cell membranes into a plant root or an invertebrate's body. Terrestrial organisms can be exposed through the skin, respiratory surface, or, more commonly, through ingestion of contaminated soil and food.

EPCs are used in the exposure estimation and represent the maximum detected concentration in each affected medium at AA 3. The EPCs are summarized in Tables 9-1, 9-2, and 9-3.

9.2.10 Risk Calculations

The integration of toxicity and exposure information is used to predict possible adverse effects to ecological receptors. The HQ method is used to screen site COPECs for their potential to cause adverse effects to ecological receptors.

9.2.10.1 HAZARD QUOTIENTS

The HQ method is used to compare media COPEC concentrations to media-specific, RBS values. For plants and invertebrates, the HQ value is calculated by dividing the maximum surface soil COPEC concentration by the EcoSSLs or ORNL Soil Benchmark concentration. For surface water, the HQ value is calculated by dividing the maximum surface water COPEC concentration by the NRWQC values for the protection of aquatic life (EPA 2002c). If NRWQC values were not available, Great Lakes Tier II values presented in Suter II and Tsao (1996) were used as secondary values.

For soil, the HQ value is calculated using Equation 3:

Equation 3: Hazard Quotient

$$HQ = \frac{Intake\ of\ COPEC\ (mg/kg/day)}{TRV\ for\ COPEC\ (mg/kg/day)}$$

Where:

HQ = The hazard quotient.

Intake = Sum of chronic daily intake from all ingestion pathways (i.e., soil, plants and invertebrates)

Sediment samples were collected at the bottom of the Agua Chinon Wash. The Wash is ephemeral and benthic organisms are not present. Therefore, maximum concentrations of sediment COPECs were evaluated using terrestrial receptors to evaluate potential risk. The HQ method described above for soil exposure is also used to evaluate potential risk to terrestrial receptors exposed to dry sediment.

HQ values were determined for each COPEC and receptor at the site. HQ values equal to or exceeding 1 indicate that the exposure level equals or exceeds the effects level and that the receptor being assessed has a potential for adverse effects resulting from exposure to site contaminants via a variety of pathways at a given site. HQ values exceeding 1 do not necessarily indicate that an effect will occur, only that a lower threshold has been exceeded based on the exposure assumptions used in the model. It should be noted that a single chemical or pathway may be responsible for the majority of the risk to a receptor at a site.

Note that the HQ calculated using NOAEL-based TRVs provides some insight into general effects on individual animal reproduction and/or survival in the local population. It is assumed that if risks are judged unacceptable for the average individual receptor, they will be considered unacceptable at the population level. However, if risks are present at the individual receptor level, risks may or may not be important at the population level.

HQ values calculated for soil and sediment COPECs at AA 3 evaluated in the SRA are presented in the tables in Appendix E2.6, for each exposure pathway for each representative species. The COPECs include VOCs, SVOCs, PAHs, metals, and dioxins/furans. The conservative exposure assumptions included use of maximum COPEC concentrations, minimum body weight, maximum ingestion rate, and a SUF of 1 (see Table 9-6).

9.2.10.2 Comparison of Surface Soil COPEC Concentrations with Plant and Invertebrate Screening Concentrations

The comparison of COPECs found in surface soil at AA 3 with the plant and invertebrate screening concentrations developed for lower trophic level species in this assessment is summarized in Table 9-7. Maximum surface soil concentrations of aluminum, chromium, selenium, vanadium, zinc, and total Group 2 PAHs (HMW PAHs) exceed plant and/or invertebrate screening concentrations. These concentrations result in an HQ greater than 1, which indicates a potential for adverse effects to lower trophic level ecological receptors. Although the potential risk to invertebrates from individual PAHs is considered acceptable. Assuming PAH toxicity is through a common process, the cumulative risk from total PAHs exceeds 1, indicating a potential risk to soil invertebrates.

Table 9-7: Comparison of Maximum Soil EPCs with Plant and Invertebrate Screening Concentrations

COPEC	Maximum Concentration (mg/kg dw)	ORNL Soil Benchmark (mg/kg dw)[1]	Ref.	Hazard Quotient
VOCs				
Acetone	0.100	DG		—
Methylene chloride	0.0092	DG		—
PAHs				
Anthracene	0.044	DG		—
Benzo(g,h,i)perylene	0.44	DG		—
Fluoranthene	1	37	5	3E-02
Phenanthrene	0.29	23	5	1E-02
Pyrene	0.96	10	5	1E-01

Table 9-7: Comparison of Maximum Soil EPCs with Plant and Invertebrate Screening Concentrations

COPEC	Maximum Concentration (mg/kg dw)	ORNL Soil Benchmark (mg/kg dw)(1)	Ref.	Hazard Quotient
Total Group 1 PAHs	**2.734**	**25**	**7**	**1E-01**
Benzo[a]anthracene	0.73	1.2	3	6E–01
Benzo(a)pyrene	1.03	1.2	3	9E–01
Benzo[b]fluoranthene	1.79	1.2	3	1E+00
Benzo[k]fluoranthene	0.51	1.2	3	4E-01
Chrysene	0.87	1.2	3	7E-01
Dibenz[a,h]anthracene	0.097	DG		—
Fluoranthene	1	37	5	3E-02
Indeno(1,2,3-cd)pyrene	0.46	1.2	3	4E-01
Total Group 2 PAHs	**5.487**	**1.2**	**3**	**5E+00**
SVOCs				
Bis(2-Ethylhexyl)phthalate	0.07	DG		—
Diethylphthalate	0.225	100	1	2E–03
Hexachlorobenzene	0.15	DG		—
Phenol	0.936	30	2	3E–02
Metals				
Aluminum	15,800	50	1	**3E+02**
Antimony	2.1	78	4	3E–02
Arsenic	4.63	10	1	5E–01
Barium	187	330	4	6E–01
Beryllium	0.31	40	4	7E–03
Cadmium	1	32	4	4E–02
Chromium	15.8	0.4	2	**4E+01**
Cobalt	7.6	13	4	6E–01
Copper	10.8	50	2	2E–01
Lead	20.7	110		2E-01
Manganese	289	500	1	4E–01
Mercury	0.069	0.1	1	7E–01
Nickel	13.7	30	1	5E–01
Selenium	1.1	1	1	**1E+00**
Silver	2	2	1	1E+00
Vanadium	44.1	2	1	**2E+01**
Zinc	57.1	50	1	**1E+00**
Dioxins/Furans				
Total 2,3,7,8-TCDD (Mammal)[6]	0.0000184	0.5	3	4E-05
Total 2,3,7,8-TCDD (Bird)[6]	0.0000353	0.5	3	7E-05

Notes:
Values in bold indicate that COPEC concentration exceeds surface soil screening criteria for lower trophic level organisms; HQ is equal to or greater than 1.
1. Plant screening value (Efroymson et al. 1997a) or
2. Soil invertebrate screening value (Efroymson et al. 1997b).
3. EPA 1999b
4. EPA 2005. Eco-SSL used
5. Sverdrup et al., 2001.
6. TEQ value calculated based on TEFs for birds and mammals respectively.
7. Jensen and Sverdrup, 2003
— = not evaluated due to data gaps
µg/kg = micrograms per kilogram
COPEC = chemical of potential ecological concern
DG = data gap; screening value not available
dw = concentration listed on a dry weight basis

EPA = Environmental Protection Agency
EPC = exposure point concentration
HQ = hazard quotient
mg/kg = milligrams per kilogram
PAH = polynuclear aromatic hydrocarbon
TCDD = tetrachlorodibenzodioxin
TEF = toxicity equivalency factor
TEQ = toxicity equivalency quotient
VOC = volatile organic compound

Two VOCs and three PAHs and two other SVOCs detected in surface soil did not have plant or invertebrate screening concentrations. The potential risks posed by these VOCs and SVOCs are unknown for plants and invertebrates due to the lack of relevant effects levels.

9.2.10.3 TIER 1 SURFACE SOIL RISK CALCULATION RESULTS

The HQ results of risk calculations based on food chain exposure and conservative exposure assumptions for surface soil COPECs are presented in Appendix E2.5. Those receptors with elevated HQs (equal to or greater than 1) are presented in Table 9-8.

The HQs for aluminum, antimony, cadmium, chromium, lead, mercury, nickel, selenium, vanadium, zinc, diethylphthalate, and total 2,3,7,8-TCDD (mammal) and (bird) are 1 or greater, with respect to specific receptors, which indicates a potential for adverse effects to terrestrial ecological receptors.

Table 9-8: Elevated Hazard Quotient Values for Soil COPECs, Tier 1

COPEC	Ornate Shrew	Deer Mouse	Long-tailed Weasel	Mourning Dove	Western Meadow-Lark	Red-Shouldered Hawk
Metals						
Aluminum	1E+03	3E+01	9E+01	2E+00	1E+01	—
Antimony	3E+00	—	—	7E+00	2E+01	1E+00
Cadmium	5E+00	—	—	—	1E+00	—
Chromium	—	—	—	—	1E+00	—
Lead	—	—	—	—	2E+00	—
Mercury	—	—	—	—	2E+00	—
Nickel	3E+01	1E+00	1E+00	—	2E+00	—
Selenium	6E+00	2E+00	—	—	1E+00	—
Silver	—	—	—	—	1E+00	—
Vanadium	4E+00	—	—	—	—	—
Zinc	1E+01	—	—	—	4E+00	—
SVOCs						
Diethylphthalate	—	—	—	—	3E+00	—
Dioxins/Furans						
Total 2,3,7,8-TCDD (Mammal)[1]	2E+01	—	—	NA	NA	NA
Total 2,3,7,8-TCDD (Bird)[1]	NA	NA	NA	—	3E+00	—

Notes:
[1]TEQ value calculated based on TEFs for birds and mammals respectively.
— = HQ is less than 1 for this receptor
COPEC = chemical of potential ecological concern
HQ = hazard quotient

NA = not applicable
TEF = toxicity equivalency factor
TEQ = toxicity equivalency quotient

9.2.10.4 TIER 1 GROUNDWATER UPTAKE SCREENING RISK CALCULATION RESULTS

The HQ results of risk estimates for herbivorous terrestrial wildlife that eat plant material from phreatophytes taking up COPCs from groundwater are presented in Appendix E2.5. The phreatophyte uptake model was used to estimate COPC concentrations in plants from use of nothing but groundwater. The standard Tier 1 food chain model was used to estimate HQ values for herbivorous representative birds and mammals assuming that they eat nothing but phreatophytes. No HQ values were greater than 1 for the mourning dove. The HQ for the deer mouse equals 2 for selenium in phreatophytes. Therefore, there is minimal potential for adverse effects to terrestrial birds and mammals from eating phreatophytes that have taken up site groundwater.

9.2.10.5 TIER 1 SEDIMENT SCREENING RISK CALCULATION RESULTS

The HQ results of risk estimates for terrestrial wildlife based on conservative exposure assumptions for sediment COPECs are presented in Appendix E2.6. Those receptors with HQs equal to or greater than 1 are presented in Table 9-9.

The HQs for aluminum, cadmium, mercury, nickel, vanadium, and zinc in sediment are 1 or greater with respect to their specific receptors which indicate a potential for adverse effects to terrestrial ecological receptors.

Table 9-9: Elevated Hazard Quotient Values for Sediment COPECs

COPEC	Ornate Shrew	Deer Mouse	Long-tailed Weasel	Mourning Dove	Spotted Towhee	Red-shouldered Hawk
Metals						
Aluminum	2E+02	6E+00	2E+01	—	4E+00	—
Cadmium	2E+00	—	—	—	—	—
Mercury	—	—	—	—	2E+00	—
Nickel	6E+00	—	—	—	—	—
Vanadium	1E+00	—	—	—	—	—
Zinc	6E+00	—	—	—	3E+00	—

Notes:
— = HQ is less than 1 for this receptor
COPEC = chemical of potential ecological concern
HQ = hazard quotient

9.2.10.6 COMPARISON OF SURFACE WATER EPCS WITH SURFACE WATER SCREENING CRITERIA

Comparisons of surface water EPCs concentrations with California Toxics Rule (CTR) (EPA, 2000d) surface water screening criteria are presented in Table 9-10. Eleven metals (aluminum, barium, beryllium, cadmium, chromium, cobalt, lead, manganese, nickel, vanadium, and zinc) exceed their surface water screening values.

Table 9-10: Comparison of Surface Water EPCs with Surface Water Benchmark Concentrations

COPEC	CTR Fresh water CCC (µg/L dissolved)	Great Lakes Tier II Criteria (µg/L dissolved)	Exposure Point Concentration (µg/L total)	Hazard Quotient
Metals (Total unfiltered)				
Aluminum[1]	87	DG	87500	**1E+03**
Arsenic	150	DG	34.2	2E–01
Barium	DG	4	871	**2E+02**
Beryllium	DG	0.66	2.7	**4E+00**
Cadmium	2.2	DG	6.4	**3E+00**
Chromium[2]	11	DG	83.5	**8E+00**
Cobalt	DG	23	31.5	**1E+00**
Lead	2.5	DG	28.2	**1E+01**
Manganese	DG	120	1070	**9E+00**
Nickel	52	DG	78.5	**2E+00**
Vanadium	DG	20	227	**1E+01**
Zinc	120	DG	286	**2E+00**

Notes:
Values in **bold** indicate that COPEC concentration exceeds surface water screening criteria for the protection of aquatic life; HQ exceeds 1.
[1] Freshwater chronic criterion for aluminum, 87 µg/L, is used. It is based on pH=6.5-9 in groundwater. EPA is aware of field data indicating that many high quality waters in the U.S. contain more than 87 µg/L of aluminum, when either total recoverable or dissolved is measured (EPA 1998b).
[2] CTR value for chromium VI used.
µg/L = micrograms per liter
CCC = Criterion Continuous Concentration
COPEC = chemical of potential ecological concern
CTR = California Toxics Rule, 2000
DG = data gap, screening value not available
EPA = Environmental Protection Agency
EPC = exposure point concentration
HQ = hazard quotient

9.2.11 Uncertainty Analysis

ERA results depend primarily on the weight of evidence supporting particular conclusions, and each line of evidence is subject to varying degrees of uncertainty. Due to the complexity of ecosystems and the associated mechanisms that cause ecological stress, uncertainty in environmental risk characterization is inevitable. Uncertainty stems from a number of sources. These include, but are not limited to, the following:

- Sampling and statistical variability,
- Limitations of toxicity testing,
- Difficulty of extrapolating from laboratory data to field data,
- Problems in evaluating environmental responses to mixtures of contaminants,
- Assumptions underlying the use of fate and transport models,
- Range of conditions for which models or HIs are applicable.

Other uncertainty sources include unexpected weather conditions or sources of contamination. Uncertainty associated with each step of this ecological risk characterization is described below.

9.2.11.1 UNCERTAINTIES IN THE ECOLOGICAL EXPOSURE ESTIMATION

A number of chemicals in surface soil, sediment, and surface water had reporting limits that were higher than their respective ecological screening values that may potentially underestimate risk for these analytes. Default values for dry soil bulk density, water filled soil porosity, and soil organic carbon fraction were used to calculate total soil concentration in soil saturated with groundwater. Site-specific values for these parameters would allow more accuracy in the estimation. The saturated soil COPC concentrations could be over- or under-estimated.

9.2.11.2 UNCERTAINTIES IN THE ECOLOGICAL TOXICITY ASSESSMENT

A variety of sources of uncertainty were not included above. For one, it has long been recognized that laboratory studies referenced as a basis for generating TRVs may not accurately represent the complexities of potential exposure under field conditions. For example, the dosing of test animals by use of highly soluble salts in drinking water may overestimate exposures compared with the same salt administered in food. The chemical form present at the site may be in a less soluble form than that used in the laboratory study (e.g., lead acetate in water compared to lead carbonate in food). Finally, toxicological studies on which TRVs are based deal with a single chemical; effects of simultaneous exposure to multiple contaminants were not addressed.

Aluminum is extracted from soil samples in the laboratory analysis using rigorous acidic conditions. The HQ exceedance of 1 for aluminum is based on an assumption of high bioavailability for birds and mammals. "EPA recognizes that due to the ubiquitous nature of aluminum, the natural variability of aluminum soil concentrations and the availability of conservative soil benchmarks..., aluminum is often identified as a contaminant of concern ... for ecological risk assessments" (EPA 2000b). The toxicity of aluminum is associated with soluble aluminum while the analytical results used in this risk assessment are based on total extractable aluminum. The EPA recommends that aluminum be identified as a COPEC only for those soils with a pH less than 5.5. The technical basis for this is that the soluble and toxic forms of aluminum are only present in soil under soil pH values of less than 5.5 (EPA 2000b). For the surface soil samples collected at AA 3, the pH value ranged between 6.41 and 10.5. Therefore, it can be concluded that aluminum does not pose adverse effects to terrestrial wildlife at AA 3.

Dioxin congeners were evaluated on the basis of TEQ relative to 2,3,7,8- TCDD. The EPA has assigned TEFs relative to 2,3,7,8-TCDD for highly CDDs and highly CDFs. The maximum concentration of each detected dioxin congener and the full reporting limit of each non-detected dioxin congener was multiplied by the congener-specific TEF for birds to calculate 2,3,7,8-TCDD TEQs. Van den Berg et al. (1998) pointed out that the TEFs developed for birds are normally applied to bird tissue concentrations to estimate a tissue burden of 2,3,7,8 TCDD. However, they can also be used as a surrogate to estimate an ingested dose when applied to diet concentrations (EPA 2003b). This application adds a level of uncertainty to the estimation of bird dioxin exposure. Because mammal TEFs are based on diet exposure, the TEFs for mammals are applied directly to each diet fraction to estimate a diet-based TEQ for mammals.

To calculate the expected bioaccumulation of dioxins/furans in the plant and earthworm, congeners were summed and a surrogate BCF, based on 2,3,7,8-TCDD, was used to estimate dioxin uptake. Since dioxins/furans are comprised of several congeners, each of which may bio-accumulate at a

unique rate, the use of the 2,3,7,8-TCDD BCF to represent all congeners may over-estimate or under-estimate total dioxins/furans in the diet.

Water quality criteria are developed for the dissolved chemical fraction which is considered the chemical fraction that is most bioavailable to aquatic life. The surface water samples collected from Agua Chinon Wash were not filtered. Therefore the samples include the total of dissolved metals plus the concentration of metals associated with suspended particles. The comparison of total metals to California WQC thus overestimates the bioavailable metals and thus overestimates potential risk to aquatic life.

9.2.11.3 UNCERTAINTY IN THE HAZARD QUOTIENT METHOD

The use of HQs for the assessment of risk presents some level of uncertainty. Primarily, calculation of an HQ is based on exposure modeling and development of TRVs, two exercises that have uncertainty in and of themselves. Although the endpoints measured in most toxicological studies used to generate TRVs were the same (development/reproduction/survival), the effects of simultaneous exposure to multiple contaminants may be, for example, synergistic or antagonistic (i.e., not necessarily additive). Thus, HQ values for specific chemical, receptor, and pathway combinations are absent. This potentially contributes to underestimating the HQ values for the pathway and, consequently, the HQ for the receptor from all pathways.

9.2.12 Risk Characterization

The results of the Tier 1, Step 2 risk estimates indicate that 11 metals, 1 semivolatile and dioxins/furans (mammal and bird) in surface soil, 6 metals in sediment, and 11 metals in surface water at AA 3 may cause adverse effects to terrestrial ecological receptors and aquatic life.

9.2.12.1 SURFACE SOIL

Four of the maximum soil concentrations for analytes that have HQs of 1 or greater (including cadmium, chromium, vanadium, and zinc) were detected in the surface soil sample collected at HA22, located in the north-central portion of AA 3 (see Figure 4-1 for locations). The maximum surface soil concentrations of total 2,3,7,8-TCDD (mammal and bird) were also detected in the north-central portion of AA 3, at HA26 (see Figure 4-1 for locations).

Locations of the remaining maximum detected concentrations of metals in soil that had HQs of 1 or greater were located in soil samples HA01 (antimony), HA03 (mercury), HA04 (lead), and HA19 (selenium), (see Figure 4-1 for locations).

The maximum soil concentration for one metal (nickel), which has an HQ greater than 1.0, was detected in Trench Sample AA 3-2E-01 (see Figure 4-1 for locations).

Aluminum was removed from the COPEC list because the minimum soil pH was 6.41 and the mean soil pH was 8.45. EPA Guidance (EPA 2003d) states that aluminum should be eliminated as a COPEC from sites with soil pH greater than 5.5.

9.2.12.2 SEDIMENT

The maximum concentrations of cadmium, mercury, nickel, vanadium, and zinc were detected in the upgradient Sediment Sample LK289 had HQs of 1 or greater (see Figure 4-1 for locations).

Aluminum was removed from the COPEC list because the minimum sediment pH was 8.78 and the mean soil pH was 8.84. EPA Guidance (EPA 2003d) states that aluminum should be eliminated as a COPEC from sites with soil pH greater than 5.5.

9.2.12.3 SURFACE WATER

Of the 12 detected in the surface water, 11 have HQs of 1 or greater. These include aluminum, barium, beryllium, cadmium, chromium, cobalt, lead, manganese, nickel, vanadium, and zinc. These metals were also detected in the downgradient Surface Water Sample LK287, (see Figure 4-1 for location). The maximum concentration of aluminum in surface water was detected in the upgradient Surface Water Sample LK286. Beryllium and manganese were detected at the same concentration at the downgradient (LK287) and upgradient location (LK286) (see Figure 4-1 for locations).

The majority of the flow through the Wash is from residential runoff upgradient of the site, which is the likely source of (non-point source) chemicals in the surface water. Because the flow in the Wash is ephemeral, there is no aquatic community present in the area. Sites downgradient will receive a relatively small proportion of their water from the AA 3 footprint. The surface water concentrations of the 11 metals with HQs of 1 or greater in the downgradient location also have concentrations that exceed the screening criteria in the upgradient location, indicating that runoff from upgradient could likely be the contributing source of potential risk to aquatic life. Therefore, the effect of runoff from AA 3 on downgradient aquatic communities is expected to be minimal.

9.2.13 Tier 1, Step 2 Exit Criteria

Three outcomes are possible at this point in the SRA:

- There is adequate information to conclude that the ecological risks are negligible and therefore there is no need for further evaluation or remediation on the basis of ecological risk;
- The information is not adequate to make a decision at this point, and the ERA process will continue to Step 3; or
- The information indicates a potential for adverse ecological effects, and a more thorough assessment is warranted.

9.2.14 Summary, Conclusions, and Recommendations of Tier 1 SRA

9.2.14.1 SUMMARY AND CONCLUSIONS

9.2.14.1.1 Plants and Invertebrates

The maximum soil concentrations of chromium, selenium, vanadium, and zinc exceed plant and invertebrate screening concentrations (ORNL soil benchmark). These concentrations result in HQs of 1 or greater, which indicate a potential for adverse effects to lower trophic level ecological receptors. Two VOCs, 14 SVOCs, and dioxins/furans detected in surface soil did not have ORNL soil benchmark concentrations.

9.2.14.1.2 Bird and Mammal Receptors

The maximum soil concentrations of antimony, cadmium, chromium, lead, mercury, nickel, selenium, vanadium, zinc, and total 2,3,7,8-TCDD (mammal and bird) result in HQ values equal to or greater than 1, which indicate a potential for adverse effects to terrestrial mammal and bird receptors at AA 3.

The maximum sediment concentrations for cadmium, mercury, nickel, vanadium and zinc result in HQs of 1 or greater, which indicate a potential for adverse effects to terrestrial mammal and bird receptors at AA 3 that forage in the riparian habitat along the Agua Chinon Wash.

9.2.14.1.3 Aquatic Life

The maximum surface water concentrations of aluminum, barium, beryllium, cadmium, chromium, cobalt, lead, manganese, mercury, nickel, vanadium, and zinc exceed surface water screening concentrations (NRWQC or Great Lakes Tier II values). These concentrations result in HQs of 1 or greater, which indicate a potential for adverse effects to aquatic organisms that may be exposed to runoff in the Agua Chinon Wash.

9.2.14.2 COPECs Retained for Tier 2, Step 3a BERA

Table 9-11 presents the list of COPECs that are retained after the SRA because HQ values are 1 or greater in their respective media.

Table 9-11: COPECs for Tier 2, Step 3a – BERA List 1

COPEC	Hazard Quotient Values Equal to or Greater than 1		
	Surface Soil	Sediment	Surface Water
Metals			
Antimony	X	NA	NA
Barium	–	–	X
Beryllium	–	NA	X
Cadmium	X	X	X
Chromium	X	X	X
Cobalt	–	–	X
Lead	X	–	X
Manganese	–	–	X
Mercury	X	X	NA
Nickel	X	X	X
Selenium	X	X	NA
Silver	X	–	–
Vanadium	X	X	X
Zinc	X	X	X
SVOC			
Diethylphthalate	X		
Dioxins/Furans			
Total 2,3,7,8-TCDD (Mammal)[1]	X	NA	NA
Total 2,3,7,8-TCDD (Bird)[1]	X	NA	NA

Notes:
[1] TEQ value calculated based on TEFs for birds and mammals respectively.
–= HQ value did not exceed 1 for COPEC in this medium
BERA = baseline ecological risk assessment
COPEC = chemical of potential ecological concern
HQ = hazard quotient
NA = analyte is not a COPEC in this medium (not applicable)
TCDD = tetrachlorodibenzodioxin
TEF = toxicity equivalency factor
TEQ = toxicity equivalency quotient
X = HQ is 1 or greater for noted COPEC and medium

Table 9-12 presents the list of COPECs that are retained after the SRA because their maximum reporting limit ranges exceed their respective screening criteria in at least one sample.

Concentrations of 10 metals, 7 PAHs, diethylphthalate, and dioxins/furans (mammal and bird) in surface soil, 7 metals in sediment, and 10 metals in surface water have HQ values equal to or greater than 1. Therefore, the site fails the SRA and soil, sediment, and surface water pathways require further evaluation in a BERA.

As mentioned in Section 9.1.2 and shown in the flowchart of Figure 9-2, there are three possible outcomes (exit criteria) after screening the site in accordance with Steps 1 and 2 of the Tier 1 SRA. Since the SRA indicated risks to plant, invertebrate, and terrestrial receptors using conservative screening values and had associated uncertainties, the outcome of the Tier 1 was that the information evaluated in Tier 1, Steps 1 and 2 (SRA) is not sufficient to make a decision, and the ERA process for the site will continue to Tier 2, Step 3a (BERA).

Table 9-12: COPECs for Tier 2, Step 3a – BERA List 2

COPEC	COPECs with Maximum Reporting Limit Ranges > Screening Criteria		
	Surface Soil	Sediment	Surface Water
Metals			
1,2,4-Trichlorobenzene	X	NA	NA
1,4-Dichlorobenzene	X	NA	NA
2,4,5-Trichlorophenol	X	NA	NA
2,4,6-Trichlorophenol	X	NA	NA
2,4-Dinitrophenol	X	NA	NA
4-Nitrophenol	X	NA	NA
Copper	–	–	X
Hexachlorocyclopentadiene	X	NA	NA
Mercury	X	X	NA
Molybdenum	X	NA	NA
Pentachlorophenol	X	NA	NA
Thallium	X	NA	NA

NOTES:
- = maximum reporting limit range did not exceed screening value
> = greater than
BERA = baseline ecological risk assessment
COPEC = chemical of potential ecological concern
NA = Analyte is not a COPEC in this medium
X = maximum reporting limit exceeds screening value

9.2.14.3 RECOMMENDATIONS

Based on the qualitative and quantitative results of the SRA, it is recommended that the COPECs listed in Tables 9-11 and 9-12 be retained as COPECs and evaluated in a Tier 2, Step 3a BERA (Section 9.3).

9.3 BERA PROCESS – TIER 2, STEP 3A

9.3.1 Introduction

The SRA for AA 3 is presented in Sections 9.1 and 9.2, and includes Tier 1, Steps 1 and 2. These steps were conducted in accordance with the EPA guidance (EPA 1997b), U.S. Navy ERA guidelines (DON 1999), and the Final RSE Work Plan (Earth Tech 2002a).

Refer to the Step 1 procedures in Section 9.2 for the ecological site description, COPECs, as well as assessment endpoints, measurement endpoints, representative species, exposure pathway analysis, the development of a CSM, and toxicity evaluation. Refer to Step 2 procedures in Section 9.3 for exposure estimations and screening level risk characterization.

The BERA Tier 2, Step 3a uses the same representative species, exposure pathways, and TRVs, with refined exposure assumptions to more accurately estimate the potential risk to ecological receptors from COPECs that failed the conservative Tier 1 screening process. NOAEL-based TRVs are retained in this BERA because it is assumed that endangered birds may occasionally utilize part of the site for foraging, and NOAEL-based TRVs are protective at the individual level.

9.3.2 Overview of Tier 2, Step 3a BERA Process

The Tier 2 ERA represents the BERA and follows a five-step process to evaluate ecological risks and to determine if site remediation is warranted from an ecological perspective. The five steps that make up Tier 2 (Steps 3 through 7) are consistent with and analogous to Steps 3 through 7 of the EPA Superfund process for an ERA. The Tier 2 BERA includes two sets of decision criteria (Step 3a and Step 7) for exiting from or proceeding with the ERA process.

The dual objectives of Tier 2, as specified in the Navy ERA policy, are to address risk management and decision-making considerations, and to identify assessment objectives to avoid multiple iterations of the BERA. The purpose of Tier 2, Step 3a is to reevaluate COPECs that were retained from Tier 1 for further evaluation in a Tier 2 BERA and to identify and eliminate from further consideration those COPECs that were retained because of the use of very conservative exposure scenarios. Using less conservative (but more realistic) assumptions, the Tier 1 SRA risk estimates will be recalculated. These recalculated risk estimates will then be used to refine the list of COPECs identified in the Tier 1 SRA in order to remove some or all of the COPECs from further consideration. The Step 3a of Tier 2 questions that would help refine the Tier 1 SRA are:

- Do site contaminant concentrations exceed background levels? (background risks)
- Are high concentrations and risks widespread across the site or limited to discrete locations? (magnitude and extent of contamination and risk)
- Could the COPEC be in a chemical form that is less hazardous? (bioavailability of the COPEC)

This Tier 2, Step 3a evaluation will involve the refinement of conservative exposure assumptions used in the SRA, including re-estimation of risk using HQs, use of 95 percent UCLs in place of

maximum soil concentrations to represent exposure concentration, use of mean body weights and food ingestion rates, use of diet fractions typical of each representative species as identified in the literature, and comparison of concentrations of inorganics to background concentrations.

The Step 3a reevaluation/refinement process is the first step in the BERA problem formulation and will follow these steps (Navy ERA process):

- Revise exposure factor assumptions and recalculate doses and HQ risk estimates. This step may also include usage of 95 percent UCL value in place of maximum detected concentration to represent the EPC.
- Identify COPECs with HQ less than 1.0 and eliminate from further evaluation.
- For inorganic COPECs with HQ greater than 1.0, compare maximum concentrations to background levels. Identify COPECs present at concentrations below background, and propose these for elimination from further evaluation.
- For COPECs with HQ greater than 1.0, examine detection frequency, identify COPECs with low detection frequencies (and sufficient data from acceptable site characterization), and propose these for elimination from further evaluation if they do not represent a "hot spot."
- For COPECs with HQ greater than 1.0, consider bioavailability, identify COPECs likely to be biologically unavailable, and propose these for elimination from further evaluation.

After the reevaluation/refinement, the decision criteria for Tier 2, Step 3a are:

- If the reevaluation of the conservative exposure assumptions used in the SRA supports an acceptable risk determination for all COPECs, then a no further action designation is warranted and the site *exits* the ERA process.
- If the reevaluation of the conservative exposure assumptions does not support an acceptable risk determination and continues to indicate an unacceptable risk for at least 1 COPEC, then the site *continues* the BERA process to Step 3b.

Similar to Tier 1 SRA process, Tier 2 Step 3a utilizes existing data with additional information obtained primarily from existing literature. Additionally, Step 3a employs the same dose models and risk characterization methods as those used in the Tier 1, with changes to the values of some input parameters.

9.3.3 Tier 2, Step 3a – Refinement of Exposure Factors

9.3.3.1 Refinement of the COPEC List

All chemicals detected in soil (0-foot to 6 feet bgs), sediment, and surface water that exceeded screening values for plants and invertebrates, or had HQ values of 1 or greater for terrestrial ecological receptors or aquatic life, at AA 3 were retained for further evaluation in Tier 2, Step 3a of the BERA. Also, those chemicals whose maximum reporting limit ranges were greater than their respective screening values and were not detected in any sample of that particular medium were also retained for discussion in Tier 2, Step 3a. See Tables 9-11 and 9-12 of the SRA for the complete list of COPECs retained for further evaluation in Tier 2, Step 3a.

9.3.3.2 REFINEMENT OF EXPOSURE FACTORS

The most conservative species-specific exposure factors were used to estimate Tier 1, Step 2 exposure. In Tier 2, Step 3a, more realistic exposure factors are substituted in the exposure equations (Table 9-13) and the resulting uptake or intake is divided by the TRVs to estimate the potential for adverse effects to ecological receptors expressed as HQs. More realistic exposure concentrations are used to calculate chemical-specific exposure factors (Appendix E2.7) based on the 95 percent UCL, if applicable. Exposure of terrestrial receptors across the site is adjusted based on species-specific site use factors (see Section 9.2.5). If the HQ exceeds 1, then it is assumed that there is a potential for adverse effects.

9.3.3.3 REFINEMENT OF TRVS

Generally in a BERA, LOAEL–based TRVs can be used to reevaluate the potential for adverse effects to representative species. NOAEL based TRVs represent a no-effect level of exposure and protect species at the individual level. This is appropriate for assessing the risk to endangered species where every individual may contribute to the survival of the species and an adverse effect may result in death. LOAELs identify the lowest exposure at which an adverse effect may occur. It does not indicate that an adverse effect will occur, only that a lower threshold has been exceeded.

Individuals of a species do not exist in isolation from other members of the species, but instead exist as a member of a population that interacts with other plant and animal species in the area as a community. At the population level, an individual death is not important in maintenance of a healthy population (Odum, 1971). A population is sustained by a balance between a death rate (mortality) and a birth rate (natality). When the mortality exceeds natality the population size decreases. When natality exceeds mortality the population size increases. Normally a population responds to increased mortality by increasing natality through density-dependent population regulation mechanisms mediated through the endocrine system. LOAELs are used to estimate the potential for adverse effects at the population level. The calculation of HQs based on both LOAELs and NOAELs gives Risk Managers a risk range to consider in making risk management decisions for a site.

Although habitat on the site does not support endangered species, because endangered species are known to forage and nest in habitat adjacent to the site, NOAEL-based TRVs were retained for the BERA. The use of only NOAEL-based TRVs in the BERA overestimates risk to species at the population level.

The proposed exposure refinements include the following:

- Assume SUF is the area of the contamination at the site divided by the species foraging area. The area of AA3 is approximately 3.64 hectares; the area of the Aqua Chinon Wash riparian habitat is approximately 0.67- hectare.
- Assume animal weight is the mean for the species.
- Assume food ingestion rate is the mean for the species.
- Use literature-derived diet fraction for incidental soil, plant, and soil invertebrate ingestion.
- Use 95 percent UCL of the mean to represent the upper limit average EPC (if the 95 percent UCL is less than the maximum; see Appendix E2, Table 1-8).

Table 9-13: Summary of BERA Species-Specific Exposure Factors

Factor	Value	Reference
Ornate Shrew		
Mean body weight (kg)	0.0059	Brown et al. (1996)
Mean foraging area (ha)	0.22	Platt (1976) (for short-tailed shrew)
Mean Food intake (mg/d, dry wt)	1,119 [a]	Nagy (2001)
Water intake (mL/day)	1.0 [b]	EPA (1993)
Diet Partition Factor	0.06 (soil)	Derived from Beyer et al. (1994)
	0.0 (plant) 0.94 (animal)	Derived from DOI (2002)
Deer Mouse		
Mean body weight (kg)	0.0196	Derived from Schlesinger and Potter (1974)
Mean foraging area (ha)	0.1	Bowers and Smith (1979)
Mean Food intake (mg/d, dry wt)	3,322 [a]	Nagy (2001)
Water intake (mL/day)	2.9 [b]	EPA (1993)
Diet Partition Factor	0.02 (soil)	Derived from Beyer et al. (1994)
	0.49 (plant) 0.49 (animal)	Derived from EPA (1993)
Long-Tailed Weasel		
Mean body weight (kg)	0.265	Derived from Baker (1983)
Mean foraging area (ha)	12	Burt and Grossenheider (1976)
Mean Food intake (mg/d, dry wt)	16,058 [a]	Nagy (2001)
Water intake (mL/day)	30 [b]	EPA (1993)
Diet Partition Factor	0.03 (soil)	Beyer et al (1994), similar to fox
	0.00 (plants) 0.97 (animals)	Derived from Burt and Grossenheider (1976)
Western Meadowlark		
Mean body weight (kg)	0.0941	Lanyon (1962)
Mean foraging area (ha)	3	Schoener (1968)
Mean Food intake (mg/d, dry wt)	14,038 [a]	Nagy (2001)
Water intake (mL/day)	12.1 [b]	EPA (1993)
Diet Partition Factor	0.093 (soil)	Beyer et al., (1994), turkey as surrogate
	0.339 (plant) 0.568 (animal)	Derived from Lanyon (1994)
Spotted Towhee		
Mean body weight (kg)	0.0405	Clench and Leberman (1978)
Mean foraging area (ha)	3.8	Derived from Barbour (1941)
Mean Food intake (mg/d, dry wt)	7,893 [a]	Nagy (2001)
Water intake (mL/day)	6.9 [b]	EPA (1993)
Diet Partition Factor	0.093 (soil)	Beyer et al., (1994), turkey as surrogate
	0.269 (plants) 0.638 (animals)	Derived from Martin et al. (1961)
Mourning Dove		
Mean body weight (kg)	0.119	Dunning (1993)
Mean foraging area (ha)	0.45	Schoener (1966)
Mean Food intake (mg/d, dry wt)	16,479 [a]	Nagy (2001)

Table 9-13: Summary of BERA Species-Specific Exposure Factors

Factor	Value	Reference
Water intake (mL/day)	14.2 [b]	EPA (1993)
Diet Partition Factor	0.093 (soil)	Beyer et al., (1994), turkey as surrogate
	0.907 (plants) 0.00 (animal)	Derived from Erlich et al., (1988)
Red-Shouldered Hawk		
Mean body weight (kg)	0.559	Hartman (1961)
Mean foraging area (ha)	36.8	McCrary (1982)
Mean Food intake (mg/d, dry wt)	56,291 [a]	Nagy (2001)
Water intake (mL/day)	40 [b]	EPA (1993)
Diet Partition Factor	0.02 (soil)	Derived from Beyer et al. (1994)
	0.00 (plants) 0.98 (animal)	Derived from Polite (2003)

Notes:
[a] Dry weight food intake estimated based on algorithm given in Nagy (2001).
[b] Water intake estimated based on algorithm given in EPA (1993).
BERA = baseline ecological risk assessment
ha = hectare
kg = kilograms
mg/d = milligrams per day
mL = milliliter
wt = weight

9.3.4 Risk Calculations

9.3.4.1 Soil

The HQ results of risk calculations based on more realistic exposure assumptions for soil COPECs are presented in Appendix E2 Tables 8-1 to 8-6 and summarized in Table 9-14 for receptors with HQs greater than 1.

Antimony, cadmium, chromium, lead, mercury, nickel, selenium, silver vanadium, zinc, diethylphthalate, and total 2,3,7,8-TCDD (mammal and bird) were further evaluated for potential risk because their HQ values were 1 or greater in Tier 1, Step 2 risk calculations.

The HQ values for antimony, cadmium, nickel, selenium, zinc, and 2,3,7,8-TCDD (mammal) in soil are greater than 1 for at least one receptor. Chromium, lead, mercury, silver, vanadium, diethylphthalate, and 2,3,7,8-TCDD (bird) have HQ values that do not exceed 1 with respect to all receptors.

Molybdenum, thallium, 1,2,4-trichlorobenzene, 1,4-dichlorobenzene, 2,4,5-trichlorophenol, 2,4,6-trichlorophenol, 2,4-dinitrophenol, 4-nitrophenol, hexachlorocyclopentadiene, and pentachlorophenol were also carried through to Tier 2, Step 3a because their respective maximum reporting limit ranges exceeded the soil screening value for ecological risk and could be underestimated. However, these COPECs were not detected in surface soil at the site; therefore, they cannot be further evaluated in Tier 2, Step 3a. The lack of lower reporting limits for these chemicals may underestimate risk to terrestrial receptors at AA 3.

Table 9-14: Tier 2, Step 3a, Hazard Quotient Values Greater than 1 for Soil COPECs after Tier 2, Step 3a BERA Calculations

COPEC	Ornate Shrew	Deer Mouse	Long-Tailed Weasel	Mourning Dove	Western Meadowlark	Red-Shouldered Hawk
Metals						
Antimony	2E+00	–	–	6E+00	8E+00	–
Cadmium	2E+00	–	–	–	–	–
Chromium	–	–	–	–	–	–
Lead	–	–	–	–	–	–
Mercury	–	–	–	–	–	–
Nickel	9E+00	5E+00	–	–	–	–
Selenium	2E+00	2E+00	–	–	–	–
Silver	–	–	–	–	–	–
Vanadium	–	–	–	–	–	–
Zinc	4E+00	3E+00	–	–	–	–
SVOCs						
Diethylphthalate	–	–	–	–	–	–
Dioxins/Furans						
Total 2,3,7,8-TCDD (mammal)	7E+00	3E+00	–	NA	NA	NA
Total 2,3,7,8-TCDD (bird)	NA	NA	NA	–	–	–

Notes:
— = HQ does not exceed 1 for this receptor
BERA = baseline ecological risk assessment
COPEC = chemical of potential ecological concern
NA = Analyte is not a COPEC in this medium (not applicable)
SVOC = semivolatile organic compound
TCDD = tetrachlorodibenzodioxin

9.3.4.2 Sediment (Mulefat Scrub Habitat)

HQ results of risk calculations based on more realistic exposure assumptions for sediment COPECs are presented in Appendix E2.9. Table 9-15 presents the receptors with HQs greater than 1.

Cadmium, mercury, nickel, vanadium, and zinc were further characterized for potential risk because their HQ values were 1 or greater in Tier 1, Step 2 risk calculations.

The HQ values for nickel, and zinc in sediment are greater than 1 for at least one receptor. Two Tier 2 metals in sediment, mercury, and vanadium, have an HQ value that do not exceed 1 with respect to all receptors.

Table 9-15: Hazard Quotient Values Greater than 1 for Sediment COPECs after Tier 2, Step 3a BERA Calculations

COPEC	Ornate Shrew	Deer Mouse	Long-Tailed Weasel	Mourning Dove	Spotted Towhee	Red-Shouldered Hawk
Metals						
Nickel	3E+00	2E+00	–	–	–	–
Zinc	3E+00	2E+00	–	–	–	–

Notes:
— = HQ does not exceed 1 for this receptor
BERA = baseline ecological risk assessment
COPEC = chemical of potential ecological concern

9.3.4.3 SURFACE WATER

Surface water risk calculations for Tier 2, Step 3a could not be refined because 95 percent UCL values were not available and more realistic exposure assumptions are not available.

Copper was also carried through to Tier 2, Step 3a because its respective maximum reporting limit range exceeded the surface water screening value for the protection of aquatic life and could be underestimated. However, this COPEC was not detected in surface water at the site; therefore, it cannot be further evaluated in Tier 2, Step 3a.

9.3.4.4 GROUNDWATER

The HQ results of risk estimates for herbivorous terrestrial wildlife that eat plant material from phreatophytes taking up COPCs from groundwater are presented in Appendix E2, Part 5. The Tier 1 HQ value for selenium consumed in phreatophytes by representative mammals was 2, assuming that they eat nothing but phreatophytes. The exposure to phreatophyte food is reduced using Tier 2 exposure assumptions. Therefore, there is minimal potential for adverse effects to terrestrial birds and mammals from eating phreatophytes that have taken up site groundwater.

9.3.5 Background Screening

This step eliminates inorganic COPECs (inorganic COPECs retained after Tier 2, Step 3a [if HQ greater than 1]) that are detected at concentrations within or equal to background concentrations (BNI 1996) typical of uncontaminated soil. No organic preliminary COPECs in any medium, regardless of whether or not they may occur naturally, were screened out by this method; all were retained for further screening. Background screening was used only for inorganic COPECs in soil by first comparing each COPEC maximum concentration from site soil to background concentrations. Five inorganic chemicals in surface soil, including antimony, cadmium, nickel, vanadium, and zinc, were within the Station-wide background concentrations (see Table 9-16).

Selenium has a maximum detected soil concentrations that exceeds the Station-wide background concentrations. The 95 percent UCL for selenium also exceeds its background concentration at AA 3 (Table 9-16).

Table 9-16: Comparison of Maximum and 95% UCL COPEC Concentrations in Soil to Background Concentrations – Inorganic COPECs only

Metals	Maximum Detected Concentration (mg/kg dw)	95% UCL of the Mean (mg/kg dw)	Surface Soil Background Concentration* (mg/kg dw)	Maximum Detected Soil Concentration Exceeds Background?	95% UCL Concentration Exceeds Background?
Antimony	2.1	n/a	3.06	No	n/a
Cadmium	1	0.699	2.35	No	No
Nickel	13.7	8.28	15.3	No	No
Selenium	1.1	0.543	0.32	**Yes**	**Yes**
Vanadium	44.1	28.1	71.8	No	No

Table 9-16: Comparison of Maximum and 95% UCL COPEC Concentrations in Soil to Background Concentrations – Inorganic COPECs only

Metals	Maximum Detected Concentration (mg/kg dw)	95% UCL of the Mean (mg/kg dw)	Surface Soil Background Concentration* (mg/kg dw)	Maximum Detected Soil Concentration Exceeds Background?	95% UCL Concentration Exceeds Background?
Zinc	57.1	38.2	77.9	No	No

Notes:
* BNI 1996. Final Technical Memorandum, Background and Reference Levels, Remedial Investigations. San Diego, CA.
% = percent
COPEC = chemical of potential ecological concern
dw = concentration listed on a dry weight basis
mg/kg = milligrams per kilogram
n/a = Only one detection above reporting limit for this data set; therefore, the 95% UCL could not be computed and compared to the background concentration.
UCL = upper confidence limit

Background screening was also used for inorganic COPEC exceedances (nickel and zinc) in sediment by comparing each COPEC maximum concentration from site sediment to site soil background concentrations. Ninety-five percent UCL values were not available for sediment, so this comparison could not be made. Both chemicals (nickel and zinc) were within the Station-wide soil background concentrations (Table 9-17).

Table 9-17: Comparison of Maximum and 95% UCL COPEC Concentrations in Sediment to Background Concentrations – Inorganic COPECs only

Metals	Maximum Detected Concentration (mg/kg dw)	Surface Soil Background Concentration* (mg/kg dw)	Maximum Detected Sediment Concentration Exceeds Background?
Nickel	2.8	15.3	No
Zinc	13.5	77.9	No

Notes:
* BNI 1996. Final Technical Memorandum, Background and Reference Levels, Remedial Investigations. San Diego, CA.
% = percent
COPEC = chemical of potential ecological concern
dw = concentration listed on a dry weight basis
mg/kg = milligrams per kilogram
UCL = upper confidence limit

9.3.6 Risk Characterization

9.3.6.1 Soil

The following five metals in soil, antimony, cadmium, nickel, selenium, and zinc, have HQ values greater than 1 after the Tier 2, Step 3a risk calculations. However, four COPC maximum soil concentrations (0-foot to 6 feet bgs) were within the Station-wide background concentrations. Therefore, site activities did not result in a release of these metals that would cause adverse effects to terrestrial wildlife at AA 3.

Uncertainty exists in the bioavailability of selenium. Risk (HQ=2) from selenium is being driven by invertebrate ingestion, which accounts for 81 percent of the total ingested dose for the deer mouse and 98 percent of the total ingested dose for the ornate shrew. The concentration of selenium in the soil invertebrates is estimated from soil concentration using a regression equation developed by Sample et al. (1998). The fit of the 13 data points to the line shows some variability, resulting in

uncertainty of the predicted BCF. This may over-estimate or under-estimate exposure and risk. Although, the maximum concentration and 95 percent UCL of selenium exceed the Station-wide background concentration, in the western part of the U.S., soil has naturally high levels of selenium compounds (ATSDR 1994). In addition, since the background determination is a statistically based approach, it is not unexpected that a certain number of samples will exceed the 95th percentile yet still be within the true population or, in other words, still be indicative of naturally occurring concentrations. Since other metals at the site do not show signs of anthropogenic influence, the Station-wide background concentrations may underestimate naturally high levels of selenium in soil at AA 3.

The selenium HQ of 2 is also based on comparison to a NOAEL-based TRV which is a no-effect dose that is protective at the individual level. A LOAEL-based TRV would be expected to be approximately 1 order of magnitude higher with a resulting HQ = 0.2 and is protective at the population level.

For 2,3,7,8-TCDD TEQ (mammal), the BERA risk calculations for the ornate shrew (HQ=7) and the deer mouse (HQ=3) are based on NOAEL-based TRVs. Since no endangered mammals are known from the area, a LOAEL-based TRV can be used to estimate a low-effect HQ to assess risk at the population level. The LOAEL-based HQ for the ornate shrew (HQ = 0.7) and the deer mouse (HQ = 0.3) are both below the point of departure of 1. This suggests that small mammal populations are not at risk from site dioxins/furans, although certain individuals may be.

The bioavailability of dioxins/furans in soil may also be overestimated. Large organic molecules such as dioxins/furans bind tightly with organic matter found in natural soil and may not be generally bioavailable.

Finally, the BERA risk calculations of dioxins/furans for the ornate shrew (HQ=7) and the deer mouse (HQ=3) are based on the 95 percent UCL (9.99 pg/g) soil concentration. This value is driven by a high variance caused by elevated concentrations detected in 2 out of 11 surface soil samples analyzed for dioxins/furans, HA31 and HA26, located in the northwest corner of AA 3. Because of the 2 elevated sample values, the estimated exposure of mammals to 2,3,7,8-TCDD is likely overestimated resulting in an overestimation of estimated risk.

The HQ values for lead, mercury, and 2,3,7,8-TCDD (bird) in soil were 1 or less for all receptors; therefore, these COPECs do not present significant threats of adverse effects to wildlife at AA 3.

9.3.6.2 SEDIMENT

Three metals in sediment of the Agua Chinon Wash had HQ values greater than 1 after the Tier 2, Step 3a risk calculations (Appendix E2.9), including, nickel, vanadium, and zinc. However, the maximum sediment concentrations of these metals were within the Station-wide background soil concentrations. Therefore, these metals do not present a threat of adverse effect to wildlife that forage in the Agua Chinon Wash.

The HQ values for cadmium, and mercury, in sediment was 1 or less for all receptors; therefore, these COPECs do not present a significant threat of adverse effects to wildlife at AA 3.

9.3.6.3 SURFACE WATER

Potential risk to aquatic life in surface water at AA 3 is indicated for several COPECs in surface water. Aluminum, barium, beryllium, cadmium, chromium, cobalt, lead, manganese, nickel, vanadium, and zinc have HQs of 1 or greater. These were detected in the downgradient Surface

Water Sample LK287. The maximum concentration of aluminum (HQ>1) in surface water was detected in the upgradient Surface Water Sample LK286. Beryllium was detected at the same concentration at downgradient (LK287) and upgradient location (LK286). Copper was not detected in surface water, but its reporting limit exceeded the CTR chronic water quality criteria, thus the risk to aquatic organisms from copper exposure cannot be estimated quantitatively.

However, evaluation of the ecological risk from other media suggests that anthropogenic activities have not had a negative effect on ecological receptors. In general, the concentrations of inorganic chemicals in the Agua Chinon Wash, where it enters the site via a culvert, are nearly the same as concentrations in surface water leaving the site (at the foot bridge). This suggests that the presence of AA 3 has no effect on the water quality of the Wash.

9.3.7 Conclusions of Tier 2, Step 3a BERA Process

In reevaluating ecological risk based on refined exposure assumptions, the exposure of ecological receptors to 2,3,7,8-TCDD TEQ (mammal), the LOAEL-based HQ for the ornate shrew (HQ = 0.7) and the deer mouse (HQ = 0.3) are both below the point of departure of 1. This suggests that small mammal populations are not at risk from site dioxins/furans, although certain individuals may be. The bioavailability of dioxins/furans in soil may also be overestimated. Large organic molecules such as dioxins/furans bind tightly with organic matter found in natural soil and may not be generally bioavailable. Risk Managers should consider the risk range (HQ = 2 to 0.2 for the shrew and deer mouse in making decisions regarding further action regarding surface soil at the site.

Ecological risk from exposure to sediment at AA 3 does not present a significant threat of adverse effects to wildlife (based on refined exposure assumptions for sediment). Although potential risk to aquatic life in surface water at AA 3 is indicated for several COPECs in surface water, concentrations in COPECs in the upgradient and downgradient samples were similar, so AA 3 has not had an adverse impact on water quality in the Agua Chinon Wash. Therefore, evaluation of the ecological risk from other media suggests that anthropogenic activities have not had a negative effect on ecological receptors.

10. CONCLUSIONS OF REMEDIAL INVESTIGATION

- Based on evaluation of historical information, all non-contiguous anomalies associated with AA 3 (i.e., APHO60-1952C, APHO60-1952D, APHO61-1960A, APHO61-1960B, APHO61-1960D, APHO61-1960E, APHO61-1960F, and APHO62-1967B) did not warrant further investigation. The site characterization and an evaluation of the nature and extent of contamination of all media (air, soil, landfill gas, groundwater, surface water, and sediment) with respect to all contiguous APHO anomalies associated with AA 3 (i.e., APHO59-1946A, APHO59-1946B, APHO59-1946C, APHO60-1952A, APHO60-1952B, APHO61-1960C, APHO62-1967A, APHO63-1981A APHO64-1988A, and APHO65-1992A) are complete.

- Debris placement delineation is complete, and it is consistent with previous estimates developed using the historic and current topographic maps. Site characterization indicates that predominantly construction-related debris is placed within the limits of AA 3. Based on results from two trenching activities (pre-RSE and RSE investigations) and subsurface exploration conducted during the soil gas survey, it was confirmed that the existing soil cover averages 4.5 feet with isolated areas having as little as 2 feet of soil cover.

  Based on all trenching activities, borehole data, and historical topographic maps, the lateral and vertical limits of construction debris placement, and the existing soil cover depth, are consistent with the initial demarcation of debris placement. One area near the southeast corner of the site was revised inward. The revised area of waste placement at AA 3 is approximately 5.15 acres (225,000 square feet). The volume of waste within AA 3 is approximately 230,000 cubic yards.

- The RSE investigation collected sufficient geotechnical soil samples to adequately respond to Project Decision Questions #2 and #3. The geotechnical properties of the soil cover have been adequately characterized and these data will be used to evaluate if the existing soil cover can serve as an effective cover or foundation layer.

- Air sampling results show that integrated surface air samples are not impacted by wastes remaining at the site and the results are consistent with ambient air samples. Although low concentrations of VOCs (including common laboratory contaminants) were detected in ambient air and integrated surface air samples, VOCs were not detected in **any** of the soil gas samples collected from within the debris placement boundary. Methane was detected in integrated surface air samples at concentrations ranging from 2 ppm_v to 3 ppm_v, similar to ambient air concentrations. There is no significant difference between the upwind and downwind ambient air sample results.

- There were no VOCs detected in soil gas samples collected from the 76 sampling locations within the waste placement area. Therefore, the waste is not the source of the low concentrations of VOCs detected in selected perimeter gas monitoring wells.

- The field screening results for subsurface soil gas samples indicate that methane was not detected at 25 of 33 sampling locations. Methane was reported at 8 locations, which were only in the central portion of the site, at concentrations ranging from 6,000 ppm_v to 230,000 ppm_v. Results from only 3 of these locations exceeded the Title 27 CCR stipulated LEL of 50,000 ppm_v. Methane was not detected in any of the perimeter soil gas wells during three rounds of sampling. These results indicate that methane is confined to the central portion and is not migrating to the perimeter gas wells of the site.

- Surface soil (0-foot to1-foot bgs) has been adequately characterized and the results show few exceedances of residential EPA Region 9 PRGs. VOCs were not detected in any of the surface soil samples (37 samples at 33 locations). Only 5 SVOCs (benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, B[a]P, and dibenz[a,h]anthracene) at only 1 location out of 33 surface soil sampling locations exceed residential PRGs. 2,3,7,8-TCDD equivalents (TEQ) were determined for 9 surface soil samples. 2,3,7,8-TCDD TEQ exceeded its residential PRG at only 1 out of 9 surface soil sampling locations analyzed for dioxins and furans. All metals that were analyzed were either less than PRGs or within the background concentrations at all 33 surface soil sampling locations. Petroleum hydrocarbons were detected at very low concentrations ranging from 0.02 J mg/kg to 160 mg/kg. These results, coupled with site-specific risk assessments, indicate that surface soil does not pose unacceptable risk to environment and/or human health.

- An evaluation of analytical results from subsurface soil samples (0-foot to 10 feet bgs) indicates that potential human health risk associated with exposure to subsurface soil is similar to that of surface soil and does not pose an unacceptable risk to human health. In addition, this evaluation of subsurface analytical results shows that the construction debris does not contain any significant levels of contamination. VOCs were not reported at concentrations exceeding their respective residential PRGs. Only 1 SVOC (B[a]P equivalent concentration) in only 1 out of 33 samples exceeded its residential PRG. Asbestos and perchlorate were not detected in any of the subsurface soil samples. Of 33 samples analyzed, 19 samples had detected concentrations of diesel range petroleum hydrocarbons; however, of these 19 detections, 17 samples had concentrations ranging between 12 mg/kg to 370 mg/kg. The remaining two samples had concentrations of 1,100 mg/kg and 5,600 mg/kg. Only 2 of 33 samples analyzed for arsenic and only 1 of 33 samples analyzed for antimony, cadmium, lead, and molybdenum exceeded both Station-wide background concentrations and respective PRGs. Analytical results indicate high variability in concentrations of metals at the site, which is not uncommon and is attributed to natural conditions.

- Human health risks associated with potential exposure to volatile chemicals in indoor air in a future setting do not pose an unacceptable risk to human health for either residential or industrial exposures.

- The results of the supplemental groundwater monitoring and statistical evaluation indicated that the groundwater data collected during the Round 9 was consistent with previous monitoring rounds. In addition, the statistical evaluation concluded that debris place at AA 3 was not impacting groundwater at the point-of-compliance wells. This finding was consistent with previous conclusions that there was no statistically significant of groundwater at the point of compliance wells and that the existing soil cover at AA 3 has effectively controlled the amount of infiltration and is protective of groundwater quality. No further characterization of groundwater was necessary and a groundwater specific response action was not required. Therefore, no groundwater-specific response action is planned for AA 3. However, groundwater monitoring would be conducted consistent with potential action-specific applicable or relevant and appropriate requirements (ARARs) for soil for capping alternatives where landfill closure and postclosure requirements may be potentially relevant and appropriate.

- To assess the impact of AA 3 on the Agua Chinon Wash, four sediment samples were collected from upstream and downstream locations. The results show that all detected metal concentrations were within the Station-wide soil background concentrations. The sediment

sampling results indicate that surface water runoff and/or surface soil transport from AA 3 are not mechanisms of off-site transport of contamination.

- Two surface water samples were collected from the upstream and downstream locations to assess the potential impact on the surface water within the Agua Chinon Wash. Out of the complete suite of analyses that were conducted on the surface water samples, only two metals, aluminum and chromium were detected at concentrations exceeding their respective MCLs. However, the upstream and downstream concentrations of these constituents were comparable, indicating that the AA 3 does not impact the surface water in the Agua Chinon Wash.

- The human health risk estimates are all within or below the EPA-established risk management range of 10^{-6} to 10^{-4} and hazard indices are all below 1. The surface soils (0-foot to 1-foot bgs) and subsurface soils (0-foot to 10 feet bgs) indicate a generally acceptable risk for residential reuse scenarios, with estimated cancer risks of $4x10^{-5}$ for both surface soil and subsurface soil intervals. The risk estimates for other receptor scenarios range from less than $2x10^{-6}$ (escorted visitor - surface soil scenario) to a maximum of $3x10^{-5}$ (agricultural worker–subsurface soil scenario). A significant portion of the risk (between 66 percent and 78 percent) is attributable to B[a]P equivalents concentration. Arsenic concentrations are within the Station-wide background concentrations. Although arsenic contributes approximately 20 percent of the risk, its exclusion from risk estimates does not substantially reduce cancer risks or noncancer hazards. Excluding arsenic, cumulative lifetime cancer risks remain within the risk management range of 10^{-6} to 10^{-4}. Therefore, based on the risk assessment, the site does not pose unacceptable threat to human health.

- The evaluation of human health risks associated with potential exposure to volatile chemicals in indoor air in a future setting resulted in ILCRs for resident equal to $1x10^{-6}$ and a cumulative noncancer hazard of less than 1 (unity). Health risks for potential industrial exposures are lower.

- For human health groundwater pathway evaluation, the RME and CTE cancer risk estimates were $3x10^{-4}$ and $5x10^{-5}$, respectively, for a residential receptor at the site. Arsenic accounted for approximately three-fourths of the risk estimates. The hazard indices ranged from 7 to 6 for the RME and CTE scenarios, respectively. The primary contributors to the noncancer hazard estimate are metals – antimony, arsenic, chromium, thallium, and vanadium. The maximum detected concentration (60.3 ug/L) and the exposure point concentration of arsenic (11.0 ug/L) exceed the current MCL of 10 ug/L; however, arsenic concentrations in groundwater are within the ambient concentrations reported at other groundwater wells at former MCAS El Toro.

- Consistent with the NCP Preamble (Federal Register, Volume 55, No. 49, Page 8717), several factors were considered by the DON for recommending a response action for the site. The primary factors considered are background levels of COPCs, detection frequency, spatial distribution and mobility. Based on the low concentrations of COPCs, low frequency of detections and spatial distribution, and low mobility characteristics of the few COPCs (e.g., arsenic, SVOCs, and dioxins/furans), AA 3 does not pose an unacceptable risk to human health.

- An evaluation performed as part of ecological BERA indicates that all inorganic COPECs (with the exception of selenium) were within the Station-wide background concentrations.

The risk posed by selenium concentrations in soil at AA 3 may be naturally higher than Station-wide background and may not be attributable to anthropogenic sources. Dioxin exposures are not expected to have an adverse effect on small mammal populations. In reevaluating ecological risk in the BERA, the exposure of ecological receptors to sediments at AA 3 does not present a threat of adverse effects. Although the ecological risk due to exposure of aquatic life to surface water from the Agua Chinon Wash may cause adverse effects, these effects are not attributable to activities at AA 3, as the surface water quality at downgradient locations is similar to upgradient locations.

- The evaluation of the ecological risk from other media suggests that anthropogenic activities have not had a negative effect on ecological receptors.

- Based on the conclusions cited above, investigation of all media (air, soil, soil gas, groundwater, sediment, and surface water) and site characterization for contiguous areas associated with AA 3 are complete.

10.1 RECOMMENDATIONS

Based on the investigation findings, an adequate characterization of the nature and extent of releases has been completed. The human health and ecological risks have been quantified and are within acceptable risk management ranges. However, due to the presence of construction related debris at the site, the proximity of waste to groundwater, and the presence of elevated methane concentrations in the central portion of the site, an evaluation of response actions necessary for continued protection of human health and the environment is recommended.

11. IDENTIFICATION AND SCREENING OF TECHNOLOGIES

This FS was conducted in accordance with guidance provided in the following: DON IRP Manual (DON 2001) (which defines how the DON will satisfy the guidelines, regulations, and criteria associated with the CERCLA of 1980/SARA of 1986); the Marine Corps Environmental Compliance and Protection Manual (DON 1998); and U.S. EPA Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (U.S. EPA 1988).

11.1 INTRODUCTION

AA 3 has been identified as a debris placement area on a military base for which the CERCLA presumptive remedy approach is applicable. The presumptive remedy approach uses past experience to streamline site investigations and expedite selection of cleanup actions. Over time, presumptive remedies are expected to ensure consistency in remedy selection and reduce the cost and time required to clean up similar types of sites (U.S. EPA 1993).

Under the presumptive remedy approach, response actions selected for cleanup of military and municipal landfill sites may include only those remedies that are necessary based on site-specific conditions (U.S. EPA 1993, 1996). The potential landfill site presumptive remedies include the following:

- landfill capping;
- source area groundwater control to contain plume;
- leachate collection and treatment;
- landfill gas collection and treatment; and/or
- institutional controls (ICs) and access restrictions.

These presumptive remedies are designed to minimize the potential for exposure to buried waste through various pathways and to streamline selection of appropriate response actions.

This section identifies and screens remedial technologies that could be applied at AA 3. The five major steps performed during this process include:

1. developing remedial action objectives (RAOs);
2. developing general response actions;
3. estimating areas requiring remedial action;
4. identifying and screening general response actions and
5. identifying and evaluating technologies for preferred presumptive remedies.

The presumptive remedy screening process identifies the appropriate technologies that will be combined into remedial alternatives. These remedial alternatives are discussed and evaluated in Sections 12 and 13.

11.2 CONTAMINANTS OF POTENTIAL CONCERN

The COPCs for the site are potentially present in the air, surface soil, subsurface soil, and groundwater. Selection of these media was based on physical conditions and the nature and extent of contaminants. The following conditions summarize the characteristics of AA 3 that need to be considered when developing remedial alternatives.

- The AA 3 waste is confined to an area of approximately 5.2 acres to a depth of 22 feet bgs. The debris placement area is covered with an average of 4.5 feet with a few isolated locations having an average soil cover of 2 feet. Debris characterization within the limits of AA3 indicated predominantly construction-related debris placed within the limits of AA 3 site.

- The boundary of the waste placement was delineated using visual and geophysical surveys, borings, trenching, interviews with Navy personnel, and reviews of aerial photographs.

- Prevailing temperatures at the site are moderate to warm, and relative humidity is usually low. Rainfall is low (less than 20-inches per year) and generally occurs during the winter. The soil cover is moderately permeable.

- Air sampling results indicate low concentrations of VOCs in ambient air and integrated surface air samples. No VOCs were detected in any of the soil gas samples collected from within the waste placement boundary. Methane was detected in integrated surface air samples at concentrations ranging from 2 ppm_v to 3 ppm_v, which is similar to ambient air concentrations. There is no significant difference between the upwind and downwind ambient air sample results.

- The shallow, subsurface, and perimeter soil gas survey performed at and adjacent to AA 3 identified no VOCs associated with the site. The subsurface soil gas sample results indicated that methane was detected in 3 out of 33 locations with concentrations exceeding the Title 27 CCR (California Code of Regulations) LEL threshold of 50,000 ppm_v for methane at the site perimeter. Methane was vertically confined to the subsurface (deeper than 5 feet) and laterally confined to the central portion of the debris, and there is no evidence of lateral migration.

- Surface soil samples (0 to 1 foot bgs) contained detectable concentrations of SVOCs, and a single occurrence of dioxins/furans. Very few metals were detected at concentrations exceeding former MCAS El Toro background levels. In addition, with the exception of arsenic, no metal exceeded its residential PRG value. Arsenic concentrations exceeded its residential PRG value, but were less than the background concentration. In conclusion, metals are detected in surface soils at concentrations that reflect natural occurrence and variation in soils. No VOCs were detected in surface soil samples.

- Subsurface soil samples (greater than 1 foot bgs) contained VOCs and SVOCs with detection frequency less than 5%. Diesel-range petroleum hydrocarbons were detected at concentrations ranging from 12 mg/kg to 5,600 mg/kg. Asbestos and perchlorate were not detected in any of the subsurface soil samples.

- Groundwater samples from AA 3 contained detectable low concentrations of VOCs, SVOCs, and motor oils/diesel fuel petroleum hydrocarbons. A comprehensive statistical evaluation of the groundwater concluded that historical activities at AA 3 have not resulted in a

statistically significant release of constituents to groundwater at the point of compliance. Additionally, a significant portion of the risk associated with groundwater at AA 3 is attributable to ambient levels of arsenic. Therefore, no groundwater-specific response action is planned for AA 3. However, groundwater monitoring would be conducted consistent with potential action-specific applicable or relevant and appropriate requirements (ARARs) for soil for capping alternatives where landfill closure and postclosure requirements may be potentially relevant and appropriate.

11.3 ARARs EVALUATION

Section 121(d) of CERCLA states that remedial actions at CERCLA sites must, upon completion, meet any federal (or state if more stringent) environmental standards, requirements, criteria, or limitations that are determined to be ARARs.

In addition to ARARs, the NCP provides that conditions for which ARARs do not exist, agency advisories, criteria, or guidance are to-be-considered (TBC) criteria useful in helping to determine what is protective at a site or how to carry out certain actions or requirements (55 Federal Register 8745). The NCP preamble states, however, that provisions in the TBC category "should not be required as cleanup standards because they are, by definition, generally neither promulgated nor enforceable, so they do not have the same status under CERCLA as do ARARs."

As the lead federal agency, the DON has the primary responsibility for identifying federal ARARs at Former MCAS El Toro. Identification of state ARARs was initiated through DON requests that the DTSC identify potential state ARARs, as provided under Section 7.6 of the FFA. The solicitation of state ARARs is discussed in more detail in Appendix H. Requirements of ARARs and TBCs are divided into three categories as described below.

- Chemical-specific ARARs are health- or risk-based numerical values for various environmental media, as specified in state or federal statutes or regulations. These numerical values establish the acceptable amount or concentration of a chemical that may be present in a specific medium at a site, or that may be discharged to the site or the ambient environment during remedial activities.

- Location-specific ARARs address the areas in which remedial action takes place. Identified regulations that are potential ARARs may require actions to preserve or protect aspects of environmental or cultural resources that may be threatened by remedial actions to be undertaken at the site.

- Action-specific ARARs are regulations that apply to specific activities used to remediate a site (e.g., design criteria and performance requirements).

Potential ARARs for AA 3 have been identified in Appendix H for each medium, location, and proposed remedial action alternative. The following sections provide a summary of these potential ARARs.

11.3.1 Chemical-Specific ARARs

Soil. A hazardous waste evaluation is needed for any contaminated soil generated during remedial action prior to disposal, unless this soil is being consolidated within the same landfill site. Analytical results from previous sampling events at AA 3 indicate that a portion of the contaminated soil and debris may exhibit the characteristics of the Resource Conservation and Recovery Act (RCRA)

hazardous waste. Therefore, the RCRA waste definition requirements per CCR Title 22, §66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100 are potential federal ARARs for evaluating whether the contaminated soil or debris exhibits the characteristics of RCRA hazardous waste. Additionally, the non-RCRA, state-regulated waste definition requirements at CCR Title 22, §66261.24(a)(2) are potential state ARARs for evaluating whether the contaminated soil or debris exhibits the characteristics of California-regulated, non-RCRA hazardous waste.

Groundwater. Groundwater is not a medium of concern at AA 3. A comprehensive statistical evaluation of the groundwater concluded that historical activities at AA 3 have not resulted in a statistically significant release of constituents to groundwater at the point of compliance. Additionally, a significant portion of the risk associated with groundwater at AA 3 is attributable to ambient levels of arsenic. Therefore, no groundwater-specific response action is planned for AA 3 and groundwater ARARs are not triggered. However, groundwater monitoring would be conducted if capping of the wastes is proposed and landfill closure and postclosure requirements are determined to be potential ARARs. The potential ARARs for groundwater detection monitoring program are summarized in Section 11.3.3.

Air. Landfill gas monitoring and control would be required at AA 3 if wastes are left in-place and a cap is constructed. The substantive provisions of Title 27 CCR §20921 (a)(1), (2) and (3) and Title 27 CCR §21160 (b) for landfill gas monitoring and controls would be potential ARARs for closure of AA 3. Chemical-specific requirements are as follows:

- Concentrations of methane gas must not exceed 1.25 percent of the volume in air within on-site structures.

- Concentrations of methane gas migrating from the landfill must not exceed 5 percent by volume in air at the facility property boundary or at an alternative boundary set in accordance with Title 27 CCR §20925. The Navy has reached an agreement with the CIWMB (see Appendix L) regarding buffer zone around AA 3. In accordance with this agreement, a 100-foot buffer zone is proposed around the final waste boundary. The compliance with limitations on concentrations of methane migrating from the landfill will be evaluated at the boundary of the proposed buffer zone.

- Trace gases must be controlled to prevent adverse acute and chronic exposure to toxic and/or carcinogenic compounds.

The chemical-specific ARARs are described further in Appendix H, Section 2 and Tables H-1 and H-2.

11.3.2 Location-Specific ARARs

The HEC-RAS modeling indicated that the southeastern portion of AA 3 adjacent to the Agua Chinon Wash is within the 100-year flood plain. Therefore, the substantive requirements of CCR Title 22, § 66264.18[b] and 40 CFR § 6.302(b) and 40 CFR. pt. 6 Appendix A, (excluding § 6[a][2], 6[a][4], and 6[a][6] of Appendix A) relating to construction in a 100-year flood plain are potential ARARs for AA 3 remedial action.

California Fish and Game Code §§ 3005, 3503, 3503.5, 3800, 4150, and 4700 are potential ARARs for remedial action at AA 3 if the animal or bird species specified in the regulations are identified at the site. Measures will be taken to avoid the take of birds or animals identified in the regulations during implementation of remedial action at AA 3. In addition, the requirements of California Fish and Game Code § 5650(a) are potential ARARs for remedial action at AA 3, which prohibit the

passage of enumerated substances or materials into waters of the state deleterious to fish, plant life, or birds.

The location-specific ARARs are described further in Appendix H, Section 3 and Tables H-3 and H-4.

11.3.3 Action -Specific ARARs

Capping or covering the landfill is a component of several of the alternatives being evaluated for AA 3. Federal and state requirements for landfill closure are the primary source of ARARs for this action. Potential action-specific ARARs for the soil cover were evaluated in three nearly identical sets of regulations: 40 CFR § 258 and CCR Title 22 and 27. All these regulations contain overlapping requirements; therefore, a table comparing the requirements at 40 CFR § 258 and CCR Titles 22 and 27 has been added to Table H-7 of Appendix H. The table identifies most stringent, or controlling, ARARs. The controlling ARARs are identified for cap design and construction, and post-closure maintenance activities including, site security, final cover design, erosion control, landfill gas control, and post-closure care.

Although groundwater is not a medium of concern at AA 3, the detection monitoring requirements of CCR Title 22 § 66264.98(e)(1-5), (j), (k)(1-3), 4(A), and (D), (5), (7)(C) and (D) are determined to be potential federal ARARs if waste is left in-place and capping is proposed. For landfill gas monitoring, substantive requirements of Title 27 CCR §§ 20921(a)(1), (2), and (3), 20921(b) and (d), 20923, 20925 (a), (b), and (c), 20925(d)(1) and (3), 20932, 20933, and 20937 are potential ARARs.

The substantive provisions of California Civil Code (CCC) § 1471; Title 22 CCR § 67391.1; and California Health and Safety Code (HSC) §§ 25202.5, 25222.1, 25232(b)(1)(A)–(E), 25233(c), 25234, and 25355.5(a)(1)(C) are potential ARARs for alternatives proposing the use of ICs.

Grading and excavation activities for consolidation and cap installation at AA 3 have the potential to create discharges of fugitive dust that must be managed to comply with the SCAQMD rules. Substantive portions of the SCAQMD Rules 401, 403, 404, 405, 1150, and 1150.1 are action-specific ARARs pertaining to air emissions during remedial action at AA 3. Rules 401 and 403 require that the fugitive dust emissions be controlled during grading, excavation, and earth-moving activities. Rule 404 and 405 establish limits on particulate emissions from equipment. Rule 1150 requires that an excavation management plan be developed prior to excavation of landfill materials. While the plan itself is considered administrative in nature, the DON will address substantive provisions of this regulation during the remedial design/remedial action. Rule 1150.1 establishes requirements for landfill gas collection, control and monitoring systems. The substantive provisions of this rule are ARARs for the landfill gas collection, control, and monitoring systems to be installed at AA 3. In addition to complying with these potential landfill gas collection and control system ARARS, the landfill gas control system and monitoring network at AA 3 will be designed and operated to comply with the agreement between the DON, FFA signatories and CIWMB documented in the letter from DON dated 24 June 2004, presented in Appendix L. The details of the design and operation of the landfill gas systems and landfill gas monitoring will be presented in the remedial design work plan.

If the excavated debris from AA 3 is stored in staging piles outside the current waste placement footprint to facilitate consolidation, the substantive requirements of 40 CFR §264.554(d)(1)(i-ii), (d)(2), (e), (f), (h), (i), (j), and (k) are potentially ARARs for design, operation, and closure of the staging pile constructed during consolidation activities.

The action-specific ARARs are described more in detail in Appendix H, Section 4 and Tables H-5 and H-6.

11.4 DEVELOPMENT OF REMEDIAL ACTION OBJECTIVES

RAOs are media-specific goals for protecting human health and the environment. The NCP requires that the RAOs address contaminants of concern, exposure pathways, and receptors; and that they establish an acceptable level or range of levels for exposure (i.e., remediation goals). Remediation goals should be consistent with exposure levels that are protective of human health and the environment (i.e., an excess cancer risk in the range of 10^{-4} to 10^{-6} or less, and a hazard quotient for exposure to non-carcinogenic contaminants of 1 or less). RAOs must also comply with the intent of federal or state regulations, statutes or policies that may dictate the remedial action (ARARs).

Final remediation goals are not determined for a site until the final remedy has been selected. Nevertheless, RAOs and associated remediation goals must be developed early in the RI/FS process to provide a basis for screening remedial technologies and performing a detailed evaluation of remedial alternatives.

11.4.1 Remedial Action Objectives

The DON reached an agreement with FFA signatories and the CIWMB regarding the ICs and access restrictions pertaining to the landfill gas control measures at AA 3 in a letter dated 24 June 2004, as presented in Appendix L. This agreement was based on the results of the following: landfill gas investigations; anticipated post-closure land use; the DON's consultation with the representatives of CIWMB and the DTSC at a meeting on 4 December 2003; and, subsequent discussions with CIWMB and other FFA signatories via email, letter, and telephone conferences on 5 February and 18 February 2004.

The CIWMB along with the FFA signatories concurred on the following measures proposed by the DON to address the underlying concern of potential landfill gas migration at AA 3:

1. Implementation of an appropriate response action at AA 3.
2. Installation of an active landfill gas collection system or gas vent system during remedy implementation at AA 3. The system will remain inactive or vent passively unless a contingency for active gas extractions is triggered based on monitoring results. While inactive, wells/pipes installed within the waste will be used to monitor landfill gas within the waste itself, providing an early warning feature.
3. As an additional safety feature, construction of passive gas-control gravel trenches within the compliance monitoring zone during remedy implementation.
4. Implementation of CIWMB monitoring protocol with compliance landfill gas monitoring probes within 50 feet of the waste boundary. The perimeter will be monitored to demonstrate that landfill gas is not migrating off-site. Once adequate data are collected, and with CIWMB concurrence, monitoring would be discontinued and associated ICs/access restrictions would be removed.
5. Implementation of ICs/access restrictions within approximately 100 feet of the waste boundary (including the 50-foot wide compliance monitoring zone plus another 50 feet as an additional safety buffer zone). Within this 100-foot land-use restriction buffer zone, any future construction of structures would require obtaining approval from the DON and the CIWMB.

In general, the RAOs developed for AA 3 as part of this FS are:

- Minimize direct contact with the landfill wastes.

- Control run-on, runoff, and erosion; minimize infiltration and potential contaminant leaching to groundwater.
- Mitigate the landfill gas migration consistent with DON's agreement with FFA Signatories and CIWMB.
- Minimize contact between surface water in Agua Chinon Wash and the landfill waste.

11.5 GENERAL RESPONSE ACTIONS

The next step of the FS process is to identify and develop general response actions that may be taken to meet the RAOs. Response actions represent general action that may be performed through the use of various technologies or combinations of technologies. Response actions for AA 3 were selected from a comprehensive list of general response actions that typically are considered for hazardous waste sites with similar contamination. The following response actions were considered applicable for conditions at AA 3.

- No Action – involves no remedial activity for the environmental media.
- ICs and access restrictions – physical access controls/restrictions (e.g., signs, fencing) and/or administrative/institutional controls (e.g., deed or access restrictions) designed to limit exposure to contaminants present at the site.
- Containment – containment technologies isolate the landfill contents and mitigate off-site migration by implementing engineered measures such as drainage controls and capping.

In addition to these presumptive remedies for municipal landfills, general response actions for removal and disposal of all wastes at AA 3 ("clean closure") were evaluated.

11.6 IDENTIFICATION AND SCREENING OF TECHNOLOGY TYPES AND PROCESS OPTIONS

Using information on the COPCs, potential receptors, and pathways, as well as ARARs, the presumptive remedies for containment of contaminants were screened to identify those that are applicable to AA 3. The presumptive remedies introduced and screened in this section include:

- landfill capping,
- ICs and access restrictions.

Screening criteria include effectiveness in accomplishing the RAOs, compliance with ARARs, and implementability.

11.6.1 Identification and Screening of Technologies

Landfill Capping. Landfill capping is a containment technology used for minimizing leachate by preventing infiltration of precipitation and surface water through the landfill mass. The primary function of the landfill cap is to provide a barrier to protect humans, animals, and plants from exposure to the contents of the landfill.

Capping technologies may be designed to reduce erosion, control emission of gas and odors, and improve aesthetics. Capping technologies also provide a stable outside surface that prevents direct

contact with wastes. The design of the cap depends not only on the technical objectives, but also on the risk factors and the ARARs identified for the landfill site. A number of factors are considered in selecting a cover system that is appropriate for a landfill and include climate, postclosure use, maintenance effort desired, and cost of construction. In general, the cap can be a single-layer native soil cover (if low-permeability soil is available at the site), a single-barrier cover (e.g., clay layer with a protective soil cover), or a composite barrier (e.g., flexible membrane layer with concrete or asphalt pavement cover).

Landfill capping is an appropriate presumptive remedy for AA 3 because it:

- will prevent direct contact with the landfill wastes;
- can continue to control runoff and erosion; and
- can prevent infiltration of rainwater and potential leaching of contaminants to the groundwater.

Leachate is primarily produced as water infiltrates through the landfill waste and waste decomposition products. Migration of leachate can contaminate groundwater and degrade water quality. A number of design alternatives, discussed later, are being considered for the cap over the waste at AA 3. Under current site conditions, leachate production is expected to be minimal due to the following: the semiarid conditions existing at the former MCAS El Toro, the predominantly construction-related waste placed at AA 3, and the age of the landfill. Installation of cap over the waste will significantly reduce the generation of leachate, further reducing the potential for groundwater contamination. For these reasons, landfill capping will be retained for further evaluation in this report.

Since groundwater occurs at or very close to the bottom of waste placement, of an unsaturated zone monitoring systems or a leachate collection and treatment is screened out as a presumptive remedy. Groundwater conditions below and downstream of the landfill will also be monitored periodically. The groundwater monitoring results will be used to assess the effectiveness of the cap.

ICs and Access Restrictions. Interim and final ICs, and access restrictions reduce exposure to on-site contamination by restricting the use of a site and protecting the integrity of the engineered cover. ICs and access restrictions are appropriate for AA 3 and will be retained for incorporation into the remedial alternatives. Access restrictions (e.g., fencing and signs) are expected to be necessary to ensure the integrity of the cover subsequent to the completion of the closure. Interim ICs may include lease restrictions and final ICs may include land-use restrictions incorporated into environmental restriction covenants included in both the quitclaim deed(s) of conveyance between the Navy and its transferee and Environmental Restriction Covenant and Agreement(s) between the Navy and DTSC. These restrictions would be used to limit development of the site.

Environmental Monitoring. Environmental monitoring of the landfill is required for the closure and postclosure periods if waste is left in place. Environmental monitoring activities expected to be applicable to the site include landfill gas monitoring, groundwater monitoring, and maintenance of drainage control structures, erosion control measures, and site security.

Landfill gas is typically generated by the natural decomposition of organic materials in a landfill. An agreement was reached between the DON and FFA signatories (including CIWMB) pertaining to the landfill gas control measures at AA3 in a letter dated 24 June 2004 (Earth Tech 2005a), as presented

in Appendix L. Accordingly, an active landfill gas collection system or gas vent system is proposed to be installed outside the landfill waste-containment area and within the property boundary to assess landfill gas migration at the site boundaries at AA 3. The monitoring results will be periodically evaluated to determine whether an active landfill gas-control system and continued monitoring are needed in the future, following the placement of the landfill cover.

11.6.2 Evaluation and Selection of Technologies

Landfill capping and ICs have been identified as primary components of appropriate presumptive remedies for AA 3. Brief descriptions of the technology options available to implement these presumptive remedies follow.

Landfill Capping. Landfill capping provides a barrier to prevent human and ecological exposure to landfill wastes. Capping also prevents infiltration into the landfill mass. This prevents potential leachate production and migration to groundwater.

The following capping designs were considered for AA 3:

- native soil or single-layer covers;
- single-barrier cover system;
- surface soil sealing;
- asphalt or concrete pavement; and
- composite pavement and barrier liner.

These designs are readily implementable at this site. Therefore, the evaluation of each design focuses on its ability to meet the RAOs and comply with the ARARs for AA 3.

Native Soil or Single-Layer Covers. Native soil (non-clay) covers for containment of wastes may be appropriate in arid climates at areas where surface water infiltration (and subsequent leachate generation) is not a controlling factor. Native soil caps are used when the primary objective is to control erosion and prevent direct contact. However, in regions having greater evapotranspiration potential than rainfall, native soil covers can be engineered to reduce infiltration.

Native soil used to reduce the rate of infiltration in arid regions typically has high field-storage capacities (e.g., 0.3 volume per volume [v/v]) and is usually soil with a high percentage of soil particles passing through a U.S. No. 200 sieve (e.g., clay, silt, and sandy silt). Native soil can be mixed with additives and mechanically compacted to lower the permeability and make it more suitable for reducing infiltration. This type of cap will be retained for inclusion in the remedial alternatives developed for AA 3.

Single-Barrier Cover System. The primary component of a single-barrier cover system is a low-permeability layer that is installed as a barrier layer. This barrier layer is usually overlain with a soil cover layer and may also incorporate a drainage layer above the barrier. A typical cross section of a single-barrier cover system, as required in the state of California, consists of the following layer from top to bottom:

- soil protective layer – 12 inches (minimum) of native soil;
- barrier layer – 12 inches (minimum) of clay (permeability <1 x 10^{-6} centimeters per second [cm/s]), or a 30-mil (minimum) flexible membrane liner (FML), or a geosynthetic clay liner (GCL); and
- foundation layer – 24 inches (minimum) of compacted soil to provide support for the barrier layer.

A single-barrier cover system will be retained for further consideration as part of a remedial alternative because it satisfies the ARARs for landfill capping.

Surface Soil Sealing. Surface soil sealing technologies are relatively new technologies that apply synthetics or derivatives of natural compounds to surface soil to bind soil particles together for protection against wind and surface-water erosion. These compounds are sprayed onto surface soil in a dissolved, emulsified, or slurry form. The compounds are typically considered to be "environmentally friendly" and aesthetic, but are generally not long-lasting due to their biodegradability and/or susceptibility to ultraviolet degradation. Therefore, an ongoing maintenance activity, such as periodic reapplication of the sealing compound, is necessary for optimal performance.

Surface soil sealing is not generally or widely used in landfill covers. This technology does not meet all the federal or state requirements for landfill covers. That is, although it might provide for temporary erosion protection, surface soil sealing would not be a suitable or preferred choice for long-term prevention of infiltration or prevention of exposure to contaminants and waste. Surface soil sealants are generally thinner compared to the significantly thicker soil covers. Surface sealants are, however, available for application over a soil cover cap or pavements. Appropriate soil sealants are available and can be used in order to replace vegetation cover on soil cover caps and to reduce erosion of the soil cover. Surface sealants that can be applied over concrete or asphalt pavement covers (caps) in order to seal cracks and reduce infiltration through the pavement are also available. Therefore, although surface sealants by themselves are not considered viable options for landfill cover or capping, they will be retained for consideration in conjunction with other capping technologies.

Asphalt or Concrete Pavement. This type of cap is a concrete or asphalt layer installed on the surface as a barrier layer. Pavement can be considered a viable option, especially if the use of the landfill is for storage or for vehicular parking associated with the recreational use of the site. The use of pavement will eliminate dust emissions associated with vehicular use and will provide an erosion-protection measure. When properly graded, it will also facilitate rapid runoff. However, pavement covers are susceptible to cracking and require regular maintenance to ensure that infiltration through the pavement is minimized. In addition, the use of asphalt and concrete as landfill cover material will require specialized mix and spreading, and high degree of quality assurance/quality control. The cost of asphalt and concrete covers is also expected to be high. The asphalt or concrete pavement will not be retained for further consideration for development of remedial alternatives for AA 3.

Composite Pavement and Liner Barrier. The composite barrier described in this feasibility study consists of pavement installed over synthetic membrane liner. The installation of the synthetic membrane liner beneath the pavement will reduce potential precipitation infiltration through the landfill cap resulting from development of cracks in the pavement. Synthetic membrane liners used

in composite barrier caps can be polyvinyl chloride (PVC), chlorinated polyethylene (CPE), very low-density polyethylene (VLDPE), or high-density polyethylene (HDPE). However, the synthetic membrane liners are themselves susceptible to puncturing if not installed properly. The construction of a composite barrier including installation of liners requires highly skilled labor, specialized tools, and high degree of quality assurance/quality control. The cost of installing composite cover is expected to be high. The composite pavement and liner barrier will not be retained for further consideration for development of remedial alternatives for AA 3.

Surface Water Erosion Control Technologies. Surface water erosion control technologies are designed to control and direct on-site runoff and to prevent off-site surface water from running onto the site. These technologies reduce water infiltration into the waste, mitigate associated leachate generation, and decrease the rate of cap erosion.

Surface water erosion controls to divert run-on and prevent infiltration at municipal landfill sites often are implemented in conjunction with site closure, and are almost always employed in concert with other technologies such as a landfill cap. In the case of AA 3, surface water erosion control technologies will only be considered in conjunction with other technologies, such as capping, due to the irregular depth of soil cover at the site.

Grading and revegetation are the most common forms of surface water erosion control technology at municipal landfill sites. Both are discussed in the following paragraphs.

Grading. Grading modifies topography in order to promote positive drainage and control the flow of surface water. A properly graded surface will channel uncontaminated surface water around the landfill, thereby minimizing infiltration through the landfill cap.

Grading is also the general term for techniques that reshape the surface of landfills in order to control erosion and manage surface-water infiltration, run-on, and run-off. Designing proper slope lengths and gradients, and creating berms and swales are common grading techniques used to control and route surface water. Earth fill, typically from off-site borrow sources, may be required to change slope gradients and to construct earthen berms. Regrading existing fill material is recommended when a significant quantity of fill is provided and the fill analysis shows that it is acceptable for reuse. Significant cost savings could be made by using existing fill, thereby minimizing the cost of transporting fill material from an off-site source.

Grading techniques are well developed and commonly used in landfills around the United States. Grading often is used in conjunction with capping and revegetation, and it can have a considerable impact by reducing leachate generated from infiltration. Due to the small grades and potential for ponding at AA 3, control of surface runoff by grading is appropriate. Grading will be retained for incorporation into the alternatives developed for this site.

Revegetation. Revegetation is used to stabilize the soil surface of a landfill site and promote evapotranspiration. Revegetation decreases erosion of the soil by wind and water, reduces sediment in storm water runoff, and contributes to the development of a naturally stable surface. AA 3 is currently covered with nonnative grasses that help to stabilize the soil and prevent erosion. An annual grass cover on the landfill cap will continue to provide erosion control. Revegetation will be retained for further consideration in conjunction with other capping technologies.

Waste Consolidation. Since consolidation within the areas of contamination is not considered "placement" of the material, the U.S. EPA land disposal restriction (LDR) requirements do not apply. Therefore, wastes can be consolidated within the area of the site without pretreatment. If

contamination has spread to eroding side slopes, contaminated soil can be excavated and consolidated within the landfill, thereby reducing the required area of the cap. Consolidated material can also be used as fill under the cap as called for by the grading plan.

Implementation, operation, and maintenance considerations associated with consolidation include the following:

- consolidation is usually implemented in conjunction with capping, and the cap design may be influenced by the volume and nature of the material being consolidated;
- consolidation may require handling, stockpiling, and hauling large volume of material by truck;
- the exact location and chemical nature of buried wastes is not known; and
- potential exposure to workers and nearby communities during consolidation activities.

The most important data needed to coordinate consolidation with the selection and testing of a landfill cap will include:

- waste characteristics of hot spots (determined during site characterization);
- volume of contaminated material; and
- location where the contaminated material will be consolidated or disposed in the event that hazardous waste is encountered.

Off-site land disposal is generally considered the least desirable alternative for remediation. However, off-site disposal may be required if the consolidation process uncovers hazardous wastes as characterized by analysis of suspected hazardous waste.

Confirmation sampling is used to determine when excavation conducted for consolidation is complete. Excavation is considered complete when confirmation sampling results in concentrations that are less than calculated site-specific RBCs. Waste consolidation will be retained for further consideration for development of remedial alternatives in conjunction with other capping technologies.

Access Restrictions/ICs. Access restrictions and ICs can be used alone to prevent exposure to on-site contamination or can be used in conjunction with other engineered remedies to increase the effectiveness of the technologies.

Access restrictions and ICs evaluated in this section include:

- Access restrictions: Fencing and signs,
- ICs: Land use restrictions incorporated into environmental restriction covenants included in both quitclaim deeds and Environmental Restriction Covenant and Agreement(s) between the Navy and DTSC, and
- Interim ICs.

Fencing and Signs. When necessary, fencing can be used to limit physical access to the landfill site. Signs may be posted to alert potential trespassers that there may be a health threat associated with the site. Signs typically are posted at equal intervals along the perimeter of the site and along roads leading to the site. The most common type of fence used to limit access is a high chain-link fence. Fencing is also a valuable adjunct to landfill capping because it can be used to protect the integrity of the cap. For this reason, fencing and signs will be retained as access controls for inclusion in the remedial alternatives.

Land-use Restrictions and Environmental Restriction Covenants. Land-use restrictions incorporated into environmental restriction covenants included in both quitclaim deeds and Environmental Restriction Covenant and Agreement(s) between the Navy and DTSC at the time of transfer of title of the site property are intended to prevent or limit use and development of the site and protect the integrity of the engineered cover and/or waste containment system. The effectiveness of environmental restriction covenants depends on the state and local laws, continued enforcement, and maintenance. Because land-use restrictions incorporated into environmental restriction covenants are generally used in conjunction with engineered remedial actions, the specific prohibitions outlined in them are based on the type of remedial action implemented at the site and how the effectiveness of that remedial action can be improved through restrictions. For municipal landfill sites, the major purpose of land-use restrictions incorporated into environmental restriction covenants is to protect the integrity of the cap. The land-use restrictions incorporated into environmental restriction covenants should limit subsurface development (excavation) and excessive vehicular traffic (including off-road vehicles and dirt bikes). Additional restrictions may be required for effective implementation of other technologies.

Land-use restrictions incorporated into environmental restriction covenants may indefinitely prohibit future land use that could disturb the buried waste, increase dust emissions, or enhance leachate generation.

The DON will be responsible for implementing, inspecting, reporting and enforcing ICs and access restrictions.

Interim ICs. Interim ICs are being administratively handled through an existing Lease in Furtherance of Conveyance (LIFOC) with Heritage Fields, LLC (DON 2005). Interim IC lease restrictions and land use restrictions incorporated into environmental restriction convenants established at the time of conveyance of the title will be retained for further consideration for inclusion in the remedial alternatives.

Monitoring. Monitoring is used to evaluate changes in the nature and extent of contamination and to assess the effectiveness of the CERCLA remedy. Monitoring is identified in the ARARs and is considered appropriate for AA 3. Monitoring of AA 3 should consist of landfill gas monitoring, groundwater monitoring, inspection and maintenance of run-on and runoff structures and revegetation programs, and monitoring the integrity of the landfill cap.

Landfill Gas Monitoring. Landfill gas is generated by the natural decomposition of organic materials in a landfill. Based on landfill gas monitoring results and an evaluation of the potential for its generation, the volume of landfill gas generated at AA 3 does not warrant installation of a landfill gas-collection system. However, the DON reached an agreement with the FFA signatories (including CIWMB) pertaining to landfill gas control measures at AA 3 in a letter dated 24 June 2004, as presented in Appendix L. According to the agreement, it has been proposed that an active landfill gas collection system or gas vent system is proposed to be installed outside the landfill waste-

containment area and within the property boundary to minimize landfill gas migration to the site boundaries/perimeter of AA 3. The results of the sampling and analysis will be evaluated periodically to assess whether a landfill gas-control system and continued monitoring are needed. Additionally, perimeter gas monitoring will be retained for further consideration for inclusion in the remedial alternatives. Perimeter gas monitoring will be conducted until landfill gas generation stabilizes and monitoring results become consistent.

Groundwater Monitoring. Groundwater monitoring entails collection and analysis of groundwater samples for detection monitoring. The groundwater monitoring results will be evaluated periodically, and the duration and/or the frequency of the groundwater monitoring may be further modified based on the results of the evaluations. Monitoring results will be used to assess the need for a future groundwater collection/treatment system. Groundwater monitoring will be retained for further consideration for inclusion in the remedial alternatives.

Monitoring and Maintenance of Landfill Cap, Runoff Structures, and Revegetation Programs. Monitoring of the cap integrity, run-on and runoff controls, and revegetation will be used to assess the effectiveness of these components. Monitoring of the cap will be accomplished by means of a visual inspection designed to identify areas of settlement, cracking, and slope stability problems. Runoff controls will be inspected for damage. Revegetation monitoring will involve a visual inspection of the vegetative cover on the cap. The most significant geotechnical concern is the amount of landfill settlement that will occur over time. This settlement results from both compression of loosely placed deposits and organic decomposition. Settlement will be monitored by a visual inspection of the cover system for cracks, eroded areas, surface irregularities, and localized depression. Surveying will also be performed as part of the monitoring activity.

Landfill cap and drainage system inspections will be conducted quarterly and following major storm events until full site revegetation occurs and site conditions stabilize.

Maintenance activities may include cap repairs to correct settlement or cracking problems, runoff control structures repairs, mowing of an annual grass cover on the landfill cap to prevent invasion by shrubs or plants with deep roots that could damage the barrier layer of the landfill cap or sealing, and repairing pavement cracks or damages.

Monitoring and maintenance of landfill cap, runoff structures, and revegetation programs will be retained for further consideration for inclusion in the remedial alternatives.

Clean Closure. In addition to capping in place, clean closure is considered as a possible remedial action at AA 3. Clean closure of a waste placement area such as AA 3 refers to the complete removal of all wastes and waste residuals, including contaminated soil, if any. A clean closure is generally defined as being successful when waste materials and residuals are removed and contaminant concentrations are at or below background concentrations or RBCs. Clean closure is retained for further consideration for development of remedial alternatives.

12. DEVELOPMENT AND SCREENING OF ALTERNATIVES

12.1 DEVELOPMENT OF ALTERNATIVES

This section of the FS report combines presumptive remedy technologies into alternatives capable of meeting the RAOs for AA 3. This presentation provides the basis for the detailed evaluation of alternatives presented in Section 13.

Four remedial alternatives have been developed for AA 3. These alternatives are as follows:

- Alternative 1: No Action
- Alternative 2: Limited Grading, Monitoring, and Institutional Controls
- Alternative 3: Containment, Monitoring, and Institutional Controls
  - Alternative 3a: Containment with Evapotranspiration (ET) Cover
  - Alternative 3b: Containment with Title 27 Prescriptive Cap
  - Alternative 3c: Containment with Modified Title 27 Prescriptive Cap with Geosynthetic Clay Liner (GCL)
  - Alternative 3d: Containment with Modified Title 27 Prescriptive Cap with Flexible Membrane Liner (FML)
- Alternative 4: Clean Closure and Groundwater Monitoring

12.2 SCREENING OF ALTERNATIVES

12.2.1 Alternative 1 - No Action

The NCP (40 CFR 300.430[e][6]) requires that a no-action alternative (Alternative 1) be evaluated in the FS to provide a baseline condition if no remedial action is taken. The baseline conditions are those described by the RI. Under Alternative 1, no actions are taken to reduce potential risks to human health or the environment including : ICs, access controls, monitoring, removal, disposal, *in situ* treatment, or *ex situ* treatment of the contaminated soil or groundwater. Under Alternative 1, landfill contents would remain under the existing cover and infiltration would continue to have the potential to migrate to groundwater. Natural processes would be the only mechanism acting to reduce the concentration of contaminants in the environment.

12.2.2 Alternative 2 – Limited Grading, Monitoring, and Institutional Controls

Alternative 2 implements limited site grading, drainage improvements, ICs, and long term monitoring. Specifically, Alternative 2 includes ICs and existing access restrictions, construction of a finger dike to control stormwater flow in the vicinity of AA 3, monitoring well abandonments and replacements, debris relocation, construction of a landfill gas collection system, long-term groundwater and soil gas monitoring, 5-year site reviews, limited site grading, survey monument installation, facility inspection and maintenance, and site closeout. Alternative 2 would physically limit or prevent access to AA 3 using measures such as perimeter fences, gates, and signs. In addition, monitoring wells would be locked and maintained to restrict unauthorized access.

ICs are non-engineered legal mechanisms established to limit human exposure to on site contamination. The ICs fall into two broad categories: 1) restrictions on existing and future land use,

and 2) provision for access for potential future inspection and maintenance activities. The ICs would be supplemented with access restrictions (e.g., physical controls) such as fencing and signs that would restrict access to the site. The Navy LUC guidance outlines Principles and Procedures for Specifying, Monitoring and Enforcement of Land-use controls (LUCs) and Other Post-ROD Actions for specifying and implementing ICs. A detailed discussion of ICs and their implementation procedures at AA 3 are discussed in Sections 12.2.2.1 and 12.2.2.2.

Alternative 2 proposes construction of a finger dike that is approximately 350 linear and riprap placement to prevent erosion and control stormwater flow in the vicinity of AA 3.

In addition, five monitoring wells (four inside [MW10, MW11, MW12, and MW 14] and one outside [MW08] the debris limits) would be abandoned in conjunction with remedial construction activities (see Figure 6-11). Five existing groundwater monitoring wells and three existing soil gas monitoring wells would be abandoned and replaced with new ones after ten and twenty years, respectively.

Alternative 2 would also include monitoring of landfill gas and groundwater. Monitoring, inspection, and maintenance of existing conditions would be conducted periodically.

Landfill gas monitoring for AA 3 includes performing periodic gas sampling and analysis of three existing triple-nested perimeter gas wells (PG1 through PG3) and three existing vadose zone wells (PZ1 through PZ3). Per the DON's agreement with the FFA signatories and the CIWMB (DON 2004), an active landfill gas collection system or gas vent system is proposed to be installed in accordance with CIWMB monitoring protocol. Compliance landfill gas monitoring probes will be installed within 50 feet of the waste boundary at AA 3. The results of the sampling and analysis will be evaluated periodically to assess whether a landfill gas-control system and continued monitoring are needed. As an additional safety feature, construction of passive gas control gravel trenches within the compliance monitoring zone during remedy implementation is proposed. The perimeter gas wells will be monitored at the landfill and can be used to detect off-site migration of landfill gases. The samples would be analyzed for fixed gases and VOCs. The results of the sampling and analysis over a 5-year period would be evaluated to determine whether a landfill gas-control system and/or continued monitoring are needed.

As discussed previously, no groundwater-specific response action is planned for AA 3. However, groundwater monitoring would be conducted as a result of potential action-specific ARARs for soil for capping alternatives where landfill closure and postclosure requirements may be potentially relevant and appropriate. The monitoring will involve collecting samples from monitoring wells MW01, MW02, MW04, MW06, MW07, MW09A, MW09B, and MW13 semiannually for 5 years and annually thereafter for a total of 25 years. The results of the groundwater monitoring would be reevaluated every 5 years, and the duration and/or frequency would be further modified based on the results of the reevaluation. These wells were installed as part of the groundwater investigation at AA 3. Groundwater samples will be analyzed for VOCs, SVOCs, general minerals, total metals and total petroleum hydrocarbons.

For cost-estimating purposes, it is assumed that the results of the first 5 years of semiannual groundwater monitoring, as well as data gathered during the RI for AA 3, will provide adequate trend data for the groundwater so that the sampling events may be reduced to an annual frequency for the next 25 years. The results of the groundwater monitoring will be reevaluated every 5 years, and the duration and the frequency of the groundwater monitoring may be further modified based on the results of the reevaluations.

Alternative 2 also includes a 5-year review which consists of a review of site-specific documents such as monitoring reports and decision documents after 5, 10, 15, 20, 25, and 30 years. As part of this review, an inspection would be conducted to assess site conditions. Each 5-year review would include a report providing conclusions and recommendations for future activities. After 30 years, site close-out activities would commence to include meetings, closure reports and decision documents, a monitoring well abandonment work plan and abandonment of five groundwater and three soil gas monitoring wells.

12.2.2.1 INSTITUTIONAL CONTROLS

ICs are legal mechanisms that implement land use and access restrictions to (1) limit the exposure of future landowners and/or users of the property to hazardous substances and (2) maintain the integrity of the remedial action until remediation is complete and remediation goals have been achieved. Monitoring and inspections are conducted to assure that the land-use restrictions are being followed.

Legal mechanisms include proprietary controls such as lease restrictions, restrictive covenants, negative easements, equitable servitudes, and deed notices. Administrative mechanisms include notices, adopted local land use plans and ordinances, construction permitting, or other existing land use management systems that may be used to ensure compliance with use restrictions.

AA 3 lies in the portion of the Station that has been leased to a private developer through a LIFOC, which includes interim land-use restrictions in its terms and conditions. (DON 2005). These interim restrictions will remain in effect until the leased property encompassing AA 3 is conveyed by deed to the Lessee. The Navy will rely upon proprietary controls in the form of land-use restrictions incorporated into environmental restriction convenants when the AA3 property is conveyed by deed as provided in the "Memorandum of Agreement Between the United States Department of the Navy and the California Department of Toxic Substances Control" and attached covenant models (DON and DTSC 2000). Appendix N contains the DON/DTSC MOA.

More specifically, the Navy proposes to rely upon land-use restrictions (set forth in Section 12.2.2.2) incorporated into environmental restriction covenants that will run with the land and that will be included in and implemented through two separate legal instruments when title to the AA 3 property is conveyed:

- Environmental restriction covenants included in a "Covenant to Restrict Use of Property" entered into by the DON and DTSC as provided in the DON/DTSC 2000 MOA and consistent with the substantive provisions of tit. 22 Cal. Code Regs. Section 67391.1, and

- Environmental restriction covenants incorporated into one or more Quitclaim Deeds from the DON to the property recipient.

Institutional controls under Alternative 2 will comply with substantive provisions of the California Civil Code Section 1471; California Code of Regulations, Title 22, Section 67391.1 (a) and (e)(1); and California Health and Safety Code Sections 25202.5, 25222.1, 25232(b)(1)(A)–(E), 25233(c), 25234, and 25355.5(a)(1)(C).

The following sections describe the land-use restrictions at AA 3 to protect human health and the environment.

12.2.2.2 LAND-USE RESTRICTIONS

Interim Land-Use Restrictions

Some of the activities and land uses prohibited at AA 3 per the LIFOC (DON 2005) include but are not limited to:

- Subsurface excavation, digging, drilling, or other disturbance of the ground surface without prior Government approval (LIFOC Section 13.15).
- Removal of or damage to security features (e.g., locks on monitoring wells), survey monuments, signs, or monitoring equipment and associated pipelines and appurtenances is prohibited without prior written Government approval (LIFOC Sections 13.19 and 13.21.3).
- Residential use of the sites and construction of day care centers (LIFOC Section 13.21.1).
- Construction of any structure, including placement of trailers without the prior written approval of the Navy and FFA signatories (LIFOC Section 13.21.2).

These restrictions are implemented in accordance with the LIFOC until the AA 3 property is conveyed by deed to the Lessee.

Proposed Land-Use Restrictions

This section identifies the land use restrictions proposed for the AA 3 property when title to the property is conveyed. The following restricted land uses for AA 3 must be reviewed and approved in writing in advance by the FFA Signatories and CIWMB in accordance with the "Covenant(s) to Restrict Use of the Property" and Quitclaim Deed(s) prior to use of the property for any of the restricted uses:

- A residence, including any mobile home or factory built housing, constructed or installed for use as residential human habitation,
- A hospital for humans,
- A school for persons under 21 years of age,
- A day care facility for children, or
- Any permanently occupied human habitation including those used for commercial or industrial purposes

The land use restrictions would prohibit following activities in accordance with the "Covenant(s) to Restrict Use of the Property" and Quitclaim Deed(s):

- Planting deep-rooted plants that have the potential to interfere with the performance of the cap (if constructed) in minimizing infiltration without prior review and written approval of the FFA signatories and CIWMB.

- Alteration, disturbance, or removal of any component of a response action including but not limited to landfill cap (if constructed), groundwater monitoring wells, and survey monuments without prior review and written approval of the FFA signatories and CIWMB.

- Removal or damage to security features including but not limited to fencing and signs without prior review and written approval of the FFA signatories and CIWMB.

- Construction of facilities, structures, or appurtenances, excavation, or any other land-disturbing activity into or on the surface of the landfills that may involve adverse impacts upon the performance of the cap or affect the drainage and erosion controls developed for the cap unless prior concurrence of the FFA signatories and CIWMB.

- Construction of structures within 100 feet of the edge of the landfill without prior concurrence of the FFA signatories and CIWMB. CIWMB monitoring protocol will be implemented using landfill gas monitoring probes within 50 feet of the waste boundary. The perimeter will be monitored to demonstrate that landfill gas is not migrating. Once adequate data are collected, and with CIWMB concurrence, monitoring would be discontinued and land-use restrictions would be removed.

The actual land-use restrictions, and the process and criteria required for getting concurrence for restricted activities will be discussed in the property transfer documents including FOST.

Access

The Deed and Covenant will provide that the Navy and FFA Signatories and their authorized agents, employees, contractors and subcontractors shall have the right to enter upon AA 3 to conduct investigations, tests, or surveys; inspect field activities; or construct, operate, and maintain any response or remedial action as required or necessary under the cleanup program, including but not limited to monitoring wells, pumping wells, treatment facilities, and cap/containment systems.

Implementation

The Navy will address/describe ICs implementation and maintenance actions including periodic inspections and reporting requirements in the preliminary and final remedial design (RD) reports to be developed and submitted to the FFA Signatories for review pursuant to the FFA (see "Navy Principles and Procedures for Specifying, Monitoring and Enforcement of Land Use Controls and Other Post-ROD Actions" attached to January 16, 2004 DoD memorandum titled "Comprehensive Environmental Response, Compensation and Liability Act [CERCLA] Record of Decision [ROD] and Post-ROD Policy"). The preliminary and final RD reports are primary documents as provided in the FFA.

12.2.3 Alternative 3 - Containment, Monitoring, and Institutional Controls

12.2.3.1 ALTERNATIVE 3A - CONTAINMENT WITH EVAPOTRANSPIRATION COVER

Alternative 3a includes the construction of a single layer cap (otherwise known as an evapotranspiration [ET] landfill cover system), stormwater control system construction, the implementation of ICs and existing access restrictions, monitoring well abandonments and installations, debris relocation, construction of a landfill gas collection system, long-term groundwater and soil gas monitoring, access road construction, 5-year site reviews, facility inspection and maintenance, and site closeout.

Landfill capping for Alternative 3a would consist of the following:

- installation of a landfill monitoring and passive gas system;
- grading and compacting the material within the landfill and under the cap area;
- constructing a single layer cover using native soil to prevent infiltration and leachate formation (ET cap);
- providing for surface drainage control;
- revegetating the surface with annual grasses to prevent erosion; and
- groundwater monitoring to assess effectiveness of cover system.

The ET landfill cover design consists of a two-foot-thick foundation layer, a monolithic soil layer consisting of off-base borrow soil, and a vegetative layer. The foundation layer would be composed of existing cover soils required to be compacted to a relative density of 90 percent. The thickness of the monolithic soil layer will be determined by unsaturated soil water flow modeling results. A typical cross section of the existing native soil cover is shown in Figure 12-1. The use of native soil as a cover for containment of wastes may be appropriate in arid climates where surface water infiltration (and subsequent leachate generation) is not a controlling factor.

Native soil caps are used when the primary objective is to control erosion and prevent direct contact. In regions having greater evapotranspiration potential than rainfall, native soil covers can be engineered to reduce infiltration. Use of a native soil cap under the current (non-irrigated) condition and under irrigated conditions must be justified by demonstrating equivalence with a Title 27 prescription (clay) cap.

The single-layer cap proposed in Alternative 3a would consist of a minimum 4-foot native soil cover over AA 3. Although this area is approximately 9 acres, the cap itself would occupy approximately 9.7 acres. This is because the 3:1 side slopes of the cap will extend the area of the landfill by approximately 12 feet all around. This cap would be composed of clean soil imported from the surrounding areas near the site that would be excavated and hauled by conventional, commercially available equipment (e.g., bulldozers, track loaders, off-road trucks, and scrapers or similar equipment). The native soil cover would be placed over the top of the landfill. The cap would be graded to provide 3-percent slopes on top of the landfill and 3:1 (horizontal: vertical) slopes on the sides.

The soils proposed for use in the monolithic cap (Alternative 3a) and much of the foundation and vegetative layers of the alternatives for the barrier covers are derived from the proposed borrow source. These soils in the proposed borrow source are marine siltstones and sandstones of the Topanga Formation. Prior to detailed design of the covers, soil samples from the borrow source should be collected and assessed for geotechnical properties, especially hydraulic conductivities.

The existing top of the landfill is currently graded and flush with the adjacent surface. Therefore, the landfill does not have any side slopes. The native soil cover material will be hauled to the site from locally available sources for placement of the 4-foot-thick cover. Consequently, the top surface of the landfill would rise 4 feet higher than the immediate surrounding ground surface. Although the

current existing landfill cover is believed to be no more than 1 foot thick in some areas, the existing cover would not be disturbed as a result of clearing, stripping, and grading activities.

Surface settlement is a potentially important issue in evaluating the implementability, effectiveness, and cost of cap installation. In general, waste in landfills or trenches consolidates over time, increasing the density of the waste as the weight of the waste and overlying soil presses the mass into a smaller volume. This consolidation process usually shows on the surface soil as surface subsidence or differential settlement. Typical surface indicators are fissures, cracks, foundation movement, and utility or road failures. The amount of settlement is usually dependent on the type, density, and depth of waste; the initial compaction effort used to place the waste; and climate. The additional weight of the landfill closure cap could increase the surface settlement. The potential impact of surface settlement on the cap installation will be addressed in the remedial design phase, and therefore is not discussed in this FS.

Alternative 3a includes monitoring well abandonment and replacement, and long term monitoring of groundwater as proposed in Alternative 2. Casing extensions would be required for four existing monitoring wells to accommodate surface elevation changes associated with the landfill cap construction and site grading.

In addition, Alternative 3a will include the construction of an active and passive landfill gas collection system and associated monitoring and construction of a stormwater control system, as described in Alternative 2.

The ICs and the implementation of the ICs for Alternative 3a will be similar to Alternative 2 (Section 12.2.2.1 and 12.2.2.2). There are no utility easements crossing AA 3, however there are stormwater conveyance structures within 50 feet of the waste placement boundary that may require repair or maintenance. Therefore, ICs and access restrictions will require coordination with the DON prior to allowing repair of utility lines. It does appear that it will be necessary to move utility lines in order to implement this alternative. However, utilities may eventually be placed at the site to support future reuse.

12.2.3.2 ALTERNATIVE 3B - CONTAINMENT WITH TITLE 27 PRESCRIPTIVE CAP

Alternative 3b involves installing a state prescriptive landfill cover system, stormwater control system construction, the implementation of ICs and existing access restrictions, monitoring well abandonments and installations, debris relocation, construction of a landfill gas collection system, long-term groundwater and soil gas monitoring, access road construction, 5-year site reviews, facility inspection and maintenance, and site close-out.

The prescriptive landfill cap would consist of the following layers.

- Foundation Layer – 2 feet of appropriate material. According to Title 27 CCR 21090 (a)(1), the prescribed foundation shall consist of a minimum 2-foot-thick layer of soil over the waste, compacted to provide an adequate structural substrata for successive layers. No permeability specification is given for this layer.

- Barrier Layer – 1 foot of compacted clay with permeability of no greater than 1 x 10^{-6} cm/s or less (or equal to the permeability of any bottom liner system or underlying natural geologic materials, whichever is less). This layer is intended to act as a barrier to infiltration.

- Protective Soil Layer – 2 feet of clean soil on top of the barrier layer. According to Title 27 CCR 21090 (a)(3), the prescribed protective soil layer consists of a minimum 1-foot-thick soil cover intended to protect the barrier layer, control surface erosion, and provide a medium for vegetation. No permeability specification is given for this layer.

The top two feet of the existing approximately 4-foot-thick soil cover would be removed and stockpiled prior to compaction of the foundation layer and placement of the clay barrier layer. The removed soil will be used for vegetative soil cover. The foundation layer would be composed of the remaining 2 feet of existing cover soil, which would be compacted to a relative density of 90 percent.

Implementation of this alternative would involve importing clay from off-site sources because suitable clayey materials are not available on-site. The material for the clay layer would be obtained from off-site clay deposits around the Former MCAS El Toro area. For cost-estimating purposes, it is assumed that potential clay borrow sources may be available within 20 miles of the site. The clay would be excavated, transported to AA 3, and graded and compacted to achieve a permeability of 1 x 10^{-6} cm/s or less. A cross section of the cap is shown on Figure 12-2.

The cap would be revegetated with annual grasses. The purpose of the vegetative layer is to protect the clay layer from erosion, desiccation and cracking, and traffic. Although the regulations only require 1 foot of vegetative cover, the proposed vegetative soil cover in Alternative 3b is 2-foot-thick to support the rooting depth of annual grasses and to enhance its effectiveness in protecting the barrier layer. This layer would be designed to maximize runoff with minimal surface erosion.

The cap would be designed and constructed in accordance with commonly practiced industry standards and would require minimal maintenance. Standard and readily available construction equipment would be used.

Alternative 3b also includes ICs, access restrictions, monitoring well abandonment, replacement and casing extensions and long term monitoring as proposed in Alternative 3a. The ICs and the implementation of the ICs for Alternative 3b will be similar to Alternative 2 (Section 12.2.2.1 and 12.2.2.2). In addition, Alternative 3b will include the construction of an active and passive landfill gas collection system and associated monitoring and construction of a stormwater control system, as described in Alternative 2 and also implemented in Alternative 3a.

12.2.3.3 ALTERNATIVE 3C - CONTAINMENT WITH MODIFIED TITLE 27 PRESCRIPTIVE CAP WITH GEOSYNTHETIC CLAY LINER

Alternative 3c includes the construction of a GCL cover system, stormwater control system construction, the implementation of ICs, existing access restrictions, monitoring well abandonments and installations, debris relocation, construction of a landfill gas collection system, long-term groundwater and soil gas monitoring, access road construction, 5-year reviews, facility inspection and maintenance, and site closeout.

Alternative 3c is a variation of Alternative 3b – State Prescriptive Landfill Cover, but uses a GCL, rather than a clay barrier layer as an infiltration barrier. Given the potentially high cost of importing clay or processing/mixing of soil/bentonite for the prescribed 1-foot-thick barrier layer, it may be cost-effective to use a GCL for the barrier layer. GCL is a manufactured hydraulic barrier consisting of sodium-bentonite clay sandwiched between two layers of geotextile that are held together by needling, stitching, or adhesives. The GCL provides a permeability of significantly less than 10^{-6} cm/s, and is simpler to construct than a geomembrane or clay liner. The GCL material is brought to the site in 15-foot-wide rolls. Sheets vary in length and are approximately 150 feet long. The

material is unrolled and placed over the surface that needs to be covered. Sheets are overlapped by 1 foot on each side. A layer of bentonite powder is placed between the overlapping areas. Anchoring may be required on the steep slopes.

The GCL landfill cover design consists of a two-foot-thick foundation layer composed of existing cover soils, a GCL barrier layer, and a two-foot thick vegetative cover layer. The foundation layer would be composed of existing cover soils required to be compacted to a relative density of 90 percent. The vegetative cover layer would be composed of the top two feet of existing soil cover, which would be removed and stockpiled prior to compaction of the foundation layer and placement of the GCL. A cross section of this cap is shown in Figure 12-3. Other components of Alternative 3c are identical to the corresponding components of Alternative 3b. Installation of the GCL does not require a specialty contractor or specialized equipment.

Alternative 3c also includes ICs, access restrictions, monitoring well abandonment, replacement, and casing extensions and long term monitoring of groundwater as proposed in Alternatives 3a and 3b. The ICs and the implementation of the ICs for Alternative 3c will be similar to Alternative 2 (Section 12.2.2.1 and 12.2.2.2). In addition, Alternative 3c will include the construction of an active and passive landfill gas collection system and associated monitoring and construction of a stormwater control system, as described in Alternative 2 and also implemented in Alternatives 3a and 3b.

12.2.3.4 ALTERNATIVE 3D - CONTAINMENT WITH MODIFIED TITLE 27 PRESCRIPTIVE CAP WITH FLEXIBLE MEMBRANE LINER

Gradual desiccation of the low-permeability layers used in Alternative 3a is a strong possibility in arid and semiarid climates. This desiccation might compromise the effectiveness of the Title 27 CCR prescriptive cap for minimizing infiltration. Alternative 3d addresses this issue by replacing the clay layer with a 40 mil (or thicker) FML.

Alternative 3d includes the construction of a FML landfill cover system, stormwater control system construction, the implementation of ICs and existing access restrictions, monitoring well modifications, abandonments, and replacements, debris relocation, construction of a landfill gas collection system, long-term groundwater and soil gas monitoring, access road construction, 5-year site reviews, facility inspection and maintenance, and site closeout.

The FML landfill cover design consists of a two-foot-thick foundation layer, a FML, and a two-foot thick vegetative cover layer. The foundation layer would be composed of existing cover soils required to be compacted to a relative density of 90 percent. The vegetative cover layer is composed of the top one to two feet of existing soil cover, which would be removed and stockpiled prior to compaction of the foundation layer and placement of the FML. All other components of this option are identical to those for Alternatives 3a, 3b, and 3c. A typical cross section of the cap system for Alternative 3d is shown in Figure 12-4.

The design and construction of the FML will be according to commonly-practiced industry standards. Examples of FMLs include HDPE or LDPE. The specific membrane material will be selected during remedial design. After compaction, grading, and surface preparation of the foundation layer, sheets of FML would be placed and fusion-welded together, followed by weld testing to assure the integrity of welded seams. The FML is available in rolls 22 or 34 feet wide and up to 450 feet in length. The material is unrolled on-site and placed over the areas to be lined. FML can easily be cut to fit corners and areas with any unusual size and shape. When placed on steep slopes, the FML requires anchoring (in anchor trenches) at the top of the slope to prevent the liner and the overlying soils from slipping and sliding. A layer of geotextile material with sufficient

thickness would be placed under and over the FML to provide additional protection to the liner against puncture or tearing resulting from the underlying foundation layer or the overlying protective soil cover.

Alternative 3d also includes ICs, access restrictions, monitoring well abandonment, replacement, and casing extensions and long term monitoring as proposed in Alternatives 3a, 3b, and 3c. The ICs and the implementation of the ICs for Alternative 3d will be similar to Alternative 2 (Section 12.2.2.1 and 12.2.2.2). In addition, Alternative 3d will include the construction of an active and passive landfill gas collection system and associated monitoring and construction of a stormwater control system, as described in Alternative 2 and also implemented in Alternatives 3a, 3b, and 3c.

12.2.4 Alternative 4 - Clean Closure and Groundwater Monitoring

Alternative 4 (clean closure) includes excavation and removal of all buried construction debris at AA 3, groundwater and soil gas monitoring well abandonment, site revegetation, long term groundwater monitoring for 5 years, a 5 year site review, and site closeout.

Clean closure may be an appropriate alternative to closing a landfill site in place. According to the CIWMB guidelines (CIWMB 1994), sites that generally lend themselves to clean closure include:

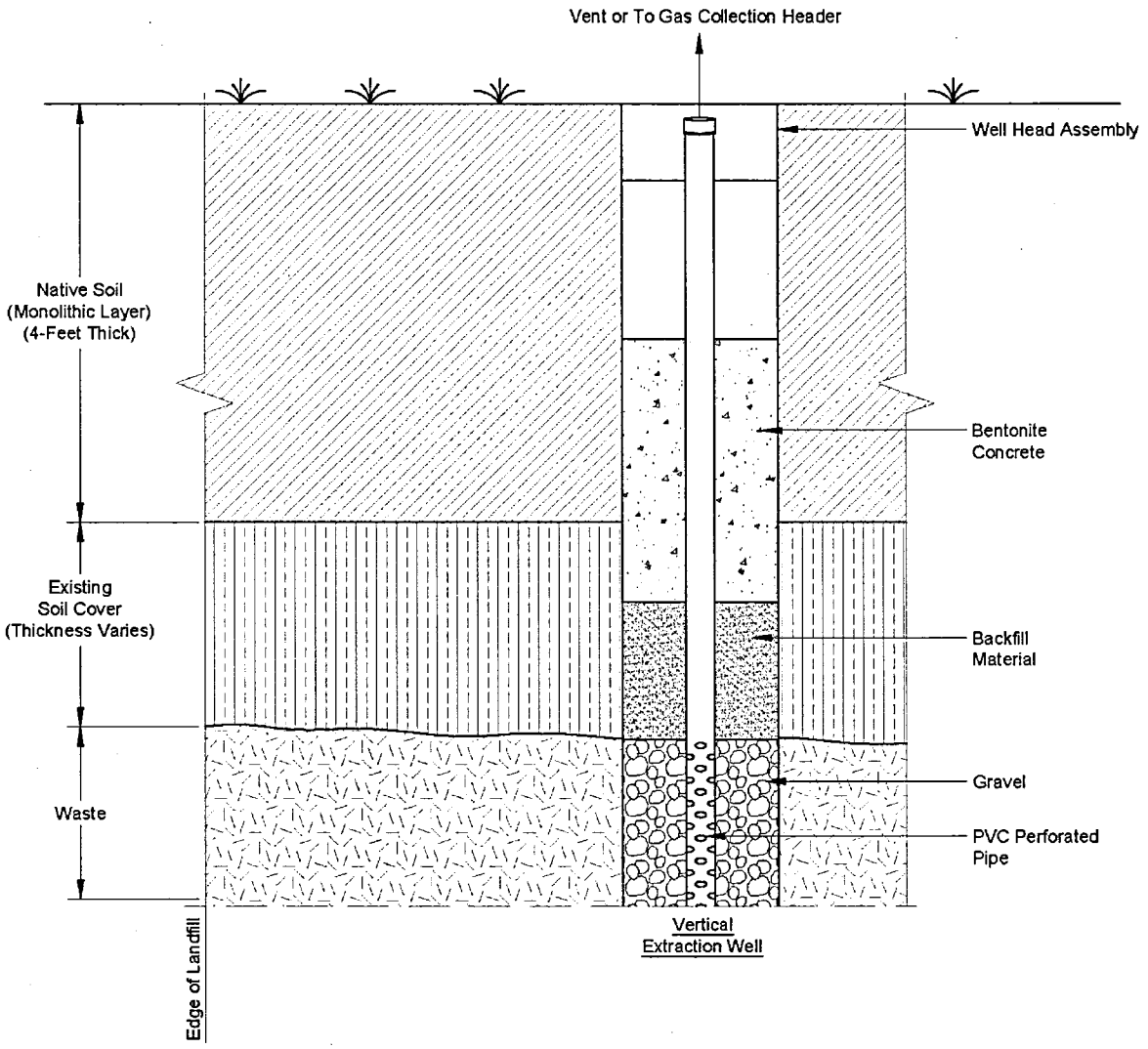
- small landfills and burn dumps;
- nonhazardous wood waste disposal sites;
- solid and liquid waste treatment and processing units; and
- sites where the cost of clean closure would be less than or equal to the costs of long-term monitoring and postclosure maintenance of the site.

The advantages of clean closure include elimination of the need for 30 years of postclosure maintenance, potential future corrective actions, regulatory agency inspections of the site, and an increase in potential future land uses of the site.

Clean closure of AA 3 was considered. To prepare a cost estimate for clean closure, three scenarios were developed:

1. 50% of the buried debris would be disposed of as RCRA hazardous waste requiring stabilization, and 50% of the buried debris would be disposed of as non-hazardous waste.
2. 25% of the buried debris would be disposed of as RCRA hazardous waste requiring stabilization, and 75% of the buried debris would be disposed of as non-hazardous waste.
3. 100% of the buried debris would be disposed of as non-hazardous waste.

Clean closure would involve removal of site contaminants to concentrations protective of human health and the environment.



Alternative 3a - Evapotranspiration Cover
Typical Landfill Cross Section

Not to Scale

RI/FS Report	Draft Final
Alternative 3a - Typical Cross-Section	
Anomaly Area 3	
Date: 04-08	Former MCAS El Toro
Project No. 04.1107.006/ 29307	**Barajas & Associates, Inc.**
Figure	12-1

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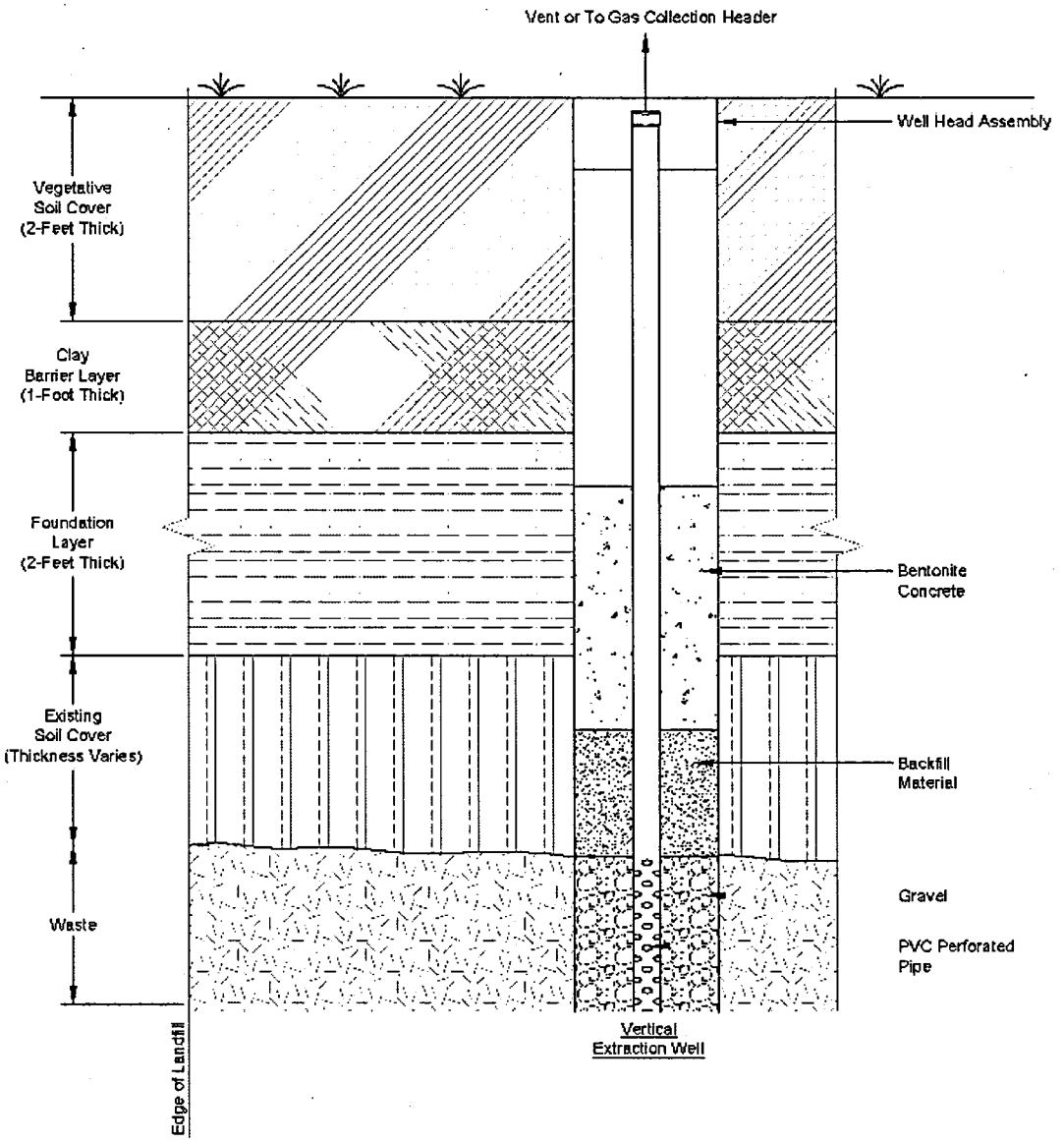

Alternative 3b - Title 27 Prescriptive Cap with Clay Barrier
Typical Landfill Cross Section

Not to Scale

RI/FS Report		Draft Final
Alternative 3b - Typical Cross-Section		
Anomaly Area 3		
Date: 04-08	Former MCAS El Toro	Figure
Project No. 04.1107.006/ 29307	**Barajas & Associates, Inc.**	12-2

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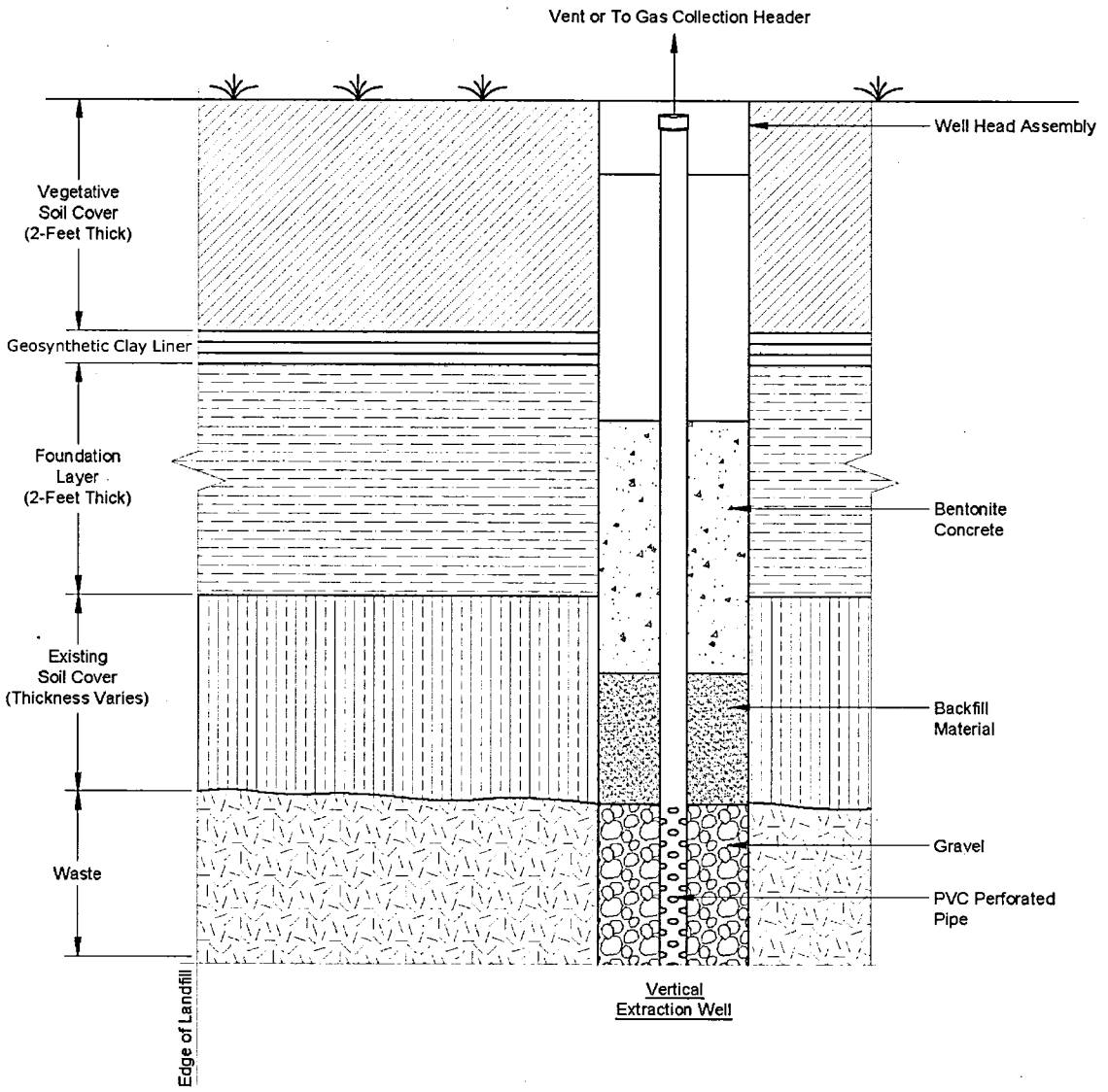

Alternative 3c - Title 27 Prescriptive Cap with
Geosynthetic Clay Liner
Typical Landfill Cross Section

Not to Scale

RI/FS Report		Draft Final
Alternative 3c - Typical Cross-Section		
Anomaly Area 3		
Date: 04-08	Former MCAS El Toro	Figure
Project No. 04.1107.006/ 29307	**Barajas & Associates, Inc.**	12-3

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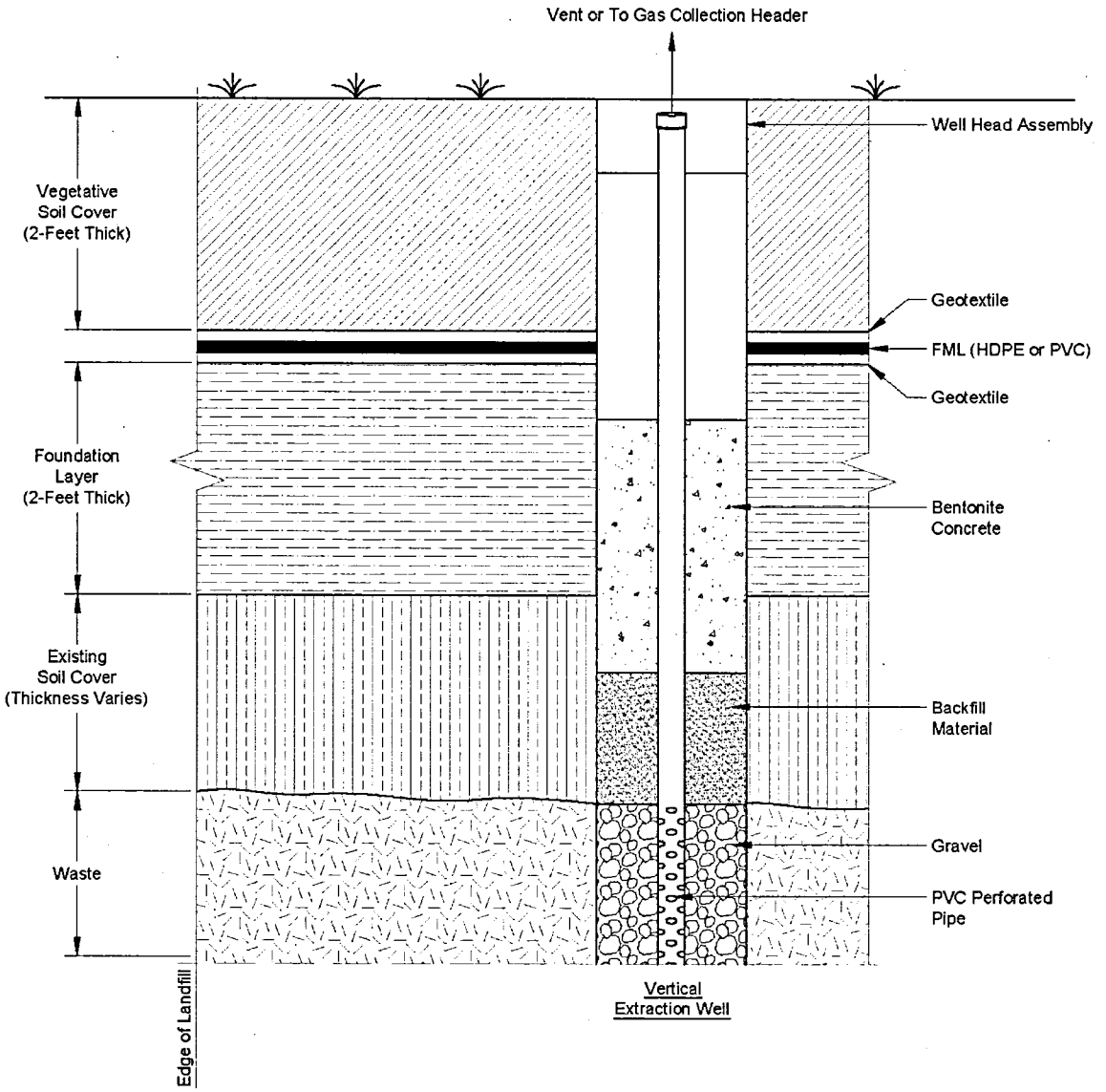

Alternative 3d - Title 27 Prescriptive Cap with Flexible Membrane Liner Typical Landfill Cross Section

Not to Scale

RI/FS Report		Draft Final
Alternative 3d - Typical Cross-Section		
Anomaly Area 3		
Date: 04-08	Former MCAS El Toro	Figure
Project No. 04.1107.006/ 29307	**Barajas & Associates, Inc.**	12-4

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13. DETAILED ANALYSIS OF ALTERNATIVES

13.1 INTRODUCTION

The detailed analyses of the remedial alternatives (described in Section 12) retained for the FS evaluation are presented below. The remedial action alternatives developed for AA 3 were evaluated using the NCP Part 300.430(e)(99)(iii) criteria. A brief introduction to these nine NCP criteria under the grouping of threshold, primary balancing, and modifying criteria is presented below.

Threshold Criteria

1. Overall Protection of Human Health and the Environment. This criterion is an assessment of how each alternative protects human health and the environment, in the short term and long term, from acceptable risks posed by hazardous substances, pollutants, or contaminants present at the site. This criterion assesses whether risks are reduced as a result of the remedial action alternative.
2. Compliance with ARARs. This criterion assesses the compliance of each alternative with ARARs under the federal environmental laws and state environmental and facility siting laws.

Primary Balancing Criteria

1. Long-term Effectiveness and Permanence. This criterion assesses long-term effectiveness and permanence of the alternatives and the degree of certainty that the alternative will prove successful. According to the U.S. EPA (U.S. EPA 1991a), the long-term effectiveness and permanence of presumptive remedies for landfills include: (1) the degree to which the cap inhibits mobility of landfill contents, and (2) the ability of the landfill cap to maintain its integrity. The effectiveness of the cap in inhibiting the mobility of the landfill contents is related to the amount by which the cap reduces infiltration into landfill materials.
2. Reduction in Toxicity, Mobility, or Volume through Treatment. This criterion assesses the degree to which the alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the site.
3. Short-term Effectiveness. The short-term effectiveness criterion assesses short-term risk to the community during implementation of an alternative including: (1) potential impacts on workers during the remedial action and the effectiveness and reliability of protective measures, and (2) potential environmental impacts of the remedial action and the effectiveness and reliability of mitigative measures during the implementation. This criterion also assesses the time required to achieve cleanup objectives until the cleanup objectives are achieved.
4. Implementability. This criterion assesses: (1) technical feasibility, (2) availability of services and materials, and (3) administrative feasibility.
5. Cost. The evaluation of the costs involves the development of the following components: (1) capital costs, including both direct and indirect costs, (2) annual operation and maintenance (O&M) costs, and (3) the grand total of capital and O&M costs including a contingency of 20%. These cost estimates are order-of-magnitude estimates that are intended to be used for comparative purposes only. These cost estimates should not be used for budget or funding purposes.

Modifying Criteria

1. State Acceptance. This criterion assesses the state acceptance of the alternative with respect to the following issues: (1) state agencies' position and key concerns related to the preferred alternative and other alternatives, and (2) state agencies' comments on ARARs.
2. Community Acceptance. This criterion assesses the general community support, reservations, or opposition to the alternatives.

13.2 INDIVIDUAL ANALYSIS OF ALTERNATIVES

The remedial alternatives developed for AA 3 were formulated in Section 12. Each of the alternatives, including options, is evaluated relative to the nine NCP criteria. This evaluation is intended to highlight the strengths and weaknesses of the alternatives and provide adequate information for decision makers to select the most appropriate alternative for AA 3. A conceptual landfill cover design drawing is presented in Figure 13-1.

13.2.1 Alternative 1 – No Action

Alternative 1 includes no action for AA 3. In evaluating this alternative, the following assumptions are made:

- the DON does not provide any ICs or access restrictions or construct any containment systems for the landfill; and
- no monitoring of the various media is conducted.

Description. Alternative 1 assumes that current conditions of the site would remain in place. Therefore, no further action will be taken to prevent direct contact with the landfill wastes, control surface water run-on and runoff, control erosion, or control infiltration and potential contaminant leaching to groundwater.

Although there is no designed landfill cap, most of the waste mass is currently covered by an approximately 2 to 5 feet thick layer of soil (Earth Tech 2005a).

Evaluation. Individual evaluation of Alternative 1 with respect to the nine NCP criteria is provided in the following subsections.

1. Overall Protection of Human-Health and the Environment. Alternative 1 includes no treatment, containment, or ICs and access restrictions. The baseline human-health risk assessment performed for AA 3 indicates that current site conditions pose an excess lifetime cancer risk greater than 1×10^{-5} due to surface soils and a risk greater than 1×10^{-4} due to groundwater; however a significant portion of the risk is attributable to background levels of arsenic. The ecological risk assessment concluded that contamination at the site is not likely to impact wildlife receptors. These values indicate that the risk due to soil and groundwater at AA 3 is within the NCP-defined risk management range. By taking no action, the possibility will remain that humans could inadvertently come directly in contact with wastes. Because Alternative 1 does not actively mitigate infiltration, take action to prevent direct contact with landfill materials, or monitor for the presence of contaminants, no risk reduction occurs.
2. Compliance with ARARs. By taking no action to contain the landfill, infiltration into the landfill could continue, and direct contact could be made with landfill contents, therefore,

Alternative 1 will not comply with the Title 27 CCR requirements for closure (engineered cover alternative) and postclosure of landfills in California.

3. Long-Term Effectiveness and Permanence. Alternative 1 would have little long-term effectiveness at reducing risks associated with the landfill. Potential impacts to groundwater through infiltration still would be present. Because of the existing small cover thickness and potential for erosion of Agua Chinon Wash, risk of exposure to contaminants through direct contact with the waste would still continue to exist.

   Because Alternative 1 is meant to serve as a baseline against which the other alternatives may be compared, the Unsaturated Soil Water and Heat Flow Model (UNSAT-H) (presented in Appendix K), was used to estimate drainage (the amount of water infiltrated through the base of the landfill cover) that would occur if no action were taken. The results indicated that if no action is implemented at AA 3, drainage over a 10-year period is estimated to be within 10 percent of the predicted drainage for a state-prescriptive cap.

4. Reduction in Toxicity, Mobility, or Volume through Treatment. The reduction of volume of landfill material would not be achieved. UNSAT-H modeling indicates comparable performance to a state-prescriptive cap if a vegetative soil cover were maintained. The existing cover would not be maintained, therefore the effectiveness could not be maintained and the resulting potential for leachate production would not be reduced.

5. Short-Term Effectiveness. There is no short-term effectiveness associated with Alternative 1 since no active remedial activities are performed.

6. Implementation. There are no implementation factors associated with Alternative 1.

7. Cost. There are no costs associated with Alternative 1.

8. State Acceptance. The review of Alternative 1 as part of this FS effort is pending.

9. Community Acceptance. Community acceptance of Alternative 1 will be assessed following the public review process.

13.2.2 Alternative 2 – Limited Grading, Monitoring, and Institutional Controls

Alternative 2 includes ICs and access restrictions and limited grading at AA 3. Environmental monitoring would be performed utilizing existing monitoring networks. ICs, access restrictions, and monitoring are some of the presumptive remedies available for municipal landfills.

Description. ICs and access restrictions restrict the use of a landfill site, thus reducing exposure to on-site contamination (see Section 12.2.2.1 and 12.2.2.2 for details). Alternative 2 would physically limit or prevent access to AA 3 using measures such as perimeter fences, gates, and signs. In addition, Alternative 2 would include construction of a finger dike and placement of riprap to prevent erosion of the soil cover and control stormwater flow in the vicinity of AA 3, long-term groundwater and soil gas monitoring, 5-year site reviews, limited site grading, survey monument installation, facility inspection and maintenance, and site closeout

Monitoring activities included in Alternative 2 are landfill gas monitoring beneath the site and groundwater monitoring from existing probes and wells. Monitoring is currently planned to be performed for 30 years or until monitoring data indicate that the waste no longer presents a risk to

human health and the environment. Monitoring requirements will be reevaluated for appropriateness at 5-year intervals.

Environmental monitoring for Alternative 2 would be conducted at currently existing monitoring locations. Landfill gas and groundwater would be monitored. Security measures (fences, signs, and locks) would be inspected and repaired as required.

- Landfill gas monitoring for AA 3 would be performed using periodic gas sampling and analysis at three existing triple nested perimeter gas wells (PG1 through PG3). An active landfill gas collection system or gas vent system is proposed to be installed in accordance with CIWMB monitoring protocol. Compliance landfill gas monitoring probes will be installed within 50 feet of the waste boundary. This will act as an early warning feature for the initiation of landfill gas collection and treatment to prevent migration of landfill gas above Title 27 CCR thresholds at the 100-foot compliance point.

- Groundwater monitoring consistent with Title 27 CCR capping requirements would be performed from five existing monitoring wells to assess if groundwater quality is being degraded.

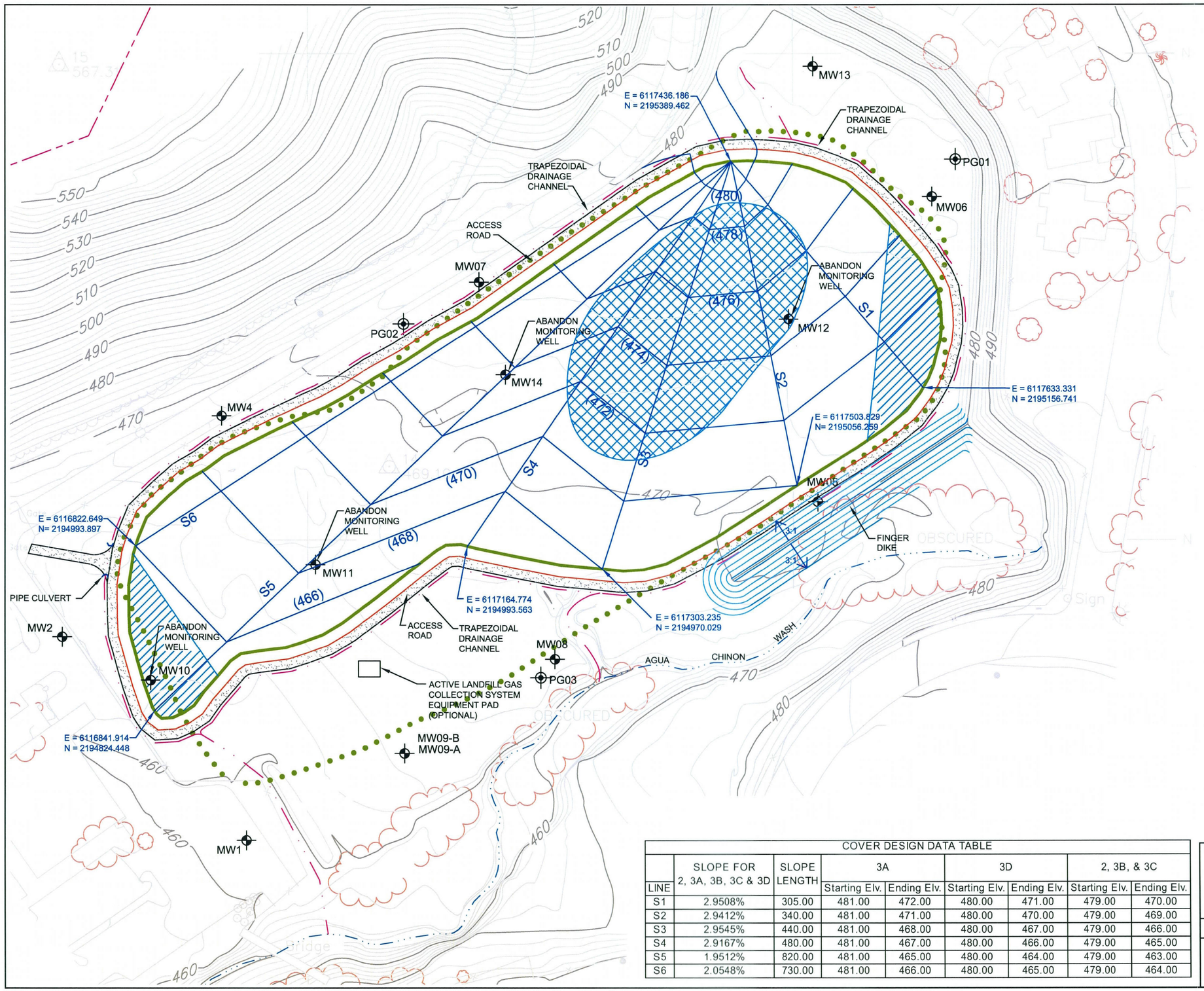
The results of the RI for AA 3 indicate that soil gas was detected at relatively low concentrations and only at isolated sampling locations. Therefore, the landfill gas-closure requirements are limited to monitoring. However in subsequent discussions with the regulatory agencies, an agreement was reached with the CIWMB and the FFA signatories pertaining to the landfill gas control measures at AA 3. The agreement was based on the results of the landfill gas investigations at AA 3, anticipated post-closure land use, and the DON's consultation with FFA representatives and CIWMB.

Evaluation. Individual evaluation of Alternative 2 with respect to the nine NCP criteria is provided in the following subsections.

1. Overall Protection of Human Health and the Environment. Current site conditions do not pose potential risks to human health. Alternative 2 includes limited grading and construction of a finger dike and placement of riprap to prevent erosion and control stormwater flow in the vicinity of AA 3. Access controls, such as fences and signs, should prevent inadvertent contact with wastes. ICs would restrict land-use that may lead to unacceptable risk to human health and the environmental and prevent activities that could threaten the integrity of the existing cover. For these reasons, Alternative 2 is considered protective of human health and the environment.

2. Compliance with ARARs. Certain provisions of Title 27 CCR were identified as ARARs that identify closure and post-closure requirements for landfills. Results from UNSAT-H modeling indicate that the existing soil cover offers equivalent performance as the state–prescriptive cap. Monitoring, ICs, and access restrictions satisfy the groundwater monitoring and security requirements of these ARARs..

3. Long-Term Effectiveness and Permanence. Annual drainage into the landfill has been estimated using UNSAT-H evaluations. The predicted water balance is provided for each year of the 10-yr simulation period, based on climatic conditions for the site from 1980 through 1989. The predicted annual drainage for the existing soil cover with an assumed 80 percent compaction ranges from 0.002 inches to 8.702 inches (0.005 cm to 22.103 cm). It should be noted that the assumed compaction value of 80 percent used for modeling purposes, represents the natural condition of the existing soil cover, and is not intended to be



LEGEND

- MINOR SURFACE ELEVATION: 2-FOOT INTERVALS
- 460 — MAJOR SURFACE ELEVATION: 10-FOOT INTERVALS
- MCAS EL TORO BOUNDARY
- AGUA CHINON WASH
- TRAPEZOIDAL DRANAGE CHANNEL
- REVISED EXTENT OF WASTE PLACEMENT BASED ON TRENCHING ACTIVITY(MARCH 2000 AND OCTOBER 2002)
- MW06 — GROUNDWATER MONITORING WELL
- PG01 — PERIMETER GAS MONITORING WELL
- DEBRIS REMOVAL AREA
- DEBRIS CONSOLIDATION AREA

NOTES

1. TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHOD FROM AERIAL PHOTOGRAPHY DATED DECEMBER 2001 BY SAN-LO AERIAL SURVEYS.
2. ELEVATIONS IN FEET; BENCHMARK BASED ONNORTHAMERICAN VERTICAL DATUM 1988.
3. COVER CONTOUR LINES WITH ELEVATIONS PRESENTED IN PARENTHESES ARE APPROXIMATE. FINAL LOCATION OF CONTOUR LINES ARE TO BE ESTABLISHED WITH THE SELECTION OF THE "FINAL DESIGN CROSS-SECTION." SEE "COVER DESIGN DATA TABLE" FOR DESIGN INFORMATION RELATED TO EACH ALTERNATIVE COVER DESIGN.

NORTH

0 — 100 FEET

SCALE: 1"= 100'

COVER DESIGN DATA TABLE

LINE	SLOPE FOR 2, 3A, 3B, 3C & 3D	SLOPE LENGTH	3A		3D		2, 3B, & 3C	
			Starting Elv.	Ending Elv.	Starting Elv.	Ending Elv.	Starting Elv.	Ending Elv.
S1	2.9508%	305.00	481.00	472.00	480.00	471.00	479.00	470.00
S2	2.9412%	340.00	481.00	471.00	480.00	470.00	479.00	469.00
S3	2.9545%	440.00	481.00	468.00	480.00	467.00	479.00	466.00
S4	2.9167%	480.00	481.00	467.00	480.00	466.00	479.00	465.00
S5	1.9512%	820.00	481.00	465.00	480.00	464.00	479.00	463.00
S6	2.0548%	730.00	481.00	466.00	480.00	465.00	479.00	464.00

RI/FS REPORT — DRAFT FINAL

CONCEPTUAL LANDFILL COVER DESIGN

ANOMALY AREA 3 FEASIBILITY STUDY

FORMER MCAS EL TORO

PROJECT NO. 04.1107.006/ 29307

BARAJAS & ASSOCIATES, INC.

FIGURE 13-1

13-5

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the design criteria for the cover. The design criteria for the cover will be developed in the remedial design phase. Results from UNSAT-H modeling indicate that the existing soil cover offers better performance than the state–prescriptive cap (see Appendix K).

4. Reduction of Toxicity, Mobility, or Volume through Treatment. The reduction of toxicity, mobility, and volume through treatment will not occur. However, the predicted drainage is comparable to a state–prescriptive cap, therefore the leaching potential will be reduced at a rate comparable to the state prescriptive cap.

5. Short-Term Effectiveness. Field activities associated with this alternative include limited grading, construction of a finger dike, placement of riprap, and monitoring of landfill gas and groundwater. A site-specific sampling plan as well as a site-specific health and safety plan (HSP) would be prepared and implemented. Because the contaminant concentrations in groundwater and landfill gas concentrations in air are low, the potential short-term risk to the community and site workers through inhalation pathways is considered insignificant. Site workers participating in monitoring activities would wear the necessary personal protective equipment (PPE), as specified in the HSP.

6. Implementability. Standard equipment and procedures would be used for grading, construction of a finger dike, placement of riprap, and to monitor landfill gas and groundwater. No significant delays or difficulties in obtaining material and services are anticipated. Interim ICs are currently being administratively handled through an existing LIFOC. The implementation of final ICs including land-use restrictions incorporated into environmental restriction covenants is an administrative process and relatively easy to implement.

7. Cost. The cost estimate for Alternative 2 was developed using the Remedial Action Cost Engineering Requirements™ (RACER™) 2005 system developed by the U.S. Air Force. RACER cost models are based on generic engineering solutions for environmental projects, technologies, and processes. These solutions are derived from historical project information, government laboratories, construction management agencies, vendors, contractors, and engineering analysis. RACER cost estimates are made site-specific through modifications of the geographic and project specific factors.

   Table 13-1 presents cost associated with the implementation of Alternative 2. Alternative 2 costs include ICs and existing access restrictions, construction of a finger dike and placement of riprap, monitoring well abandonment and replacements, debris relocation, construction of a landfill gas collection system, long-term groundwater and soil gas monitoring, 5-year site reviews, limited site grading, survey monument installation, facility inspection and maintenance, and site closeout. These costs are intended to be used for comparative purposes in this FS and not for budgeting or planning purposes. Appendix J presents a more detailed discussion of the costs associated with Alternative 2.

   The present worth for Alternative 2 is estimated to be $3,539,475.

8. State Acceptance. The review of Alternative 2 as part of this FS effort is pending.

9. Community Acceptance. Community acceptance of this alternative will be assessed following the public review process.

Table 13-1: Alternative 2 - Cost Estimate Summary

Cost Category	Capital Costs[a]	Operation and Maintenance Costs[a]
Direct Costs		
Design	$79,087	
Land Use Controls (Capital)	$50,940	-
Site Grading (Capital)	$77,257	-
Drainage Improvements (Capital)	$107.836	-
SG Well Installs/Monitoring Well Abandonments (Capital)	$68,046	-
Debris Relocations (Capital)	$538,703	
Active Landfill Gas Collection System (Capital)	$234,853	-
Passive Landfill Gas Collection System (Capital)	$81,879	-
Operation and Maintenance Costs		
Long Term Monitoring (Years 1-5)	-	$512,671
Long Term Monitoring (Years 6-30)	-	$1,432,987
Monitoring Well Replacements (10 years)	-	$138,484
Monitoring Well Replacements (20 years)		$138,484
5-Year Review	-	$182,229
Site Closeout	-	$75,185
Subtotal Costs	$1,238,601	$2,480,039
Contingency (20%)[b]	$221,715	$496,008
Total Costs	$1,460,316	$2,976,047
Grand Total Alternative 2	$4,436,363	
Present Worth[c]	$3,539,475	

Notes:
[a] Individual costs presented in this table for each line item do not constitute present value costs. Present value costs for each line item are presented in Appendix J.
[b] Contingency of 20% was added to cover cost increases that may occur as a result of unforeseen conditions and changes that typically occur on remediation projects. Contingency was not applied on cost estimates for design and land use controls.
[c] Base year of 2008.

13.2.3 Alternative 3 – Containment, Monitoring, and Institutional Controls

13.2.3.1 ALTERNATIVE 3A – CONTAINMENT WITH EVAPOTRANSPIRATION COVER

Alternative 3a is a combination of landfill capping, ICs, access restrictions and monitoring. The ICs, access restrictions, and monitoring are similar to those associated with Alternative 2, but with provisions for protecting the integrity of the landfill cap and erosion control features. Monitoring will be used to assess the effectiveness of the remedy. A typical cross-section of Alternative 3a is shown in Figure 12-1.

Description

Monitoring and Inspections. Environmental monitoring for Alternative 3a would be conducted at currently existing monitoring locations. At AA 3, landfill gas and groundwater would be monitored. Security measures (fences, signs, and locks) would be inspected and repaired as required.

- Landfill gas monitoring for AA 3 would be performed using periodic gas sampling and analysis of three existing triple nested perimeter gas wells (PG1 through PG3). An active landfill gas collection system or gas vent system is proposed to be installed in accordance with CIWMB monitoring protocol. Compliance landfill gas monitoring probes will be installed within 50 feet of the waste boundary. This will act as an early warning feature for the initiation of the landfill gas collection and treatment to prevent migration of landfill gas above Title 27 CCR thresholds at the 100-foot compliance point.

- Groundwater monitoring, consistent with Title 27 CCR capping requirements, would be performed from five existing monitoring wells to assess if groundwater quality is being degraded.

This alternative includes minimal consolidation of waste, placement of a single layer of native-soil cap over the landfill, construction of surface-water drainage control, and construction of run-on and runoff structures. Existing soil cover over the landfill would be excavated, backfilled, compacted and graded making it unnecessary to import large quantities of additional soil from off-site. However, clean soils from borrow sources will be used for constructing some of the foundation layer and the vegetative cover.

The landfill cap will consist of a 4-foot-thick single layer ET soil cap designed to prevent exposure and reduce infiltration through the cover. The cover would be graded to prevent ponding. The soil cover will be clean imported fill that will be compacted to achieve a permeability that would offer equivalent protection as a state-prescribed cover as specified in Title 27 CCR.

Evaluation. Individual evaluation of Alternative 3a with respect to the nine NCP criteria is provided in the following subsections.

1. Overall Protection of Human Health and the Environment. The ET soil cover in Alternative 3a would be constructed using clean off-site soil. Consequently, Alternative 3a will eliminate soil-related risks by removing the pathway for inhalation, ingestion, and dermal contact with soils. Grading of the cap provides added assurance that ponding would not occur and prevents potential future impacts to groundwater.

2. Compliance with ARARs. Data collected to date do not indicate that groundwater has been impacted due to waste placement. In addition, construction of a landfill cover will prevent infiltration and will significantly reduce the potential for groundwater to be degraded. Monitoring will be conducted as part of this alternative to assess the effectiveness of this alternative.

   Dust suppression would be used during grading activities to control dust and comply with visible emissions nuisance and fugitive-dust standards regulated by SCAQMD rules and are identified as chemical-specific ARARs for air.

   Potential action-specific ARARs for this alternative relate to construction of an engineered alternative to the prescriptive final cover for municipal landfills, groundwater monitoring, landfill gas control and monitoring, waste excavation during consolidation, and post-closure maintenance. Since the landfill gas concentrations at AA 3 are relatively low, the landfill gas-closure requirements are limited to monitoring. Appendix H lists the substantive provision of Titles 22, 23, and 27 CCR, and 40 CFR 258 pertaining to landfill closure and post-closure and identifies the most stringent (or controlling) potential ARARs.

The UNSAT-H modeling was performed to demonstrate that the ET soil cover would meet Title 27 CCR final cover requirements and would be an acceptable engineered alternative to the prescriptive cap. Results from the UNSAT-H modeling are provided in Appendix K.

Alternative 3a involves excavation, relocation, and consolidation of waste. The U.S. EPA has determined that disposal occurs when waste is placed in a land-based unit. However, movement within a unit does not constitute disposal or placement, and at CERCLA sites, an area of contamination can be considered comparable to a unit. Therefore, movement or consolidation within the landfill site does not constitute placement, and RCRA land-disposal restrictions are not triggered (U.S. EPA 1989b).

In summary, Alternative 3a is expected to meet all ARARs and provide protection equivalent to Title 27 CCR prescriptive cap.

3. Long-Term Effectiveness and Permanence. Consolidation and capping are reliable remedial technologies for a landfill provided that the cap is properly designed, constructed, and maintained. Capping is designed to prevent infiltration and potential future impact to groundwater.

   The native soil cap in Alternative 3a is resistant to desiccation and resultant cracking. Typically, deeply rooted plants negatively impact other landfill covers by breaching the barrier layer. However, they are an integral part of the ET soil cover because the roots of these plants tend to increase the depth of the evapotranspiration zone and reduce infiltration into the landfill.

   The ET cover meets the requirements of the land reuse, as AA 3 is to be part of low-density residential.

   The UNSAT-H modeling has been performed to evaluate if the ET soil cover would meet CCR Title 27 CCR final cover requirements and would be an acceptable engineered alternative to the prescriptive cap. The predicted water balance is provided for each year of the 10-yr simulation period, which is based on climatic conditions for the site from 1980 through 1989. Based on this, the predicted annual drainage ranges from less than 0.001 inches to 1.685 inches (0.002 cm to 4.282 cm). Results from the UNSAT-H modeling are provided in Appendix K.

   Groundwater and landfill gas monitoring would be conducted to comply with the controlling ARARs noted in Appendix H. The base transfer considerations have necessitated the design and installation of a landfill gas-collection and treatment system. However, the landfill gas collection and treatment will be triggered only if soil-gas concentrations exceed thresholds at the 100-ft buffer boundary, at perimeter soil-gas monitoring locations or at any facilities at the site.

   The long-term effectiveness of the landfill cap itself is dependent upon maintenance and the continued application of ICs and access restrictions. The following measures are included in Alternative 3a to assure long-term effectiveness and permanence:

   - Continued inspection and maintenance of the cap (including surface water run-on and runoff controls, final cover grades, settlement, erosion, and vegetative cover).
   - Enforcement of limited future land use at AA 3.

- Landfill gas and groundwater monitoring.
- A 5-year review of this alternative is required under the NCP because wastes remain on site.

4. Reduction in Toxicity, Mobility, or Volume through Treatment. There would not be an appreciable reduction in the volume of landfill materials as a result of implementation of this alternative. However, mobility in the form of infiltration and leaching through the landfill would be prevented and controlled by capping.

5. Short-term Effectiveness. Alternative 3a involves excavation, consolidation, grading, construction of a landfill cap, and construction of surface-water drainage controls. Risks associated with exposure of site personnel to dust emissions and direct contact with impacted soil/waste during excavation would be minimized using dust suppressants and PPE. PPE would also be used during groundwater sampling to prevent direct contact with the impacted groundwater. Exposure of the community or to site construction workers may occur through inhalation of fugitive dust that is windborne over a distance of 1/4 mile south or west of the site.

   Exposure of the community is expected to be minimal due to the short time required to excavate and consolidate landfill materials and the use of dust suppressants and vapor monitoring to prevent off-site releases of contaminants. Heavy equipment will conform to the specifications of the California Occupational Safety and Health Administration (Cal-OSHA). Only authorized personnel will perform heavy-equipment operation.

   Safety devices provided with the machinery, including seat belts, would be used at all times. Personnel not trained or not directly involved in the work area would keep a safe distance. Trained personnel directly involved in the operation would avoid moving into the path of the operating equipment or into blind spots of the operator.

   The time required for completion of the remedial response objectives is approximately 3 months and includes site preparation, cap placement, drainage controls, erosion controls, installation of active landfill gas collection system, passive trenches and perimeter gas monitoring wells, and contract closeout.

6. Implementability. Excavation, consolidation, and capping are reliable and well-established technologies that can be readily implemented using widely available commercial services, materials, and equipment. The standard equipment and machinery used for excavation, loading, and transportation, as well as the installation of the native cap, would be readily available. Should any technical problems occur with the equipment or machinery, a minimum delay in schedule would result from equipment/machinery substitution. ICs and access restrictions for land and groundwater use are also readily implementable.

   Fugitive dust and potential (but unlikely) VOC emissions would be monitored using portable emission monitors during construction activities. Long-term landfill gas and groundwater monitoring would be conducted using commercially available equipment.

7. Cost. The cost estimate for Alternative 3a includes the construction of a single layer cap otherwise known as an ET landfill cover system, stormwater control system construction, the implementation of ICs and existing access restrictions, monitoring well abandonments and installations, debris relocation, construction of a landfill gas collection system, long-term groundwater and soil gas monitoring, access road construction, 5-year site reviews, facility

inspection and maintenance, and site closeout. A summary of the costs for Alternative 3a is provided in Table 13-2. Cost-estimating details, including assumptions and RACER input parameters, are provided in Appendix J.

The present worth for Alternative 3a is estimated to be $5,448,664.

8. State Acceptance. The review of Alternative 3a as part of this FS effort is pending.

9. Community Acceptance. Community acceptance of this alternative will be assessed following the public review process.

Table 13-2: Alternative 3a - Cost Estimate Summary

Cost Category	Capital Costs[a]	Operation and Maintenance Costs[a]
Direct Costs		
Design	$110,381	-
ET Cover (Capital)_	$1,566,972	
Monitoring Well Abandonments/Install SGMWs/Casing Extensions (Capital)	$80,400	-
Active Landfill Gas Collection System (Capital)	$234,853	-
Passive Landfill Gas Collection System (Capital)	$81,879	-
Land Use Controls (Capital)	$50,940	
Debris Relocation (Capital)	$538,703	
Operation and Maintenance Costs		
Long Term Monitoring (Years 1-5)	-	$534,293
Long Term Monitoring (Years 6-30)	-	$1,541,071
5-Year Review		$292,943
Monitoring Well Replacements (10 years)	-	$138,484
Monitoring Well Replacements (20 years)		$138,484
Site Closeout	-	$100,529
Subtotal Costs	$2,664,127	$2,745,804
Contingency (20%)[b]	$500,561	$549,161
Total Costs	$3,164,689	$3,294,965
Grand Total Alternative 3a	$6,459,654	
Present Worth[c]	$5,448,664	

Notes:
[a] Individual costs presented in this table for each line item do not constitute present value costs. Present value costs for each line item are presented in Appendix J.
[b] Contingency of 20% was added to cover cost increases that may occur as a result of unforeseen conditions and changes that typically occur on remediation projects. Contingency was not applied on cost estimates for design and land use controls.
[c] Base year of 2008.

13.2.3.2 *ALTERNATIVE 3B – CONTAINMENT WITH TITLE 27 PRESCRIPTIVE CAP*

Alternative 3b uses three layers required for a Title 27 CCR prescriptive cap. These layers include a minimum 2-foot-thick foundation layer, a barrier layer (consisting of a minimum 1-foot-thick

compacted clay), and a 2-foot-thick soil cover layer for vegetation. A typical cross section of Alternative 3b is presented in Figure 12-2.

Description

Monitoring and Inspections. Environmental monitoring for Alternative 3b would be conducted at currently existing monitoring locations. Landfill gas and groundwater would be monitored. Security measures (fences, signs, and locks) would be inspected and repaired as required.

- Landfill gas monitoring for AA 3 would be performed using periodic gas sampling and analysis of three existing triple-nested perimeter gas wells (PG1 through PG3). An active landfill gas collection system or gas vent system is proposed to be installed in accordance with CIWMB monitoring protocol. Compliance landfill gas monitoring probes would be installed within 50 feet of the waste boundary. This would act as an early warning feature for the initiation of the landfill gas collection and treatment to prevent migration of landfill gas above Title 27 CCR thresholds at the 100-foot compliance point.

- Groundwater monitoring, consistent with Title 27 CCR capping requirements, would be performed from five existing monitoring wells to assess if groundwater quality is being degraded.

Evaluation. Individual evaluation of Alternative 3b with respect to the nine NCP criteria is provided in the following subsections.

1. Overall Protection of Human Health and the Environment. Since the vegetative soil cover in Alternative 3b would be constructed using clean off-site soil, this alternative will eliminate soil-related risks by removing the pathway for inhalation, ingestion, and dermal contact with soils. With the consolidation of wastes, Alternative 3b will eliminate long-term risk associated with these waste areas. Grading of the cap provides added assurance that ponding would not occur and prevents potential future impacts to groundwater. Alternative 3b also prevents infiltration into landfill contents, thus reducing potential impacts for revegetation with annual grasses resulting in low maintenance.

   Annual inspection and maintenance would be performed to identify and remove plants with deep root systems that could compromise the integrity of the barrier. Monitoring and maintenance would be used to assure continued integrity of the landfill cap. ICs and access restrictions will be used to protect the cap and to prevent exposure to groundwater. Because the wastes would remain on site, a 5-year reevaluation would be required under the NCP. Monitoring of landfill gas from perimeter monitoring probes, active landfill gas collection wells and passive trenches, and groundwater will be used to assess the effectiveness of the remedy.

2. Compliance with ARARs. Data collected to date do not indicate that groundwater has been impacted due to waste placement. In addition, construction of a landfill cover will minimize infiltration and will significantly reduce the potential for groundwater to be degraded. Monitoring will be conducted as part of this alternative to assess the effectiveness of this alternative.

   Alternative 3b meets chemical-specific, location-specific, and action-specific ARARs, as discussed for Alternative 3a. In addition, the installation of the Title 27 CCR landfill cap meets the prescriptive design requirements, in contrast to the engineered alternative discussed

for Alternative 3a. Groundwater and landfill gas monitoring will be conducted to comply with the substantive requirements Titles 22 and 27 CCR respectively, identified as potential ARARs (see Appendix H). Former MCAS El Toro transfer considerations have necessitated the design and installation of a landfill gas-collection and treatment system. However, the landfill gas collection and treatment will be triggered only if soil-gas concentrations exceed thresholds at perimeter soil-gas monitoring locations or at any facilities at the site.

3. Long-Term Effectiveness and Permanence. In general, installation of the Title 27 CCR prescriptive landfill cap provides an adequate and reliable long-term remedial response. The effectiveness, reliability, and adequacy of this remedial technology have resulted in its selection as the presumptive remedy for landfills. However, there are three anticipated concerns with a clay cap: (1) potential to crack when desiccated, (2) its low resistance to cracking from differential settlement, and (3) the difficulty of repairing the cap if it becomes damaged. Although a 2-foot soil cover and revegetation are used to protect the clay barrier, the semiarid climate at Former MCAS El Toro could cause drying and cracking of the clay barrier if prolonged number of dry years occur. Differential settlement is common as wastes in a landfill consolidate over time and could result in breaches in the clay barrier. Monitoring and inspection would need to be used to assure the continued integrity of the clay barrier.

   Following completion of construction, the cap would be inspected quarterly for signs of erosion, settlement, subsidence, or invasion by burrowing animals or deep-rooted vegetation. Quarterly inspections will continue until site conditions stabilize and complete revegetation occurs. The frequency of monitoring would be reevaluated at 5-year intervals. Signs of unexpected settling or subsidence would be addressed immediately by repairing the affected areas.

   The UNSAT-H modeling has been performed to evaluate the effectiveness of the Alternative 3b cap in preventing infiltration. The predicted water balance is provided for each year of the 10-yr simulation period, which is based on climatic conditions for the site from 1980 through 1989. The predicted annual drainage for Alternative 3b ranges from less than 0.606 inches to 6.031 inches (less than 1.540 cm to 15.319 cm). Results on the UNSAT-H modeling are presented in Appendix K.

   Alternative 3b involves excavation, relocation, and consolidation of waste within the revised landfill footprint. The U.S. EPA has determined that disposal occurs when waste is placed in a land-based unit. However, movement within a unit does not constitute disposal or placement, and at CERCLA sites, an area of contamination can be considered comparable to a unit. Therefore, movement or consolidation within the landfill site does not constitute placement, and RCRA land-disposal restrictions are not triggered (U.S. EPA 1989b).

   The installation of an active landfill gas collection system (serving in an inactive or passive venting mode until triggered) and the passive trenches within the compliance zone would assist in monitoring for landfill gas inside the waste itself, providing an early warning feature. These landfill gas control measures would eliminate potential risks to human health. However, once adequate landfill gas data are collected from the compliance landfill gas monitoring probes at the perimeter, and with the concurrence of the CIWMB, monitoring would be discontinued and ICs and access restrictions would be removed.

4. Reduction in Toxicity, Mobility, or Volume through Treatment. Mobility, in the form of infiltration through the landfill, would be prevented and controlled by capping. There would not be an appreciable reduction in the volume of landfill materials.

5. Short-Term Effectiveness. Alternative 3b involves excavation of waste, construction of a landfill cap, construction of surface-water drainage controls, a landfill gas-collection system consisting of active vertical extraction wells and passive trenches and migration monitoring well system. Risks associated with exposure of site personnel to dust emissions and direct contact with impacted soil/waste during excavation would be minimized using dust suppressants and PPE. PPE would also be used during the groundwater sampling to prevent direct contact with any potentially impacted groundwater.

   Exposure of the community or personnel at Former MCAS El Toro to site construction activities may occur through inhalation of fugitive dust that is windborne over a distance of 1/4 mile south or west of the site. Exposure of the community is expected to be minimal due to the short time required to excavate and consolidate landfill materials and the use of dust suppressants and vapor monitoring to prevent off-site releases of contaminants.

   Heavy equipment will conform to Cal-OSHA specifications. Only authorized personnel will perform heavy-equipment operation. Safety devices provided with the machinery, including seat belts, would be used at all times. Personnel not trained or not directly involved in the work area would keep a safe distance. Trained personnel directly involved in the operation would avoid moving into the path of the operating equipment or into blind spots of the operator.

   The time required for completion of the remedial response objectives is approximately 3.9 months and includes site preparation, cap placement, drainage controls, gas collection and monitoring system controls, erosion controls, revegetation, and contract closeout.

6. Implementability. Consolidation and capping are reliable and well-established technologies that can be readily implemented using widely available commercial services, materials and equipment. The standard equipment and machinery used for excavation, loading, and transportation, as well as the installation of the cap, would be readily available. Should any technical problems occur with the equipment or machinery, a minimum delay in schedule would result from equipment/machinery substitution. ICs and access restrictions for land and groundwater use are also readily implementable.

   Some of the existing soil cover material would be used for the foundation of the landfill cap. Clean soil for the remaining foundation layer and the vegetative layer is available from an on-site borrow source. This borrow source is readily accessible. However, clay material would have to be imported to the site from off-site borrow areas. Importing clay material would increase the costs of this alternative, particularly as the distance of the potential off-site borrow sources from the site increases.

   Fugitive dust and potential (but unlikely) VOC emissions would be monitored using portable emission monitors during construction activities. Long-term landfill gas and groundwater monitoring would be conducted using commercially available equipment.

7. Cost. The estimated costs for the implementation of Alternative 3b includes a state-prescriptive landfill cover system, stormwater control system construction, the implementation of ICs and existing access restrictions, monitoring well abandonments and installations, debris

relocation, construction of a landfill gas collection system, long-term groundwater and soil gas monitoring, access road construction, 5-year site reviews, facility inspection and maintenance, and site close-out. A summary of the costs for Alternative 3b is provided in Table 13-3. Cost-estimating details, including assumptions and RACER input parameters, are provided in Appendix J.

The present worth for Alternative 3b is estimated to be $5,660,178.

8. State Acceptance. The review of Alternative 3b as part of this FS effort is pending.

9. Community Acceptance. Community acceptance of this alternative will be assessed following the public review process.

Table 13-3: Alternative 3b - Cost Estimate Summary

Cost Category	Capital Costs[a]	Operation and Maintenance Costs[a]
Direct Costs		
Design	$110,556	
Prescriptive Cover (Capital)	$1,743,087	
Monitoring Well Abandonments/Install SGMWs/Casing Extensions (Capital)	$80,400	
Active Landfill Gas Collection System (Capital)	$234,853	
Passive Landfill Gas Collection System (Capital)	$81,879	
Land Use Controls (Capital)	$50,940	
Debris Relocation (Capital)	$538,703	
Operation and Maintenance Costs		
Long Term Monitoring (Years 1-5)		$534,293
Long Term Monitoring (Years 6-30)		$1,541,071
5-Year Review		$292,943
Monitoring Well Replacements (10 years)		$138,484
Monitoring Well Replacements (20 years)		$138,484
Site Closeout		$100,529
Subtotal Costs	$2,840,418	$2,745,804
Contingency (20%)[b]	$535,784	$549,161
Total Costs	$3,376,202	3,294,965
Grand Total Alternative 3b	**$6,671,167**	
Present Worth[c]	**$5,660,178**	

Notes:
[a] Individual costs presented in this table for each line item do not constitute present value costs. Present value costs for each line item are presented in Appendix J.
[b] Contingency of 20% was added to cover cost increases that may occur as a result of unforeseen conditions and changes that typically occur on remediation projects. Contingency was not applied on cost estimates for design and land use controls.
[c] Base year of 2008.

13.2.3.3 ALTERNATIVE 3C – CONTAINMENT WITH MODIFIED TITLE 27 PRESCRIPTIVE CAP WITH GEOSYNTHETIC CLAY LINER

Alternative 3c is a variation of Alternative 3b that replaces the low-permeability clay layer with a GCL. Individual evaluation of Alternative 3c with respect to the nine NCP criteria follows.

1. Overall Protection of Human Health and the Environment. Alternative 3c renders the exposure pathways for human health and the environment due to direct exposure, inhalation, and ingestion of soils incomplete. Soils-related risks are removed if the alternative is implemented. The cap also provides protection for human health by reducing infiltration into landfill contents, thus minimizing further impacts to groundwater. The 2-foot-thick native soil cover will also provide sufficient soil thickness for revegetation of the cover with annual grasses. Inspection and annual maintenance will be used to identify and remove plants with deep root systems that could impact the integrity of the GCL. Monitoring and maintenance will be used to assure continued integrity of the landfill cap. Because the wastes will remain on-site, a 5-year reevaluation is required under the NCP.

2. Compliance with ARARs. Alternative 3c meets chemical-specific, location-specific, and action-specific potential ARARs as discussed for Alternative 3a. In addition, the installation of the modified Title 27 CCR prescriptive landfill cap meets the potential action-specific ARARs for the landfill final cover construction. Groundwater and landfill gas monitoring will be conducted to comply with requirements of Titles 22 and 27 CCR that have been determined to be potential ARARs (see Appendix H).

3. Long-Term Effectiveness. The GCL is resistant to desiccation, can withstand large differential movement, and provides a permeability significantly less than 10^{-6} cm/s. Thus Alternative 3c is both reliable and an adequate option for long-term effectiveness and permanence, including O&M and management.

   Because dry bentonite in the GCL is more permeable to landfill gas, landfill gases could continue to be released to the atmosphere above the landfill. This is considered to be acceptable due to very low concentrations of gases being emitted. Former MCAS El Toro transfer considerations have necessitated the design and installation of a landfill gas-collection and treatment (serving in an inactive or passive venting mode until triggered) and the passive trenches within the compliance zone. This would assist in monitoring for landfill gas inside the waste itself, providing an early warning feature. However, once adequate landfill gas data are collected from the compliance landfill gas monitoring probes at the perimeter, and with the concurrence of the CIWMB, monitoring would be discontinued and ICs and access restrictions would be removed.

4. Reduction of Toxicity, Mobility, or Volume through Treatment. Reduction of inorganic landfill contaminant toxicity in groundwater is expected to occur through precipitation. In addition, contaminant mobility, in the form of infiltration and leaching of the landfill material, will be prevented and controlled by capping. There would not be an appreciable reduction in volume.

5. Short-Term Effectiveness. Alternative 3c involves waste consolidation; grading, and compaction; constructing a landfill cap; and constructing surface-water drainage controls. Potential exposure and protection procedures for workers engaged in construction activities at AA 3 will be addressed in the site-specific HSP. Risks associated with exposure of site personnel to dust emissions and direct contact with impacted soil/waste during consolidation activities will be minimized using dust suppressants and PPE. The PPE will also be used

during groundwater sampling to prevent direct contact with any potentially impacted groundwater.

Exposure of the community or personnel at Former MCAS El Toro to site construction activities may occur through inhalation of fugitive dust that is windborne over a distance of 1/4 mile south or west of the site.

Field activity associated with the installation of the GCL in Alternative 3c is less extensive than that required for installation of clay or soil/bentonite mix barrier layers. GCL is simple to construct and can be rapidly installed. GCL is a manufactured hydraulic barrier consisting of sodium/bentonite clay sandwiched between two layers of geotextile that are held together by needling, stitching, or adhesives. The GCL rolls can be placed immediately over the completed and prepared foundation layer and can be unrolled, thus requiring very little specialized equipment or labor. No welding for the installation of the GCL is needed. The GCL layer edges are overlapped with a bentonite layer between the overlaps.

Heavy equipment will conform to Cal-OSHA specifications. Only authorized personnel will perform heavy-equipment operation. Safety devices provided with the machinery, including seat belts, would be used at all times. Personnel not trained or not directly involved in the work area would keep a safe distance. Trained Personnel directly involved in the operation would avoid moving into the path of the operating equipment or into blind spots of the operator.

The time required for completion of the remedial response objectives is approximately 3.4 months and includes capping, and construction of drainage controls, erosion controls, and gas migration monitoring well system.

6. Implementability. GCL as a low-permeability layer in a landfill cap is a proven and reliable technology. The material is readily available and easily installed by contractors. Specialty equipment is not required.

7. Cost. The cost estimate for Alternative 3c includes the construction of a GCL cover system, stormwater control system construction, the implementation of ICs and existing access restrictions, monitoring well abandonments and installations, debris relocation, construction of a landfill gas collection system, long-term groundwater and soil gas monitoring, access road construction, 5-year reviews, facility inspection and maintenance, and site closeout. A summary of the costs for Alternative 3c is provided in Table 13-4. Cost-estimating details, including assumptions and RACER input parameters, are provided in Appendix J.

   The present worth for Alternative 3c is estimated to be $5,056,891.

8. State Acceptance. The review of Alternative 3c as part of this FS is pending.

9. Community Acceptance. Community acceptance of this alternative will be assessed following the public review process.

Table 13-4: Alternative 3c - Cost Estimate Summary

Cost Category	Capital Costs[a]	Operation and Maintenance Costs[a]
Direct Costs		
Design	$97,679	
GCL Cover (Capital)	$1,251,079	
Monitoring Well Abandonments/Install SGMWs/Casing Extensions (Capital)	$80,400	
Active Landfill Gas Collection System (Capital)	$234,853	
Passive Landfill Gas Collection System (Capital)	$81,879	
Land Use Controls (Capital)	$50,940	
Debris Relocation (Capital)	$538,703	
Operation and Maintenance Costs		
Long Term Monitoring (Years 1-5)		$534,293
Long Term Monitoring (Years 6-30)		$1,541,071
5-Year Review		$292,943
Monitoring Well Replacements (10 years)		$138,484
Monitoring Well Replacements (20 years)		$138,484
Site Closeout		$100,529
Subtotal Costs	2,335,533	$2,745,804
Contingency (20%)	$437,383	$549,161
Total Costs	$2,772,916	$3,294,965
Grand Total Alternative 3c	**$6,067,881**	
Present Worth[c]	**$5,056,891**	

Notes:
[a] Individual costs presented in this table for each line item do not constitute present value costs. Present value costs for each line item are presented in Appendix J.
[b] Contingency of 20% was added to cover cost increases that may occur as a result of unforeseen conditions and changes that typically occur on remediation projects. Contingency was not applied on cost estimates for design and land use controls.
[c] Base year of 2008.

13.2.3.4 ALTERNATIVE 3D – CONTAINMENT WITH MODIFIED TITLE 27 PRESCRIPTIVE CAP WITH FLEXIBLE MEMBRANE LINER

Alternative 3d is a variation of Alternative 3a that replaces the low-permeability clay layer with an FML. Individual evaluation of Alternative 3d with respect to the nine NCP criteria follows.

1. Overall Protection of Human Health and the Environment. Alternative 3d renders the exposure pathways incomplete for human health and the environment due to direct exposure, inhalation, and ingestion of soils. Soils-related risks are removed if the alternative is implemented. The cap will also reduce infiltration into landfill contents, thus minimizing further impacts to groundwater. The 2-foot- thick soil cover will also provide sufficient soil thickness for revegetation with annual grasses. Inspection and annual maintenance will be used to identify and remove plants with deep root systems that could compromise the integrity of the FML barrier. Monitoring and maintenance will be used to assure continued integrity of the landfill cap. Because the wastes will remain on-site, a 5-year reevaluation is required under the NCP.

2. Compliance with ARARs. Alternative 3d meets chemical-specific, location-specific, and action-specific ARARs as discussed for Alternative 3a. In addition, the installation of the modified Title 27 CCR prescriptive landfill cap meets the potential action-specific ARARs for

the landfill final cover construction. Groundwater and landfill gas monitoring will be conducted to comply with the requirements of Titles 22 and 23 CCR determined to be potential ARARs (see Appendix H).

3. Long-Term Effectiveness. The FML is virtually impermeable to water. It will provide a permeability significantly less than $1x10^{-6}$ cm/s for extended periods of time if properly designed, constructed, and maintained.

   In addition, FML is not subject to desiccation in semiarid to arid climates and can withstand large tensile strains resulting from stretching and settlements. Thus, FML is both reliable and an adequate option for long-term effectiveness and permanence.

4. Reduction of Toxicity, Mobility, or Volume through Treatment. Contaminant mobility, in the form of infiltration and leaching of the landfill, will be prevented and controlled by capping. There would not be an appreciable reduction in volume.

5. Short-Term Effectiveness. Alternative 3d involves construction of a landfill cap, surface-water drainage controls and a landfill gas-migration monitoring well system. Risks associated with exposure of site personnel to dust emissions and direct contact with impacted soil or waste during excavation would be minimized using dust suppressants and PPE. PPE would also be used during the groundwater sampling to prevent direct contact with any potentially impacted groundwater.

   Exposure of the community or personnel at Former MCAS El Toro to site construction activities may occur through inhalation of fugitive dust that is windborne over a distance of 1/4 mile south or west of the site.

   Heavy equipment will conform to Cal-OSHA specifications. Only authorized personnel will perform heavy-equipment operation. Safety devices provided with the machinery, including seat belts, would be used at all times. Personnel not trained or not directly involved in the work area would keep a safe distance. Trained personnel directly involved in the operation would avoid moving into the path of the operating equipment or into blind spots of the operator.

   The FML is expected to require less time to construct than clay or soil/bentonite liner and approximately the same time to construct as a GCL liner. The time required for completion of the remedial response objectives is approximately 3.7 months and includes capping, and construction of drainage controls, erosion controls, and gas migration monitoring well system.

6. Implementability. Use of FML as a low-permeability layer in a landfill cap is a proven and reliable technology, and it is readily available and easily installed by contractors. The FML will be transported and installed using standard construction procedures. Specialized equipment will be required for welding the geomembrane sheets. A quality assurance/quality control program is required to ensure proper installation.

7. Cost. Cost estimates for Alternative 3d include the construction of a FML landfill cover system, stormwater control system construction, the implementation of ICs and existing access restrictions, monitoring well modifications, abandonments, and replacements, debris relocation, construction of a landfill gas collection system, long-term groundwater and soil gas monitoring, access road construction, 5-year site reviews, facility inspection and maintenance, and site closeout. A summary of costs for Alternative 3d is provided in Table 13-5. Cost-

estimating details, including assumptions and RACER input parameters are provided in Appendix J.

The present worth for Alternative 3d is estimated to be $5,515,928.

8. State Acceptance. The review of Alternative 3d as part of this FS is pending.

9. Community Acceptance. Community acceptance of this alternative will be assessed following the public review process.

Table 13-5: Alternative 3d - Cost Estimate Summary

Cost Category	Capital Costs[a]	Operation and Maintenance Costs[a]
Direct Costs		
Design	$106,345	
FML Cover (Capital)	$1,626,389	
Monitoring Well Abandonments/Install SGMWs/Casing Extensions (Capital)	$80,400	
Active Landfill Gas Collection System (Capital)	$234,853	
Passive Landfill Gas Collection System (Capital)	$81,879	
Land Use Controls (Capital)	$50,940	
Debris Relocation (Capital)	$538,703	
Operation and Maintenance Costs		
Long Term Monitoring (Years 1-5)		$534,293
Long Term Monitoring (Years 6-30)		$1,541,071
5-Year Review		$292,943
Monitoring Well Replacements (10 years)		$138,484
Monitoring Well Replacements (20 years)		$138,484
Site Closeout		$100,529
Subtotal Costs	$2,719,508	$2,745,804
Contingency (20%)	$512,445	$549,161
Total Costs	$3,231,953	$3,294,965
Grand Total Alternative 3d	**$6,526,918**	
Present Worth[c]	**$5,515,928**	

Notes:
[a] Individual costs presented in this table for each line item do not constitute present value costs. Present value costs for each line item are presented in Appendix J.
[b] Contingency of 20% was added to cover cost increases that may occur as a result of unforeseen conditions and changes that typically occur on remediation projects. Contingency was not applied on cost estimates for design and land use controls.
[c] Base year of 2008.

13.2.4 Alternative 4 – Clean Closure and Groundwater Monitoring

Individual evaluation of Alternative 4 with respect to the nine NCP criteria is as follows.

1. Overall Protection of Human Health and the Environment. Alternative 4 renders the exposure pathways incomplete for human health and the environment due to direct exposure, inhalation, and ingestion of soils. Soils-related risks are removed if the alternative is implemented. Clean Closure will reduce contaminant concentrations to levels that eliminate unacceptable risk.

2. Compliance with ARARs. Alternative 4 would include excavation of debris from AA 3 and disposal at an off-site disposal facility. The excavated debris from AA 3 is proposed to be stored in staging piles in accordance with the requirements at 40 CFR §264.554 identified as potential ARARs in Appendix H. If the debris exhibits the characteristics of the RCRA hazardous waste, substantive provisions of 40 CFR §264.554(d)(1)(i-ii), (d)(2), (e), (f), (h), (i), (j), and (k) are potentially "applicable" ARARs for design, operation, and closure of the staging pile. However, if the debris does not meet the definition of RCRA or non-RCRA hazardous waste, the staging pile requirements would be potentially relevant and appropriate federal ARARs since COPCs in the debris are same or similar to the contaminants found in RCRA hazardous waste. In addition, Alternative 4 would comply with the requirements of Title 22 § 66264.114 as relevant and appropriate ARARs. Title 22 § 66264.114 requires that all contaminated equipment, structures and soils be properly disposed or decontaminated by removing all hazardous waste and residues during partial and final closure periods.

3. Long-Term Effectiveness. Alternative 4 may require total dismantlement and removal of facilities. This may include removal of all buildings, vaults, tanks, transfer piping, and contaminated soil. This alternative would require a large quantity of soil for backfilling and would also require topsoil for revegetation. Use of the facilities (or the facility sites) after Clean Closure would present no risk to workers or the public from hazardous constituents. Since the landfill is clean closed, concerns about the long-term performance of landfill waste containment system components are also eliminated.

   Alternative 4 would also eliminate the need for potential future corrective actions, inspections and post-closure maintenance of the site. The chances of possible postclosure land uses of the facility are also increased.

4. Reduction of Toxicity, Mobility, or Volume through Treatment. Alternative 4 involves the removal of the contaminant source and beneficial use of waste materials. Reduction of landfill contaminant toxicity occurs through the complete removal of all waste and waste residuals, including contaminated soils.

5. Short-Term Effectiveness. Alternative 4 involves removal of all wastes and waste residuals, including contaminated soils. Risks associated with exposure of site personnel to dust emissions and direct contact with impacted soil and IDWs during excavation would be minimized using dust suppressants and PPE. The PPE would also be used during the groundwater sampling to prevent direct contact with the impacted groundwater.

   Exposure of the community to site construction activities may occur through inhalation of fugitive dust that is windborne over a distance of 1/4 mile south or west of the site.

   Heavy equipment will conform to Cal-OSHA specifications. Only authorized personnel will perform heavy-equipment operation. Safety devices provided with the machinery, including seat belts, would be used at all times. Personnel not trained or not directly involved in the work area would keep a safe distance. Trained personnel directly involved in the operation would avoid moving into the path of the operating equipment or into blind spots of the operator.

6. Implementability. Use of Clean Closure alternative is a proven and reliable technology, and requires the characterization of the site including (1) the extent and character of the wastes present and (2) the levels and extent of any contamination remaining on site after waste

removal and disposal. A quality assurance/quality control program is required to assure proper completion of the process.

7. Cost. The cost estimate for Alternative 4 (clean closure) includes excavation and removal of all buried construction debris at AA 3, groundwater and soil gas monitoring well abandonments, site revegetation, long term groundwater monitoring for 5 years, a 5-year site review, and site closeout. Costs for clean closure were estimated using three scenarios; 50% hazardous waste/50% non-hazardous waste, 25% hazardous waste/75% non-hazardous waste, and 100% non-hazardous waste. A summary of costs for Alternative 4 is provided in Table 13-6. Cost-estimating details, including assumptions and RACER input parameters are provided in Appendix J.

   Costs for Alternative 4 are estimated at the following:

   Scenario 1 (50%/50%): The present worth for Alternative 4 under Scenario 1 is $37,292,950.

   Scenario 2 (25%/75%): The present worth for Alternative 4 under Scenario 2 is $31,139,872.

   Scenario 3 (100%): The present worth for Alternative 4 under Scenario 3 is $25,286,065.

8. State Acceptance. The review of Alternative 4 as part of this FS is pending.

9. Community Acceptance. Community acceptance of this alternative will be assessed following the public review process.

Table 13-6: Alternative 4 - Cost Estimate Summary

Clean Closure Scenario 1 (50% Hazardous Waste/50% Non-Hazardous Waste)		
Cost Category	Capital Costs[a]	Operation and Maintenance Costs[a]
Direct Costs		
Design	$103,732	
Dig and Haul (Capital)	$30,488,543	
Revegetation (Capital)	$34,233	
Monitoring Well Abandonments/Casing Extensions (Capital)	$61,026	
Operation and Maintenance Costs		
Long Term Monitoring (5 Years)		$336,526
5-Year Review		$26,450
Site Closeout		$75,185
Subtotal Costs	$30,687,534	$438,160
Contingency (20%)[b]	$6,116,760	$87,632
Total Costs	$36,804,294	$525,792
Grand Total Alternative 4 (Scenario 1)	**$37,330,087**	
Present Worth[c]	**$37,292,950**	

Clean Closure Scenario 2 (25% Hazardous Waste/75% Non-Hazardous Waste)

Cost Category	Capital Costs[a]	Operation and Maintenance Costs[a]
Direct Costs		
Design	$104,577	
Dig and Haul (Capital)	$25,360,274	
Revegetation (Capital)	$61,026	
Monitoring Well Abandonments/Casing Extensions (Capital)	$34,233	
Operation and Maintenance Costs		
Long Term Monitoring (5 Years)		$336,526
5-Year Review		$26,450
Site Closeout		$75,185
Subtotal Costs	$25,560,109	$438,160
Contingency (20%)[b]	$5,091,107	$87,632
Total Costs	$30,651,216	$525,792
Grand Total Alternative 4 (Scenario 2)	**$31,177,008**	
Present Worth[c]	**$31,139,872**	

Clean Closure Scenario 3 (100% Non-Hazardous Waste)

Cost Category	Capital Costs[a]	Operation and Maintenance Costs[a]
Direct Costs		
Design	$99,602	
Dig and Haul (Capital)	$20,486,247	
Revegetation (Capital)	$61,026	
Monitoring Well Abandonments/Casing Extensions (Capital)	$34,233	
Operation and Maintenance Costs		
Long Term Monitoring (5 Years)		$336,526
5-Year Review		$26,450
Site Closeout		$75,185
Subtotal Costs	$20,681,108	$438,160
Contingency (20%)[b]	$4,116,301	$87,632
Total Costs	$24,797,409	$525,792
Grand Total Alternative 4 (Scenario 3)	**$25,323,201**	
Present Worth[c]	**$25,286,065**	

Notes:
[a] Individual costs presented in this table for each line item do not constitute present value costs. Present value costs for each line item are presented in Appendix J.
[b] Contingency of 20% was added to cover cost increases that may occur as a result of unforeseen conditions and changes that typically occur on remediation projects. Contingency was not applied on cost estimates for design and land use controls.
[c] Base year of 2008.

13.3 COMPARATIVE ANALYSIS OF ALTERNATIVES

The purpose of the comparative evaluation is to contrast the advantages and disadvantages of each alternative relative to the others. The remedial action alternatives (Alternative 2, 3, and 4) are based on the selected presumptive remedies, capping and ICs and access restrictions. These presumptive remedies achieve RAOs in the following manner:

Landfill capping uses engineered designs to:

- Prevent contact with landfill wastes;
- Control run-on and runoff and erosion;
- Prevent infiltration and potential leaching;
- Prevent the landfill gas from migrating to and beyond the 100-foot buffer zone established for AA 3;
- Prevent surface water from contacting wastes; and
- Prevent contaminated sediments from washing off-site.

ICs and access restrictions restrict access by fencing and signs and prevent development by deed restrictions (negotiated during BRAC property transfer). Long-term monitoring of soil-gas, groundwater, erosion controls and revegetation will be used to confirm the effectiveness of the remedy.

Table 13-7 provides a summary of the effectiveness of the remedial alternatives with respect to the 9 NCP criteria for AA 3, respectively. Table 13-8 compares costs for each alternative evaluated within the FS for AA 3, respectively. Table 13-9 presents the advantages and disadvantages of barrier covers evaluated within the FS for AA 3. Table 13-10 presents technical comparison of each alternative evaluated within the FS for AA 3, respectively.

13.3.1 Overall Protection of Human Health and the Environment

Alternative 1 would not lower the risks that currently exist at AA 3; however, Alternative 2 would use limited grading, ICs and access restrictions to assure that exposure pathways remain incomplete. Alternative 1 is not considered protective of human health and the environment because infiltration and leaching of landfill wastes due to ponding on ungraded portions of the landfill are not minimized. Alternative 2 would include limited grading, construction of a finger dike and placement or riprap for controlling stormwater erosion, and monitoring of landfill gas and groundwater. Therefore Alternative 2 is protective of human health and the environment.

Alternative 3 includes construction of a landfill cap. These alternatives eliminate risks due to dermal exposure, ingestion, and inhalation of surface soils. In addition, through grading and cap construction, these alternatives are expected to reduce risks due to direct contact with landfill material and the potential for ponding and resultant infiltration into the landfill.

Alternative 3 provides protection of human health and the environment by preventing contact with landfill mass, mitigating erosion of landfill materials, and reducing the potential for infiltration and

transport of contaminants off-site. However, certain cap designs appear to be more effective than others in terms of preventing infiltration.

In addition, for Alternatives 2 and 3, the installation of landfill gas controls in the form of vertical wells and horizontal trenches prevents potential landfill gases from migrating beyond the 100-foot buffer zone.

In general, the existing soil and the evapotranspirative clay caps (Alternative 1, 2, 3a, and 3b) had comparable drainage estimates. The GCL and FML barriers (Alternative 3c and 3d) generally allow the least drainage, however, these liners are susceptible to puncture and damage due to rodents.

Alternative 4 is very effective in protecting human health and the environment. This alternative eliminates unacceptable risks due to dermal exposure, ingestion, and inhalation of surface soils. Alternative 4 reduces contaminant concentrations values to levels that eliminate unacceptable risk. Alternative 4 includes excavation of debris from AA 3 and disposal at an off-site disposal facility. After implementation of this alternative, the site would not present unacceptable risk to workers or the public from hazardous constituents.

13.3.2 Compliance with ARARs

Alternative 1 does not trigger ARARs. Alternative 2 meets location-specific and groundwater monitoring action-specific requirements identified as potential ARARs (see Appendix H). Alternative 3 meets all identified potential ARARs. Alternatives 3a, 3c, and 3d meet all potential ARARs including Title 22 and Title 27 CCR, because these alternatives reduce infiltration into the landfill as effectively as the Title 27 CCR prescriptive standard (clay) cap. Alternatives 3b, 3c, and 3d include construction of a Title 27 CCR prescriptive cap.

All remedial alternatives except Alternative 1 would comply with the 27 CCR §20921 (a)(1), (2) and (3) and 27 CCR §21160 (b) requirements for landfill gas monitoring and controls, thereby meeting the requirement of not exceeding 5 percent by volume in air at the facility property boundary. In addition, all remedial alternatives (except Alternative 1) include installation of landfill gas controls in the form of vertical wells and horizontal trenches preventing potential landfill gases from migrating beyond the 100-foot buffer zone. Alternative 4 complies with the requirements of 40 CFR §264.554(d)(1)(i-ii), (d)(2), (e), (f), (h), (i), (j), and (k) for design, operation, and closure of the staging pile.

13.3.3 Long-Term Effectiveness and Permanence

Each of the alternatives, except Alternative 4, leaves wastes in place. Alternative 3 consolidates waste but does not move wastes off-site. Comparison of annual drainage into the landfill has been determined using UNSAT-H modeling evaluations. The results of this model are provided in Appendix K.

The native soil cap in Alternative 3a is resistant to desiccation and resultant cracking. Alternative 3b has a barrier layer that is subject to desiccation in arid and semiarid climates such as El Toro. The clay utilized in this alternative also has low resistance to cracking from differential settlement. The GCL and FML liners used in Alternatives 3c and 3d have an advantage over a clay barrier layer because they are not subject to desiccation and can withstand large tensile strains. However, the greater thickness of the clay and soil barrier layers used in Alternative 3a and 3b make these barriers more resistant to puncture root systems or burrowing animals than the thinner barrier layers used in Alternatives 3c and 3d.

Table 13-7: Comparative Analysis of Remedial Alternatives

Criteria	Alternative 1	Alternative 2	Alternative 3a	Alternative 3b	Alternative 3c	Alternative 3d	Alternative 4
Overall Protection of Human Health and the Environment[a]	**Low.** Does not prevent direct contact with landfill wastes.	**Low-Moderate.** Prevents direct human contact with wastes. Installation of landfill gas controls in the form of vertical wells and horizontal trenches prevents potential landfill gases from migrating beyond the 100-foot buffer zone.	**Moderate.** Eliminates risks due to dermal contact, inhalation, and ingestion of surface soil. Installation of landfill gas controls in the form of vertical wells and horizontal trenches prevents potential landfill gases from migrating beyond the 100-foot buffer zone.	**Moderate.** Eliminates risks due to dermal contact, inhalation, and ingestion of surface soil. Installation of landfill gas controls in the form of vertical wells and horizontal trenches prevents potential landfill gases from migrating beyond the 100-foot buffer zone.	**Moderate-High.** Eliminates risks due to dermal contact, inhalation, and ingestion of surface soil. Installation of landfill gas controls in the form of vertical wells and horizontal trenches prevents potential landfill gases from migrating beyond the 100-foot buffer zone.	**Moderate-High.** Eliminates risks due to dermal contact, inhalation, and ingestion of surface soil. Installation of landfill gas controls in the form of vertical wells and horizontal trenches prevents potential landfill gases from migrating beyond the 100-foot buffer zone.	**High** Eliminates risks due to dermal contact, inhalation, and ingestion of surface soil due to complete removal of waste and waste residuals.
Compliance with ARARs[b]	**Low.** Does not trigger ARARs.	**High.** Meets ARARs.	**High.** Meets ARARs. Equivalent to a Title 27 CCR prescriptive cap.	**High.** Meets ARARs. Title 27 CCR prescriptive cap.	**High.** Meets ARARs. Title 27 CCR prescriptive cap.	**High.** Meets ARARs. Title 27 CCR prescriptive cap.	**High.** Meets ARARs.
Long-term Effectiveness and Permanence[c]	**Low.** The existing cover with assumed 80% compaction prevents most drainage (predicted annual drainage ranges from 0.002 inches per year to 8.702 inches per year)	**Moderate** The existing cover with assumed 80% compaction prevents most drainage (predicted annual drainage ranges from 0.001 inches per year to 8.702 inches per year).	**High.** Prevents direct contact with wastes. Prevents most drainage (predicted annual drainage ranges from 0.001 inches per year to 1.685 inches per year). Resistant to desiccation cracking and cracking from settlement.	**Moderate** Clay barrier is subject to desiccation and cracking from settlement. Prevents most drainage if intact (predicted annual drainage ranges from 0.606 inches per year to 6.031 inches per year).	**Moderate-High** Geosynthetic clay liner is resistant to desiccation. Easily punctured. Not impermeable to gases.	**Moderate-High.** Flexible membrane liner is flexible, resistant to desiccation. Can be punctured.	**High.** High degree of long term effectiveness due to complete removal of waste and waste residuals.

Table 13-7: Comparative Analysis of Remedial Alternatives

Criteria	Alternative 1	Alternative 2	Alternative 3a	Alternative 3b	Alternative 3c	Alternative 3d	Alternative 4
Reduction of Toxicity, Mobility, or Volume through Treatment[d]	**Low.** Does not significantly reduce infiltration or production of leachate. No reduction in the volume of landfill materials.	**Moderate.** Reduces infiltration and potential production of leachate. No reduction in the volume of landfill materials. Installation of landfill gas controls in the form of vertical wells and horizontal trenches prevents potential landfill gases from migrating beyond the 100-foot buffer zone.	**Moderate-High.** Prevents most infiltration. No reduction in the volume of landfill materials. Installation of landfill gas controls in the form of vertical wells and horizontal trenches prevents potential landfill gases from migrating beyond the 100-foot buffer zone.	**Moderate-High.** Prevents almost all of the infiltration. No reduction in the volume of landfill materials. Installation of landfill gas controls in the form of vertical wells and horizontal trenches prevents potential landfill gases from migrating beyond the 100-foot buffer zone.	**Moderate-High.** Prevents almost all of the infiltration. No reduction in the volume of landfill materials. Installation of landfill gas controls in the form of vertical wells and horizontal trenches prevents potential landfill gases from migrating beyond the 100-foot buffer zone.	**Moderate-High.** Prevents almost all of the infiltration. No reduction in the volume of landfill materials. Installation of landfill gas controls in the form of vertical wells and horizontal trenches prevents potential landfill gases from migrating beyond the 100-foot buffer zone.	**High.** High degree of reduction in toxicity, mobility, and/or volume of debris at the site due to the complete removal of debris.
Short-term Effectiveness[e]	**High.** No construction activities to increase risk to workers or general public.	**High.** No construction activities in areas that increase risk to workers or general public.	**Moderate-High.** Moderate earthwork. Shortest time to construct of all the landfill cap options (3 months).	**Low.** Most earthwork. Longest time to construct (3.9 months).	**Moderate.** Moderate earthwork.Intermediate time to construct (3.3 months).	**Moderate.** Moderate earthwork.Intermediate time to construct (3.3 months).	**Low.** Most earthwork and excavation of wastes.
Implementability[f]	**High.** No construction activities.	**High.** No construction activities. ICs are readily implementable.	**Moderate-High.** Materials are readily available. No specialized equipment involved.	**Low-Moderate.** Suitable clay will have to be imported from off-site sources. Slow construction.	**Moderate-High.** Materials are readily available. No specialized equipment involved. Geosynthetic clay liner can be rapidly installed.	**Moderate-High.** Materials are readily available. Requires specialty contractor to weld and seam the liner. Extensive quality assurance/quality control.	**Moderate-High.** Requires Site characterization to know the level, extent and character of the wastes.
Cost[g]	**High.** No cost.	**Moderate-High.** Minimal cost for fencing, monitoring, and deed restrictions ($3.54 million)	**Low-Moderate.** Costly due to specialized equipment, quality assurance/quality control. ($5.45 million)	**Low – Moderate.** Costly due to import of clay ($5.66 million).	**Moderate.** Least costly of Alternative 3 landfill cap designs ($5.06 million).	**Low-Moderate.** Costly due to specialized materials, equipment and quality assurance/quality control ($5.52 million).	**Low.** Very costly due to dig and haul tasks for a large volume of waste. ($25.29 - 37.29 million[i]).

Table 13-7: Comparative Analysis of Remedial Alternatives

Criteria	Alternative 1	Alternative 2	Alternative 3a	Alternative 3b	Alternative 3c	Alternative 3d	Alternative 4
State Acceptance[h]	The review of this alternative as part of this FS effort is pending.	The review of this alternative as part of this FS effort is pending.	The review of this alternative as part of this FS effort is pending.	The review of this alternative as part of this FS effort is pending.	The review of this alternative as part of this FS effort is pending.	The review of this alternative as part of this FS effort is pending.	The review of this alternative as part of this FS effort is pending.
Community Acceptance[h]	To be discussed.	To be discussed.	To be discussed.	To be discussed.	To be discussed.	To be discussed.	To be discussed.

Notes:

a This assessment focuses on how the alternative, as a whole, achieves and maintains protection of human health and the environment. Among the factors considered are how well the alternative reduces risk by preventing contact with wastes or mitigating waste migration.

b ARARs - Applicable or relevant and appropriate requirements. The assessment against this criterion considers whether the alternative complies with the ARARs for AA 3.

c This criterion focuses on long-term effectiveness in maintaining protection of human health and the environment after the response objectives have been met. Among factors considered are how well the alternatives prevent infiltration and erosion and maintain their integrity over time.

d None of the AA 3 alternatives treat landfill wastes. Alternatives that reduce mobility of landfill wastes are rated slightly higher than those that do not attempt to reduce mobility.

e The assessment against this criterion focuses on how well the alternative protects human health and the environment during the construction and implementation of the remedy until response objectives have been met. Alternatives that take longer to implement and require exposing/moving large amounts of landfill wastes are rated the lowest.

f This assessment evaluates the technical and administrative feasibility of alternatives and availability of required goods and services. Alternatives that are easy to construct using readily available materials and no specialized equipment are rated the highest.

g This assessment is based on the present worth of alternatives. Alternatives that cost the least or have no cost are rated highest, due to high favorability within the cost category

h State and community acceptance will be assessed following the California Department of Toxic Substances and public review process.

I Three scenarios were developed for Alternative 4 costs: Scenario 1 (50%/50%) = $37.29 million, Scenario 2 (25%/75%) = $31.14 million, and Scenario 3 (100%) = $25.29 million.

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Table 13-8: Cost Comparison of Remedial Alternatives

Alternative	Capital Cost (millions)[a]	Operation and Maintenance Costs (millions)[a]	Grand Total Costs (millions)[a]	Present Worth (millions)	Remedial Construction Duration (Months)	Monitoring and Maintenance Period (years)
Alternative 1	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Alternative 2	1.46	2.98	4.44	3.54	Not Applicable	30
Alternative 3						
Alternative 3a	3.16	3.29	6.46	5.45	3.0	30
Alternative 3b	3.38	3.29	6.67	5.66	3.9	30
Alternative 3c	2.77	3.29	6.07	5.06	3.4	30
Alternative 3d	3.23	3.29	6.53	5.52	3.7	30
Alternative 4[b]	Scenario 1: 36.80 Scenario 2: 30.65 Scenario 3: 24.80	Scenario 1: 0.52 Scenario 2: 0.52 Scenario 3: 0.52	Scenario 1: 37.33 Scenario 2: 31.18 Scenario 3: 25.32	Scenario 1: 37.29 Scenario 2: 31.14 Scenario 3: 25.29	Not Applicable	5

Notes:
a Costs do not include the Present Value Discount Factor (2.8 %).
b Three scenarios were developed for Alternative 4 costs: Scenario 1 (50% hazardous waste/50% non-hazardous waste, Scenario 2 (25% hazardous waste/75% non-hazardous waste), and Scenario 3 (100% non-hazardous waste).

Table 13-9: Advantages and Disadvantages of Barrier Covers

Material	Advantages	Disadvantages
Clay	1. Long history of use. 2. Greater thickness assures layer will not be breached by puncture.	1. Barrier can desiccate and crack in arid climates. 2. Low resistance to cracking from differential settlement. 3. Difficult to compact soil above compressible waste. 4. Suitable material not always locally available. 5. Difficult to repair if damaged. 6. Slow construction.
Geosynthetic Clay Liner	1. Rapid Installation. 2. Very low hydraulic conductivity if properly installed. 3. Low cost. 4. Can withstand large differential settlement. 5. Excellent self-healing characteristics. 6. Not dependent on availability of local soils. 7. Easy to repair.	1. Low shear strength of hydrated bentonite. 2. Can be punctured during or after installation. 3. Dry bentonite is not impermeable to gas. 4. Difficult to install than the other alternatives. 5. Potential strength problem at interfaces with other materials.
Flexible Membrane Liner	1. Rapid Installation. 2. Virtually impermeable to water if properly installed. 3. Low cost. 4. Can withstand large tensile strains. 5. Easy to repair. 6. Available in a large range of sizes, thicknesses, and densities.	1. Potential shear strength problems at interfaces with other materials. 2. Relatively resistant to puncture during or after installation. 3. Extensive construction quality assurance/quality control required.

Notes:
Source: Adapted from Dunn and Singh 1995

Table 13-10: Technical Comparison of Remedial Alternatives

Alternative	Technical Specifications					ICs, Access Restrictions, and Monitoring					
	Total Cap Thickness (feet)	Barrier Layer	Annual Drainage (inches)	Re-vegetate with Annual Grasses	Drainage Controls	Deed Restrictions	Fencing and Signs	Landfill Gas Monitoring	Groundwater Monitoring	Cap and Runoff Monitoring	Revegetation Monitoring
Alternative 1	NA	NA	0.002 – 8.702	NA	None	None	None	None	None	None	None
Alternative 2	NA	NA	0.002 – 8.702	NA	Finger Dike and Riprap,	Yes	Yes	Yes	Yes	NA	NA
Alternative 3 Alternative 3a	4	Soil	0.001 – 1.685	Yes	Finger Dike, Ditches and Riprap	Yes	Yes	Yes	Yes	Yes	Yes
Alternative 3b	5	Clay	0.606 – 6.031	Yes	Finger Dike, Ditches and Riprap	Yes	Yes	Yes	Yes	Yes	Yes
Alternative 3c	4	GCL	NA	Yes	Finger Dike, Ditches and Riprap	Yes	Yes	Yes	Yes	Yes	Yes
Alternative 3d	4	FML	NA	Yes	Finger Dike, Ditches and Riprap	Yes	Yes	Yes	Yes	Yes	Yes
Alternative 4	NA	NA	NA	Yes	None	None	None	None	Yes	NA	Yes

Notes:
The annual drainage has been determined using the Unsaturated Soil Water and Heat Flow Model (UNSAT-H) and provided in Appendix K.
FML – flexible membrane liner
GCL – geosynthetic clay liner
ICs – institutional controls
NA – not applicable

Alternative 4 provides the highest degree of long-term effectiveness because of the complete removal of the waste and waste residuals including contaminated soils. Alternative 4 eliminates the need for potential future corrective actions, inspections and post-closure maintenance of the site.

13.3.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Mobility of potential contaminants by leaching and erosion of the landfill would be prevented and controlled by capping in Alternatives 3a, 3b, 3c and 3d. In Alternative 4, reduction of landfill contaminant toxicity occurs through the complete removal of all waste and waste residuals, including contaminated soils. In addition, contaminant mobility, in the form of infiltration and leaching of the landfill, will be eliminated. Alternatives 1 and 2 do not minimize potential leaching of the landfill. None of the alternatives in this FS are intended to reduce the volume of landfill materials.

13.3.5 Short-term Effectiveness

Alternative 1 poses no additional risks to workers or general public over current site conditions because no response actions are taken.

Alternative 2 poses minimal risk to site workers during limited grading, and groundwater and landfill gas sampling.

Alternatives 3a, 3b, 3c, and 3d present more short-term risks because these alternatives involve construction activities associated with consolidation and capping.

Alternatives 3b presents the most risk to the community because these alternatives involve the most extensive field construction operations due to placement of clay and soil. Alternative 3a requires the shortest amount of time to complete.

Alternative 4 involves greater risk because of the excavation of wastes and earthwork. Risks associated with exposure of site personnel to dust emissions and direct contact with impacted soil during excavation is high.

13.3.6 Implementability

Alternative 1 is the easiest to implement because no actions are being taken. Alternative 2 is also readily implementable because it involves limited grading, ICs, access restrictions, and monitoring. Alternatives 3a, 3b, 3c, and 3d use proven remedial technologies and commercial services for implementation and are generally comparable in implementability. They are also comparable in terms of ability to monitor effectiveness. The GCL barrier used in Alternative 3c can be rapidly installed and is easier to install than the FML used in Alternative 3d; however, the primary difference in installation is that specialized equipment and trained labor are needed to install the FML. This is not necessary for the GCL landfill cap. The installation of the clay layer in Alternative 3b is also more time consuming than the installation of the GCL barrier.

Implementation of Alternative 3 (all options) is also more complicated than Alternatives 1 and 2 because of the activities associated with waste consolidation at AA 3.

Alternative 3a is the easiest capping alternative to implement because this alternative does not involve importing materials from off-station.

ICs and access restrictions associated with Alternatives 2, 3a, 3b, 3c, and 3d are also readily implementable.

Implementation of Alternative 4 is complicated and involves site characterization that would provide an idea of the extent and character of the wastes and the levels and extent of any contamination remaining at the site. It requires a significant amount of earthwork, excavation, and removal of waste material.

13.3.7 Cost

No cost is associated with Alternative 1. The costs associated with the implementation of the other alternatives are presented in Table 13-8 for AA 3. The present-worth of remedial alternatives for AA 3 range from approximately $3.54 million to approximately $37.29 million. Of the remedial action alternatives, the least costly is Alternative 2 and the most costly is Alternative 4.

13.3.8 State Acceptance

State regulatory agencies will have the chance to comment on the draft FS for AA 3.

13.3.9 Community Acceptance

Community acceptance of the FS re-evaluated alternatives will be assessed following the public review process.

14. SUMMARY OF THE FS EFFORT

This section summarizes the results of the FS conducted for AA 3. The selection of a preferred alternative will be based on risk-management decisions, which will occur following review of this document by regulatory agencies and the public. The preferred alternative will be stated in the Proposed Plan and the Record of Decision documents for AA 3.

The following summarize the results of the comparative evaluations of the alternatives for AA 3.

- Alternative 1 would not add a landfill cover or provide erosion control. The existing soil layer prevents contact with landfill wastes and reduces infiltration into landfill materials. However, since the site is currently ungraded, portions of the site are subject to ponding and potential infiltration. Alternative 1 is not considered protective of human health and the environment.

- Alternative 2 implements limited site grading, construction of a finger dike and placement of riprap to prevent erosion of the soil cover and control stormwater flow in the vicinity of Agua Chinon Wash, long term monitoring, and construction of landfill gas control systems. Alternative 2 is considered protective of human health and the environment since it would include limited grading to prevent erosion and with 80 % compaction prevents most drainage (predicted annual drainage ranges from 0.002 inches per year to 8.702 inches per year).

- Alternative 1, which is no action, would not trigger ARARs. Alternatives 2 and 3 are expected to comply fully with Titles 22 and 27 CCR requirements identified as potential ARARs for closure and post-closure of landfills in California. Alternative 4 would comply with potential ARARs for clean closure of landfills.

- Alternative 3 involves construction of landfill covers with erosion and landfill gas control measures. Construction activities at AA 3 will result in added short term risks compared to Alternatives 1 and 2 due to consolidation of wastes and fugitive-dust releases.

- Alternative 3a (ET landfill cover) would prevent contact with landfill wastes, mitigates erosion, controls landfill migration and reduces infiltration and resultant potential migration of contaminants to groundwater. Alternative 3a provides performance equivalent to the state prescriptive standard (clay) cap (Alternative 3b) in preventing potential migration of contaminants to groundwater where they could pose a risk to human health and the environment. For this reason, Alternative 3a is expected to comply with potential ARARs identified for AA 3.

- Alternatives 3b, 3c, and 3d would prevent contact with landfill wastes, mitigate erosion, control landfill gas migration, and reduce infiltration and resultant potential migration of leachate to groundwater. These alternatives are expected to comply with potential ARARs identified for AA 3. Both Alternatives 3c and 3d are as effective as the prescriptive standard (clay) cap (Alternative 3b) in preventing potential migration of contaminants to groundwater where they could pose a risk to human health and the environment. Of the four Alternative 3 options, 3c and 3d are the most effective in reducing infiltration into the landfill.

- Of the four Alternative 3 options, Alternative 3a could be implemented in the shortest period of time. In addition, the native soil cover used in Alternative 3a is resistant to desiccation and cracking, as well it is easy to maintain and repair. The CRWQCB has indicated that this

type of cover is preferred in semiarid climates such as Former MCAS El Toro. However, this type of cover is not as effective in areas where the reuse requires irrigation such as recreational parks.

- Of the four Alternative 3 options, Alternative 3c is the least costly and is the easiest and fastest to implement. This is because the geosynthetic clay liner barrier included in these alternatives does not require specialized equipment or labor to install. Alternative 3d is easier to install than the clay layer but still requires skilled labor.

- The clay layer used in Alternative 3b is subject to desiccation in arid climates and to cracking due to possible settlement. The FML used in Alternative 3d can withstand large differential settlement and is not subject to desiccation and cracking. The clay cap is also more difficult to maintain and repair than both GCL and FML.

- The FML barrier used in Alternative 3d is expected to be slightly more reliable than the GCL barrier used in Alternative 3c because it is more resistant to root penetration. In addition, this type of liner is preferred in areas where the reuse requires irrigation such as recreational parks.

- Alternative 4, clean closure is the most effective in meeting RAOs; however, this alternative is extremely expensive compared to the other alternatives presented in this FS.

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Appendix A
Logs

Appendix A1
Trench Excavation Logs

EARTH TECH

A CH2M HILL INTERNATIONAL LTD COMPANY

Excavation Log

LEGEND

ANOMALY AREA 3

PLAN VIEW

	PREVIOUSLY ESTIMATED EXTENT OF WASTE PLACEMENT
	REVISED ESTIMATED EXTENT OF WASTE PLACEMENT
	MINOR CONTOUR
	MAJOR CONTOUR
	FENCE (IF IN VIEW)
	EXISTING IMPROVEMENT
	LIGHT POLE
TR10-A' TR10-A	TRENCH LOCATION
TR10-IF	INTERFACE OF DEBRIS AND CLEAN SOIL
HA02	HAND AUGER LOCATION
PZ1-2	PIEZOMETER
MW1	MONITORING WELL
CPT05	CONE PENETROMETER LOCATION
bgs	BELOW GROUND SURFACE
ft	FEET
in	INCH
gal	GALLON
TD	TOTAL DEPTH

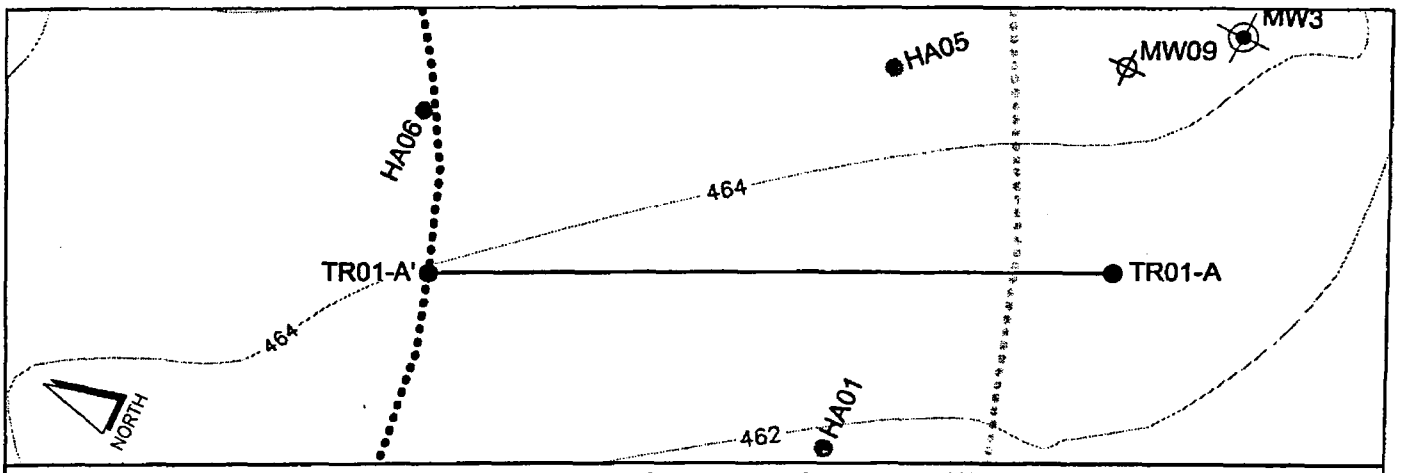
EXCAVATION

LK01	GEOTECHNICAL SAMPLE LOCATION
	CRUSHED SILTSTONE
	TRASH, DEBRIS
	CONSTRUCTION DEBRIS
	ML - SILT
	SM - SILTY SAND
	SP - POORLY GRADED SAND
	BEDROCK

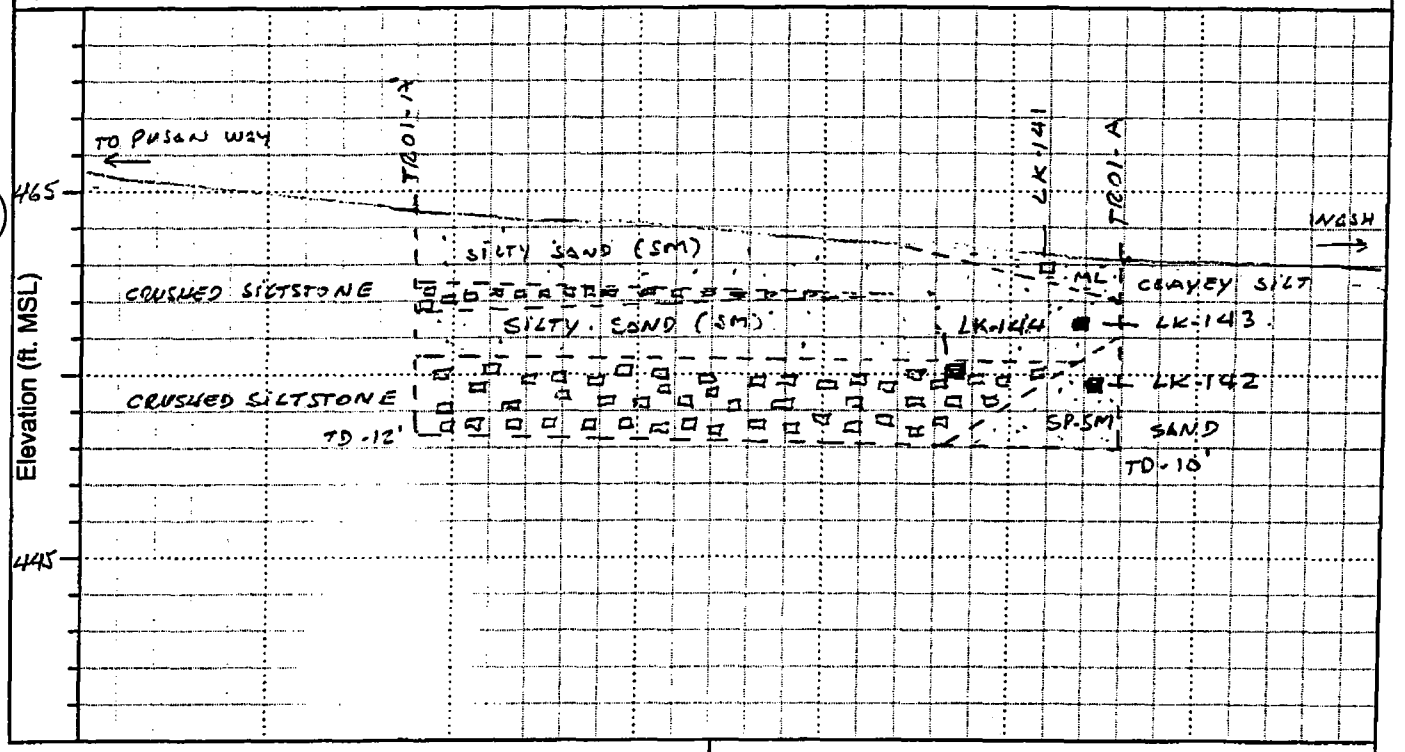
EARTH TECH
A EXCO INTERNATIONAL LTD. COMPANY

Excavation Log

Project Name: PREDESIGN INVESTIGATION, ANOMALY AREA 3, MCAS EL TORO Project Number: 37380
Location: ANOMALY AREA 3 - A3TR01 A-A'
Northing: A:2194763.10;A':2194894.59 Easting: A:6117058.31;A':6116994.16 Elevation: A:462.99;A':464.00
Recorded by: ROD LAZO Date: 10/22/02 Checked by: CW Date: JAN 2002



1"=40' CONTOUR INTERVAL 2' PREVIOUSLY REVISED ESTIMATED EXTENT OF WASTE PLACEMENT



Soil Description, Site Observations:

0-2 ft.: Clayey silt w/sand (ML), dark olive brown (2.5Y3/3). 85% medium plasticity silt, 15% medium to fine grained sand, stiff, dry no debris.
0-8ft.: Silty sand (SM), light olive brown (2.5Y5/4). 85% medium to fine sand, 15% medium plasticity silt, stiff, slighty moist, trace wire, brick chips, asphalt.
4-8ft.: Poorly graded sand w/silt (SP-SM), light yellowish brown (2.5Y6/4), 85 to 95% medium to fine sand, 15 to 5% low plasticity fines, loose, slightly moist, no debris.
4-12ft. (TD): Interbedded-crushed bedrock, siltstone, greenish in color, breaks down to clayey sand (SC), to sandy lean clay (CL); no debris.

Reference: Field Book, Pg.: 29
Attachments:

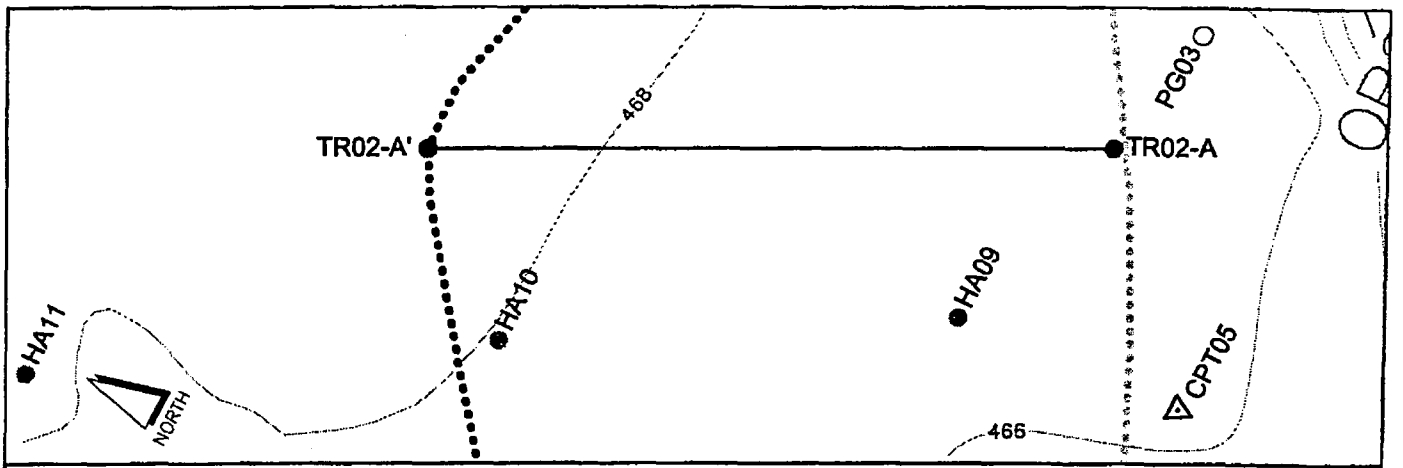
Field Monitoring

FID (ppm):	0.0
Dust (mg/m^3):	0.06 to 0.1
Radioactivity (cpm):	5,500 to 10,000
Photograph Numbers:	100 - 1969 thru 1974
Geotechnical Samples	LK141 (0-2')
	LK142 (4-10')
	LK143 (2-8')
	LK144 (8-12')
Remarks:	n/a

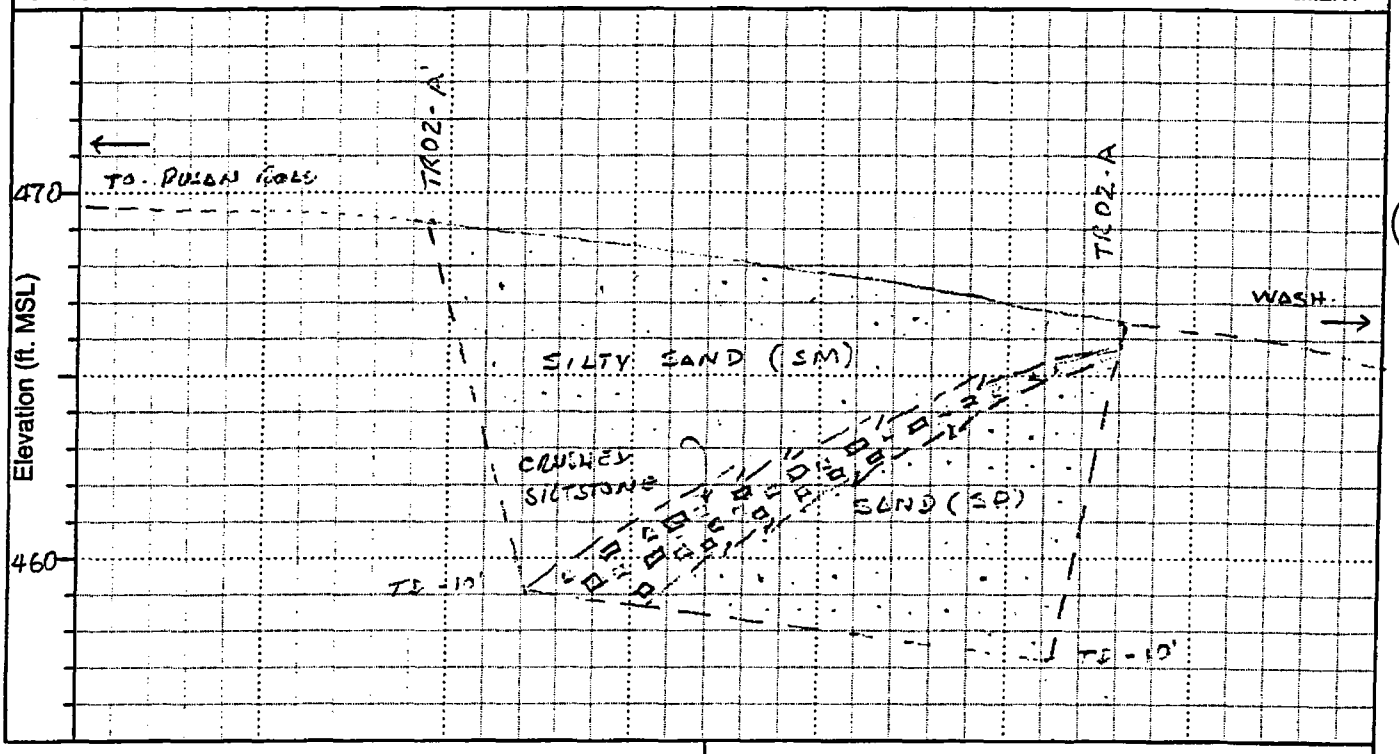
EARTH TECH
A CH2M HILL INTERNATIONAL LTD. COMPANY

Excavation Log

Project Name: PREDESIGN INVESTIGATION, ANOMALY AREA 3, MCAS EL TORO Project Number: 37380
Location: ANOMALY AREA 3 - A3TR02 A-A'
Northing: A:2194863.80;A':2194994.58 Easting: A:6117209.48;A':6117142.53 Elevation: A:466.63;A':469.20
Recorded by: ROD LAZO Date: 10/21/02 Checked by: CW Date: JAN 2002



1"=40' CONTOUR INTERVAL 2' PREVIOUSLY REVISED ESTIMATED EXTENT OF WASTE PLACEMENT



Soil Description, Site Observations:

0-10 ft. (TD): Poorly graded sand (SP), light yellowish brown (10YR6/4), 95% medium to fine sand with trace subangular gravel up to 1 inch and some low plasticity silt, no debris.
0-10ft. (TD): Silty sand (SM), brown (10YR5/3), 60% medium to fine sand, 40% medium plasticity silt, stiff, slighty moist, no debris.
Crushed bedrock, greenish, siltstone, interbedded between the poorly graded sand and silty sand; no debris.

Field Monitoring

FID (ppm): 0.0
Dust (mg/m^3): 0.07 to 0.09
Radioactivity (cpm): 5,600 to 13,300
Photograph Numbers: 100 - 1966 through 1968
Geotechnical Samples n/a

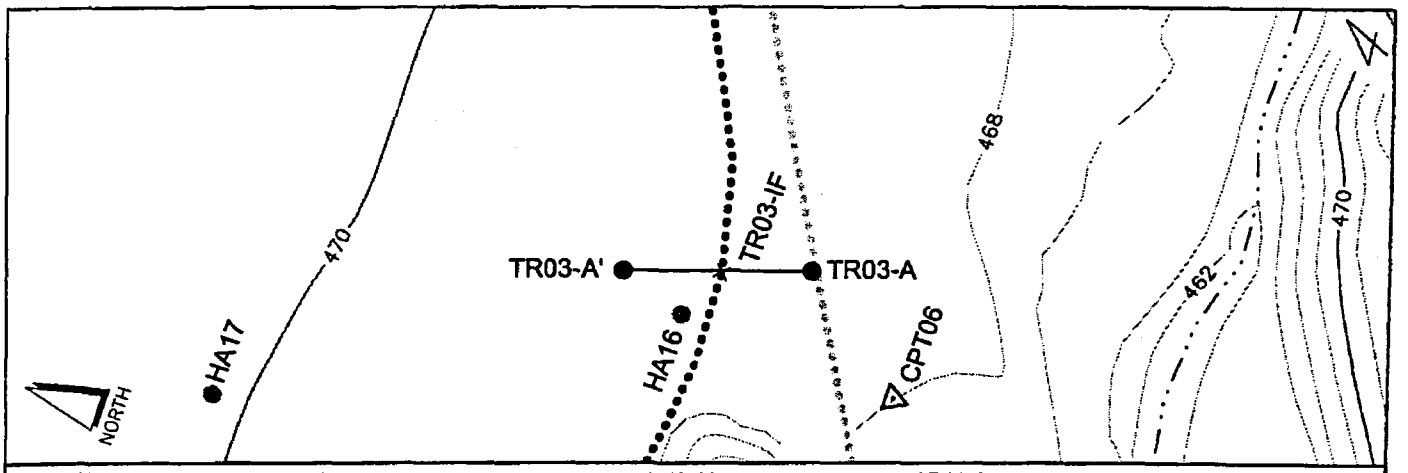
Remarks: n/a

Reference: Field Book, Pg.: 27
Attachments:

EARTH TECH
A AECOM INTERNATIONAL LTD. COMPANY

Excavation Log

Project Name: PREDESIGN INVESTIGATION, ANOMALY AREA 3, MCAS EL TORO Project Number: 37380
Location: ANOMALY AREA 3 - A3TR03 A-A'
Northing: A:2194951.26; A':2194989.37 Easting: A:6117352.56;A':6117339.26 Elevation: A:469.32;A':469.21
Recorded by: ROD LAZO Date: 10/21/02 Checked by: CW Date: JAN 2002



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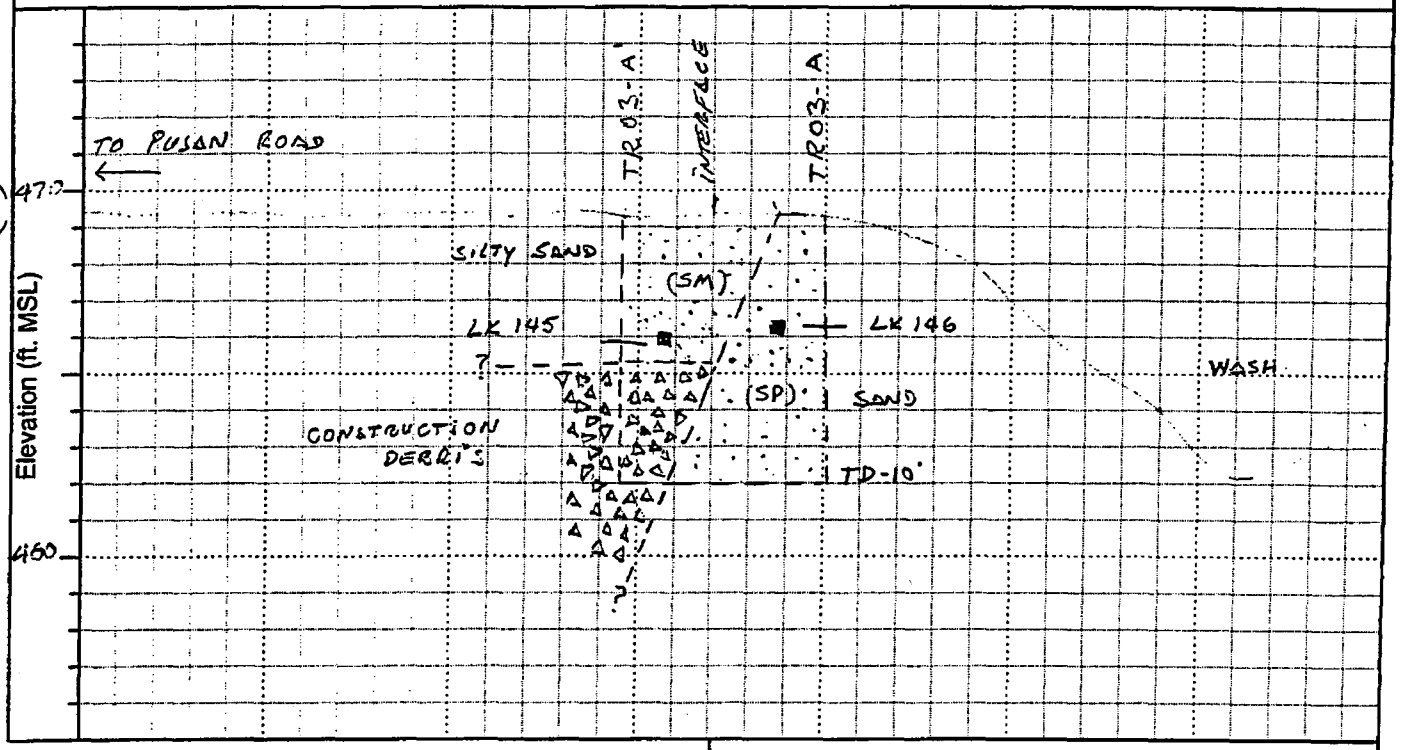


Soil Description, Site Observations:

0-7 ft. (TD): Silty sand (SM/SP), light yellowish brown (10YR6/4), 85% medium- to fine-grained sand, 15% low-plasticity silt, loose, slighty moist, no debris. Sample TRO3-0-7'

0-4 ft.: Silty sand (SM), brown (10YR5/3), 60% medium- to fine-grained sand, 40% medium-plasticity silt, stiff, slighty moist, no debris. Sample TRO3-0-4'

4-7 ft. (TD): Concrete-cobbles rubble, granodioritic boulders up to 2.5 ft. with some rebar, metal, dry.

Reference: Field Book, Pg.: 26
Attachments:

Field Monitoring

FID (ppm): 0.0
Dust (mg/m^3): 0.06 to 0.08
Radioactivity (cpm): 5,100 to 11,200
Photograph Numbers: 100 - 1964, 1965
Geotechnical Samples LK145 (0-4')
LK146 (0-7')

Remarks: n/a

EARTH TECH

A AECOM INTERNATIONAL LTD. COMPANY

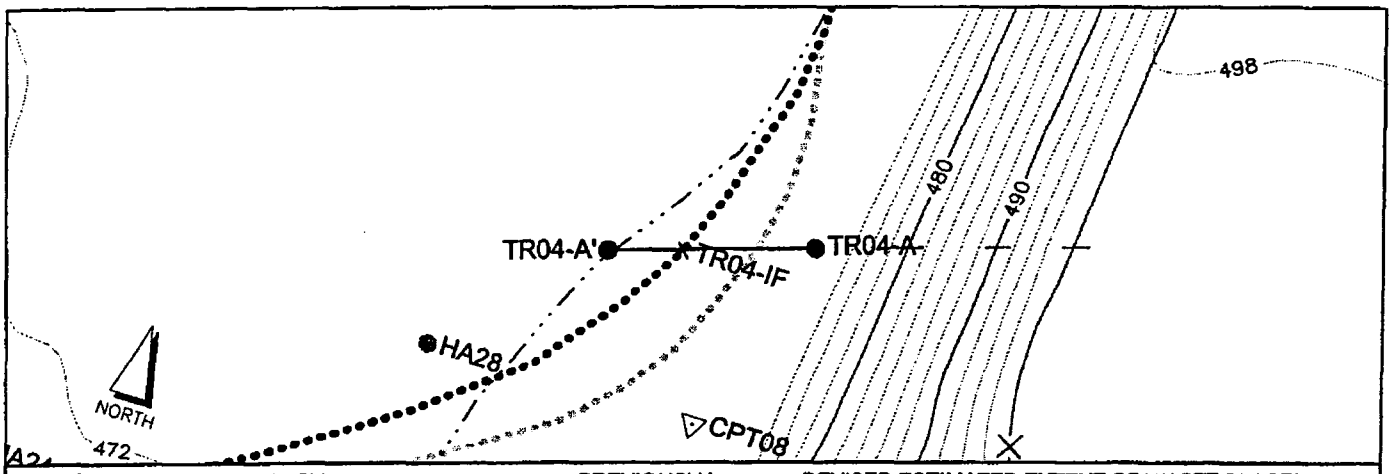
Excavation Log

Project Name: PREDESIGN INVESTIGATION, ANOMALY AREA 3, MCAS EL TORO Project Number: 37380

Location: ANOMALY AREA 3 - A3TR04 A-A'

Northing: A:2195175.48;A':2195161.37 Easting: A'6117665.66;A':6117623.55 Elevation: A:473.06;A':472.78

Recorded by: ROD LAZO Date: 10/21/02 Checked by: CW Date: JAN 2002



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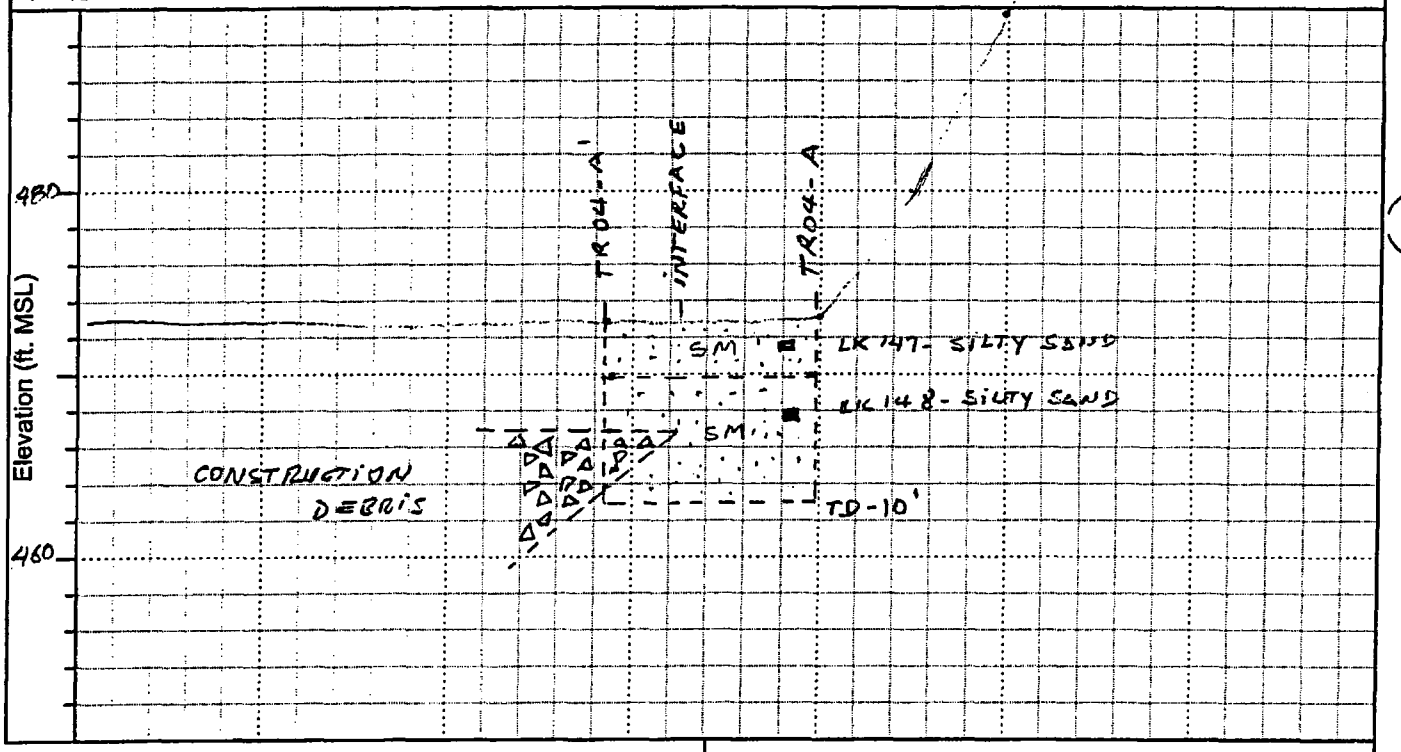


Soil Description, Site Observations:

0-3 ft.: Silty sand (SM), light yellowish brown (10YR6/4), 80% medium- to fine-grained sand, 15% low-plasticity silt, 5% subangular gravel up to 3 inches, loose, dry, no debris.

3-10 ft.: Silty sand (SM), light olive brown (2.5YR5/3), 85% medium- to fine-grained sand, 15% low plasticity silt, scattered debris, asphalt, concrete, slighty moist.

6-10 ft. (TD): Massive concrete rubble with rebar, metal, pipes, asphalt, dry.

Field Monitoring

FID (ppm): 0.0

Dust (mg/m^3): 0.06 to 0.09

Radioactivity (cpm): 5,100 to 9,700

Photograph Numbers: 100 - 1962, 1963

Geotechnical Samples LK147 (0-3')

LK148 (3-6')

Remarks: n/a

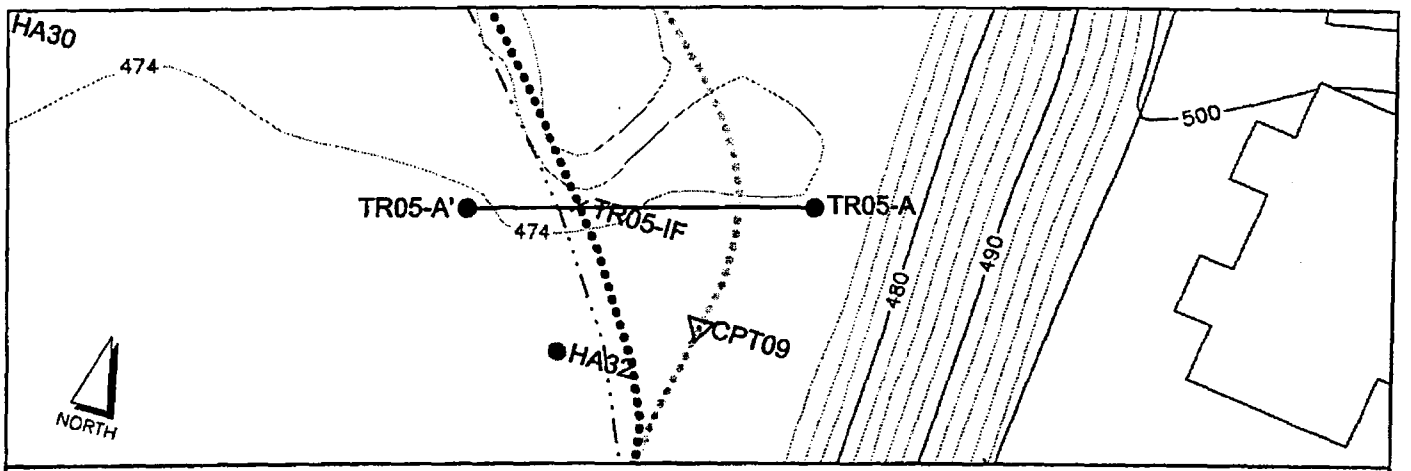
Reference: Field Book, Pg.: 25

Attachments:

EARTH TECH
A TYCO INTERNATIONAL LTD. COMPANY

Excavation Log

Project Name: PREDESIGN INVESTIGATION, ANOMALY AREA 3, MCAS EL TORO Project Number: 37380
Location: ANOMALY AREA 3 - A3TR05 A-A'
Northing: A:2195311.72;A':2195290.53 Easting: A:611770.88;A':6117599.43 Elevation: A:473.83;A':473.91
Recorded by: ROD LAZO Date: 10/18/02 Checked by: CW Date: JAN 2002



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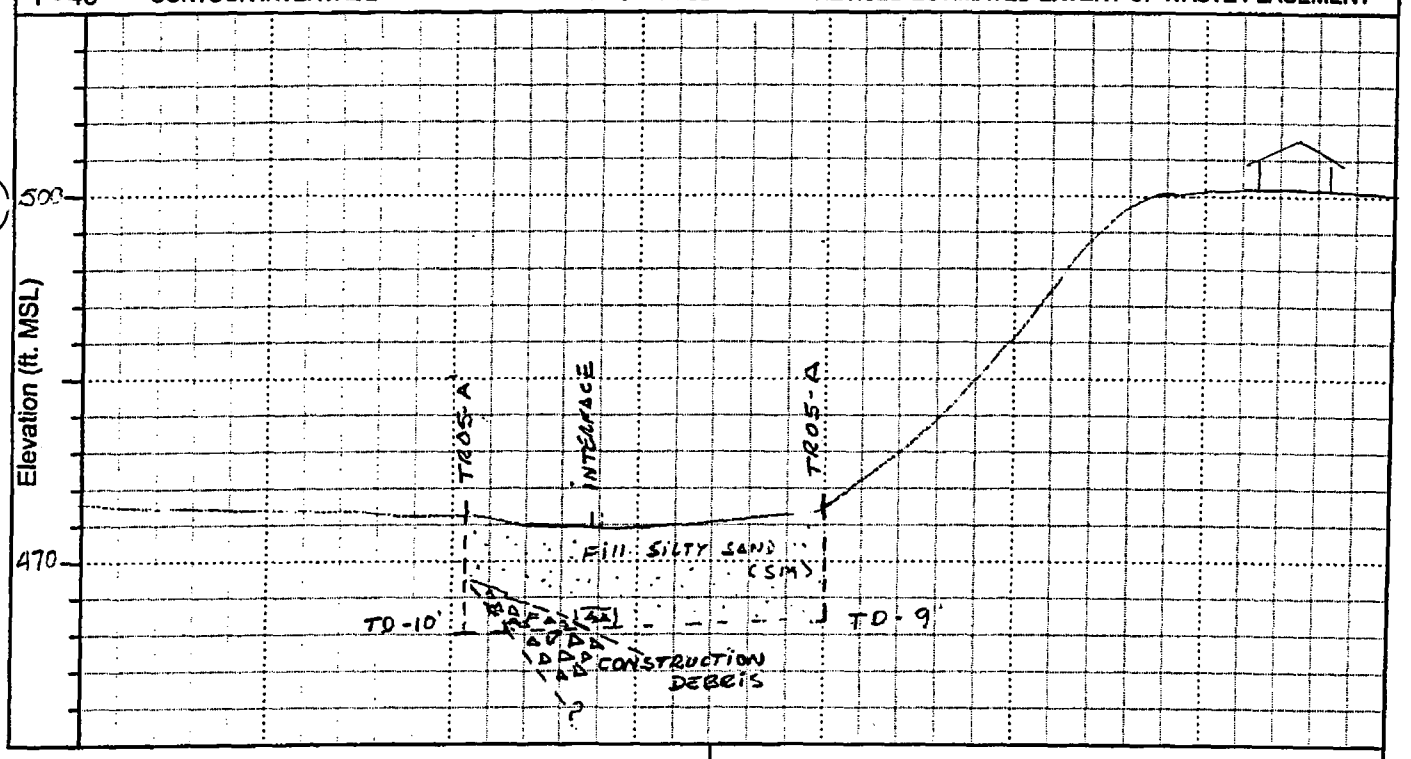

Soil Description, Site Observations:

0-10 ft.: Silty sand (SM), light yellowish brown (10YR6/4), 85% medium- to fine-grained, 15% low-plasticity silt with scattered debris, wire, asphalt, plastic, slighty moist.
5-10 ft.: Fill with massive construction debris, mostly concrete rubble, asphalt, concrete/gravel slurry, dry.

Field Monitoring

FID (ppm): 0.0
Dust (mg/m^3): 0.04 to 0.08
Radioactivity (cpm): 4,800 to 10,200
Photograph Numbers: 100 - 1959 through 1961
Geotechnical Samples n/a

Remarks: n/a

Reference: Field Book, Pg.: 23
Attachments:

EARTH TECH
A TYCO INTERNATIONAL LTD. COMPANY

Excavation Log

Project Name: PREDESIGN INVESTIGATION, ANOMALY AREA 3, MCAS EL TORO Project Number: 37380
Location: ANOMALY AREA 3 - A3TR06 A-A'
Northing: A:2195380.74;A':2195352.92 Easting: A:6117611.43;A':6117563.13 Elevation: A:472.95;A':474.44
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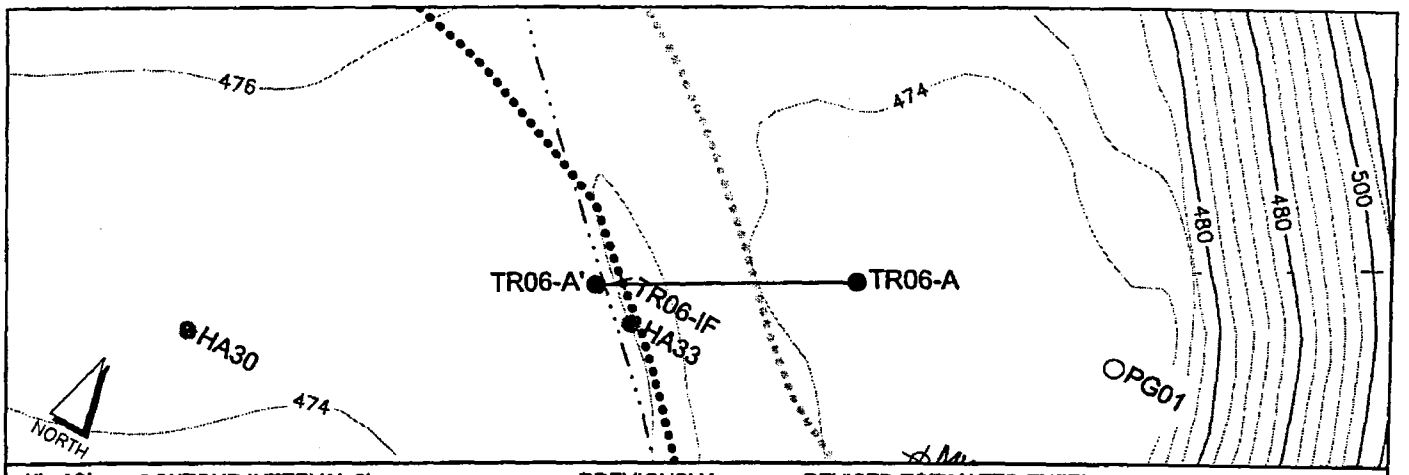
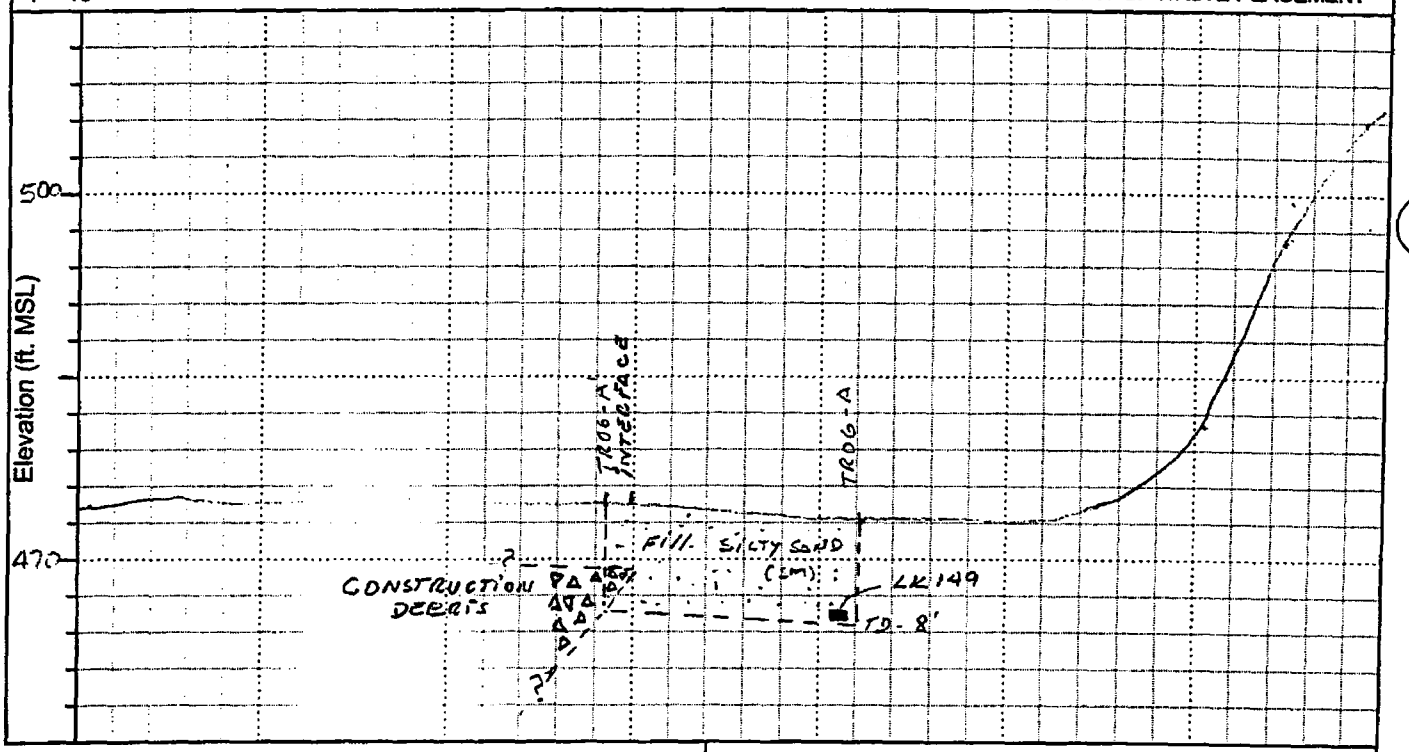


1"=40' CONTOUR INTERVAL 2' PREVIOUSLY REVISED ESTIMATED EXTENT OF WASTE PLACEMENT



Soil Description, Site Observations:

0-8 ft. (TD): Silty gravely sand (SM), yellowish-brown (10YR5/6), 70% medium- to fine-grained sand, 15% low-plasticity silt, 15% subangular gravel up to 3 inches with scattered minor construction debris (concrete, asphalt, 1/2 inch plastic pipe), slightly moist.
6-8 ft. (TD): Major debris, mostly concrete rubble, rebar, steel pipes, asphalt, dry.

Field Monitoring

FID (ppm): 0.0
Dust (mg/m³): 0.06 to 0.09
Radioactivity (cpm): 4,700 to 11,500
Photograph Numbers: 100 - 1956, 1957, 1958
Geotechnical Samples LK149 (8')

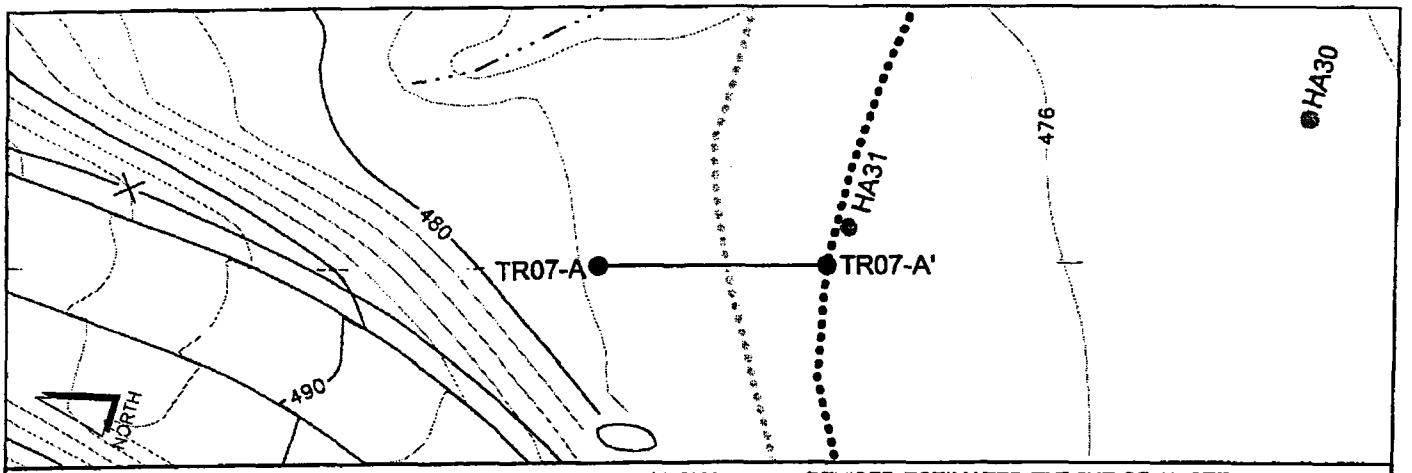
Remarks: n/a

Reference: Field Book, Pg.: 22
Attachments:

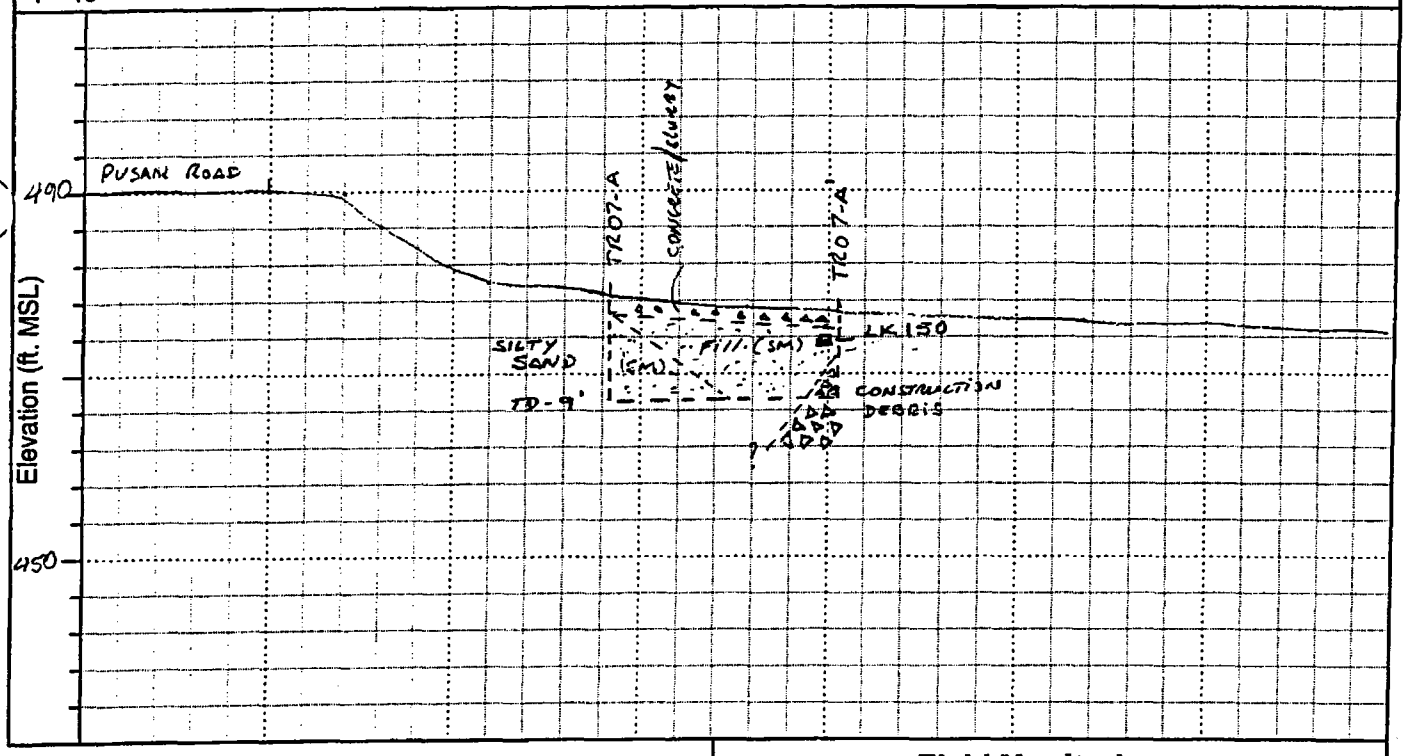
EARTH TECH
A EXECO INTERNATIONAL LTD. COMPANY

Excavation Log

Project Name: PREDESIGN INVESTIGATION, ANOMALY AREA 3, MCAS EL TORO Project Number: 37380
Location: ANOMALY AREA 3 - A3TR07 A-A'
Northing: A:2195436.06;A':2195389.28 Easting: A:6117418.44;A':6117432.28 Elevation: A:478.22;A':477.19
Recorded by: ROD LAZO Date: 10/18/02 Checked by: CW Date: JAN 2002



1"=40' CONTOUR INTERVAL 2' PREVIOUSLY REVISED ESTIMATED EXTENT OF WASTE PLACEMENT



Soil Description, Site Observations:

0-2 ft.: Gravel - concrete slurry.
2-11 ft. (TD): Silty gravel sand (SM); 75% medium- to fine-grained sand, 15% low-plasticity silt, 10% sub rounded gravel up to 3 inches with some cobbles up to 10 inches slightly moist, trace of asphalt debris.
5-9 ft. (TD): Construction debris, mostly concrete, fence poles, wire. plastic, dry.

Field Monitoring

FID (ppm): 0.0
Dust (mg/m^3): 0.06 to 0.09
Radioactivity (cpm): 5,500 to 11,300
Photograph Numbers: 100 - 1952 through 1955
Geotechnical Samples LK150 (3')

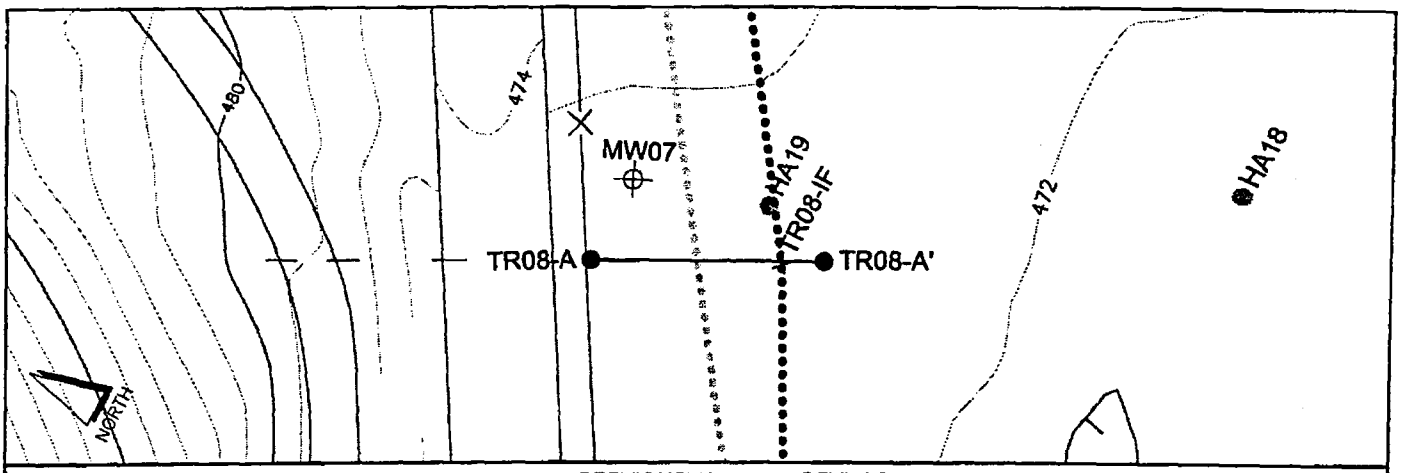
Remarks: n/a

Reference: Field Book, Pg.: 21
Attachments:

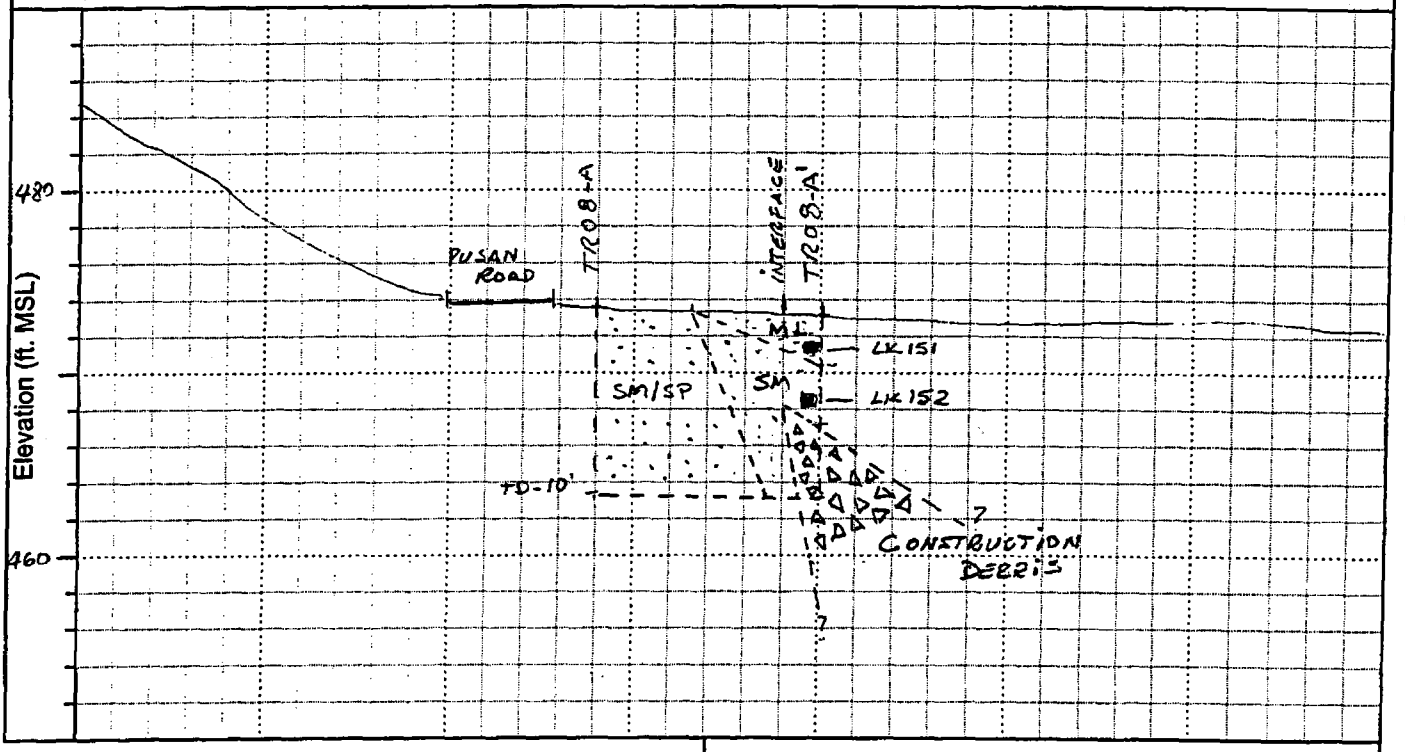
EARTH TECH
A TYCO INTERNATIONAL LTD. COMPANY

Excavation Log

Project Name: PREDESIGN INVESTIGATION, ANOMALY AREA 3, MCAS EL TORO Project Number: 37380
Location: ANOMALY AREA 3 - A3TR08 A-A'
Northing: A:2195265.32;A':2195220.68 Easting: A:6117157.07;A':6117180.22 Elevation: A:473.76;A':473.36
Recorded by: ROD LAZO Date: 10/17/02 Checked by: CW Date: JAN 2002



1"=40' CONTOUR INTERVAL 2' PREVIOUSLY REVISED ESTIMATED EXTENT OF WASTE PLACEMENT



Soil Description, Site Observations:

0-3 ft.: Sandy silt (ML), brown (10YR4/3), with chunks of dark brown, clayey silt (ML) 85% silt, 15% sand, slighty moist.
3-6 ft.: Silty sand with gravel (SM), yellowish brown (10YR5/6), fine- to medium-grained sand, subangular gravel up to 2 inches, 75% sand, 20% silt, 5% gravel.
6-10 ft. (TD): Major concrete debris with some asphalt and spent sand bags, dry.

Field Monitoring

FID (ppm): 0.0
Dust (mg/m³): 0.04 to 0.08
Radioactivity (cpm): 5,100 to 10,300
Photograph Numbers: 100 - 1949 through 1951
Geotechnical Samples LK151 (2')
LK152 (5')

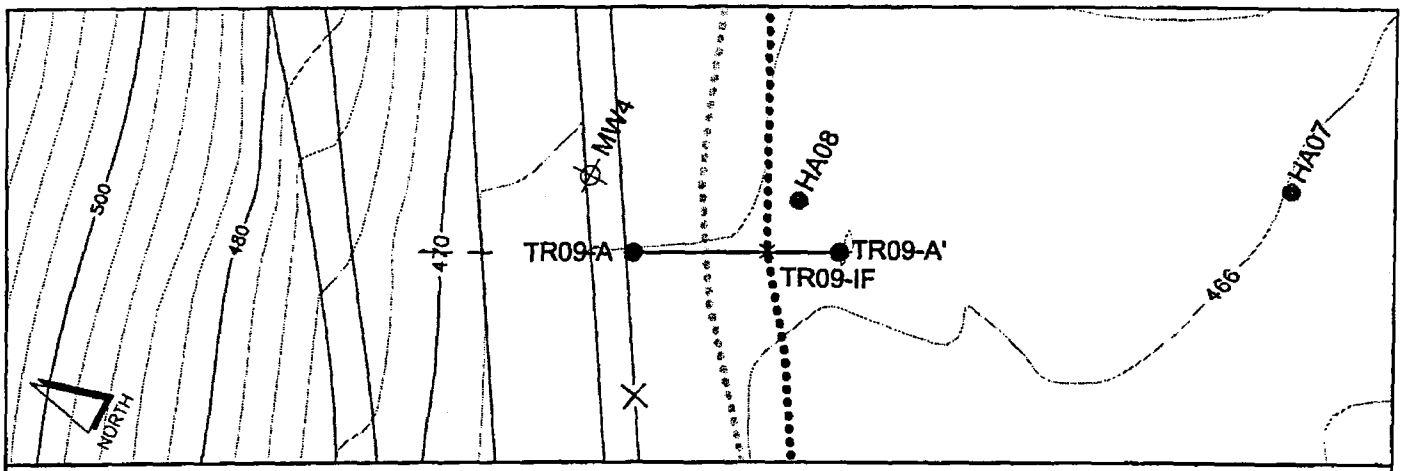
Remarks: n/a

Reference: Field Book, Pg.: 19
Attachments:

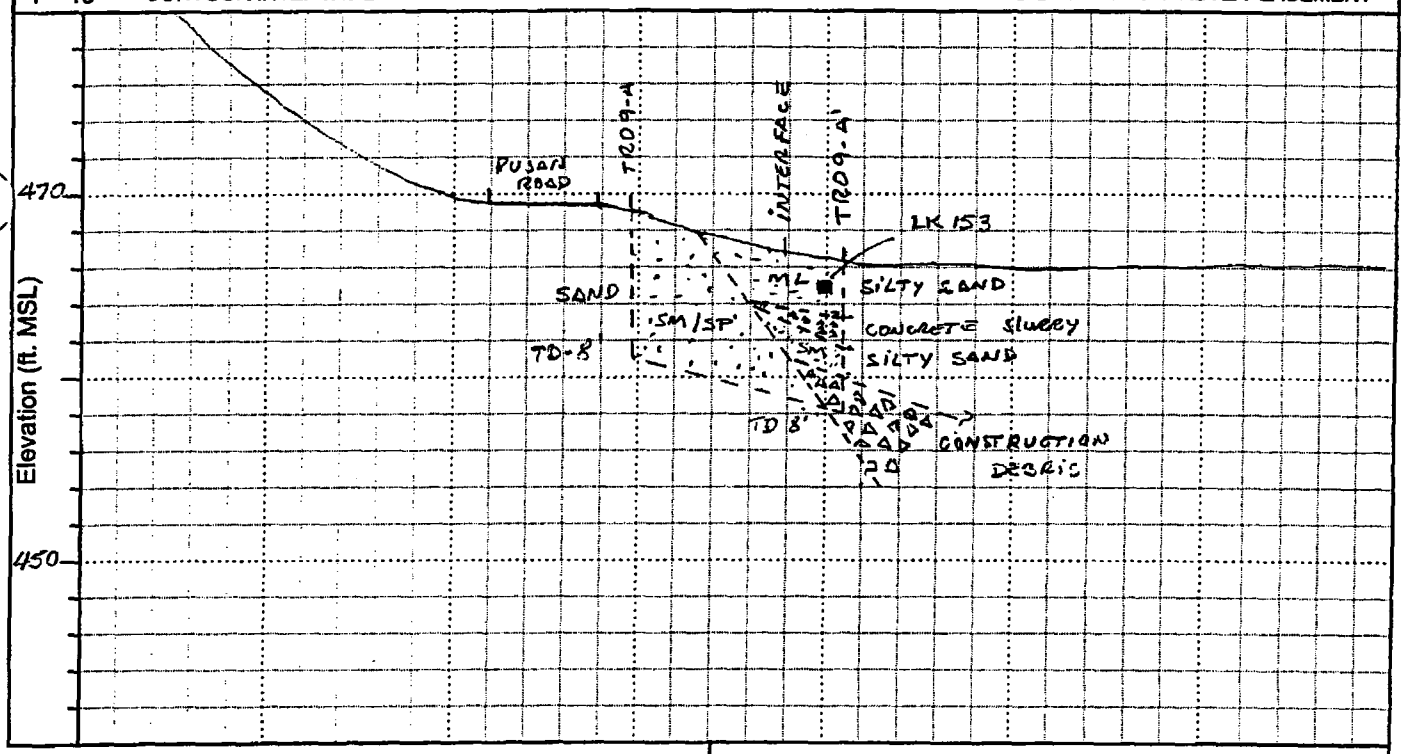
EARTH TECH
A TYCO INTERNATIONAL LTD. COMPANY

Excavation Log

Project Name: PREDESIGN INVESTIGATION, ANOMALY AREA 3, MCAS EL TORO Project Number: 37380
Location: ANOMALY AREA 3 - A3TR09 A-A'
Northing: A:2195112.01;A':2195072.81 Easting: A:6116900.52;A':6116920.19 Elevation: A:468.47;A':466.05
Recorded by: ROD LAZO Date: 10/17/02 Checked by: CW Date: JAN 2002



1"=40' CONTOUR INTERVAL 2' PREVIOUSLY REVISED ESTIMATED EXTENT OF WASTE PLACEMENT



Soil Description, Site Observations:

0-3 ft.: Sandy silt (ML), brown (10YR4/3), 85% medium-plasticity silt, 15% medium- to fine-grained sand, moderately compacted, slightly moist, no debris.
3-4.5 ft.: Concrete slurry/gravel.
4.5-6 ft.: Silty gravelly sand (SM), yellowish brown (10YR5/6), 70% medium- to fine-grained sand, 15% low-plasticity silt, 15% subangular gravel up to 2 inches, moderately compacted, dry, some asphalt debris.
6-8 ft. (TD): Concrete debris with rebar, dry.

Reference: Field Book, Pg.: 16
Attachments:

Field Monitoring

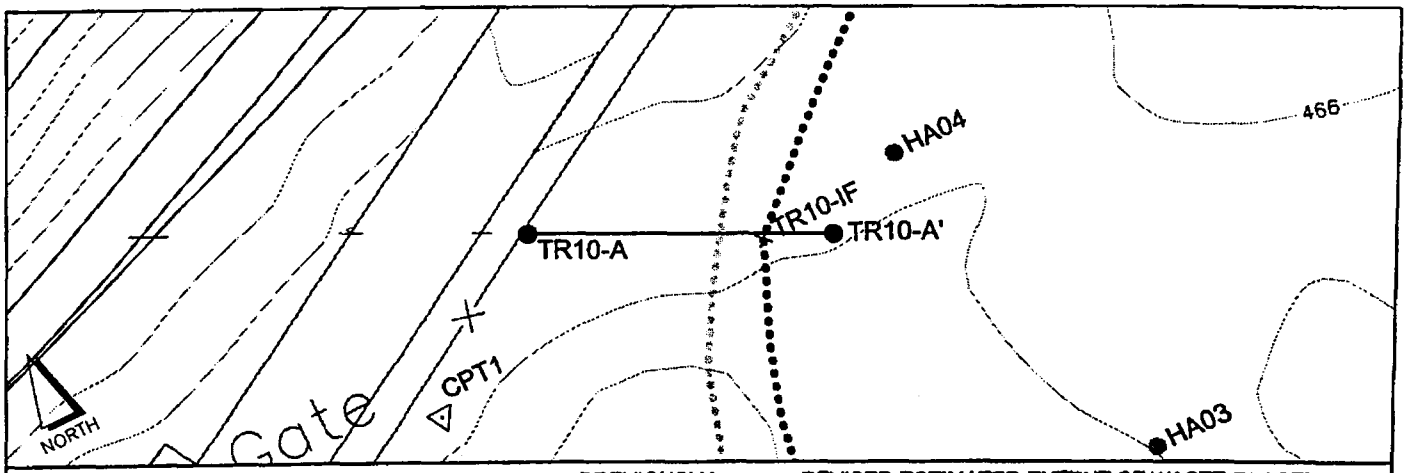
FID (ppm): 0.0
Dust (mg/m^3): 0.054 to 0.098
Radioactivity (cpm): 5,600 to 12,200
Photograph Numbers: 100 - 1941, 1942
Geotechnical Samples LK153 (2')

Remarks: n/a

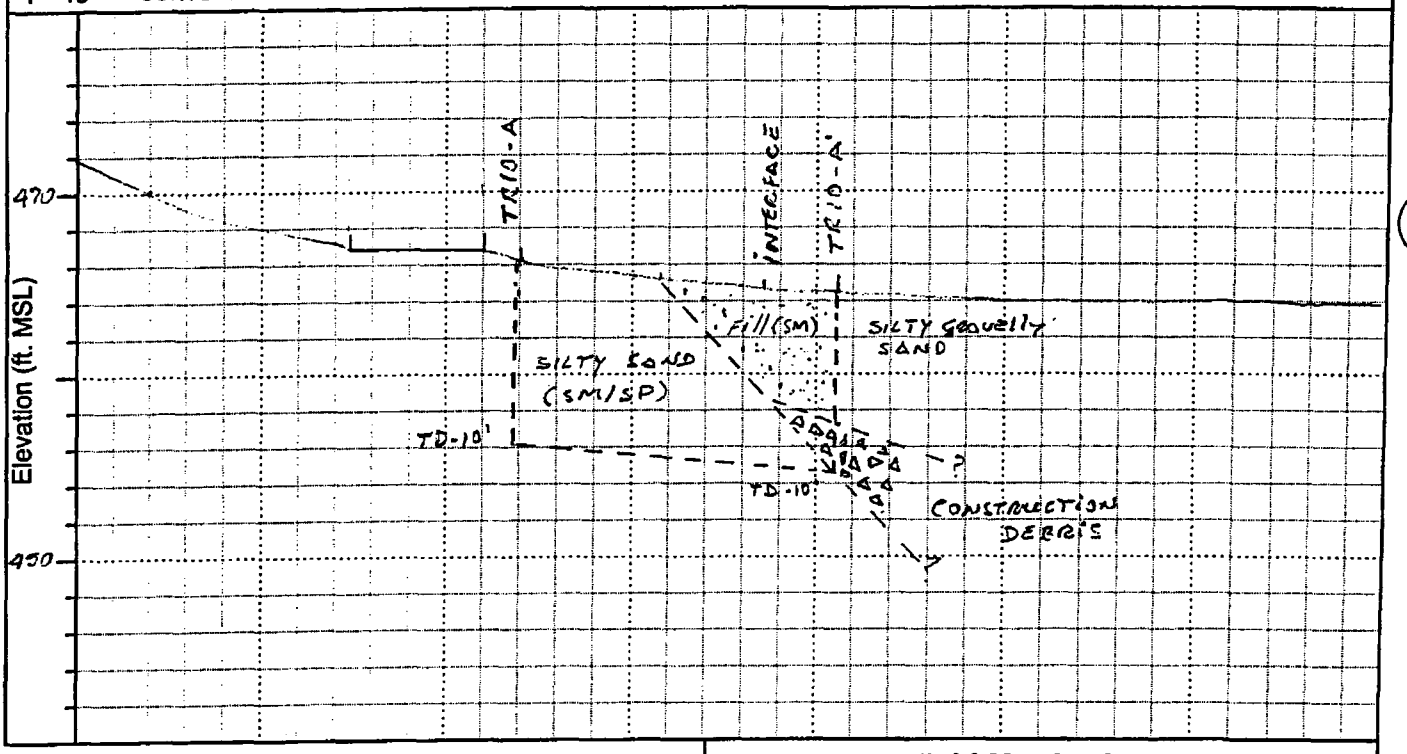
EARTH TECH
A EXCEL INTERNATIONAL LTD. COMPANY

Excavation Log

Project Name: PREDESIGN INVESTIGATION, ANOMALY AREA 3, MCAS EL TORO Project Number: 37380
Location: ANOMALY AREA 3 - A3TR10 A-A'
Northing: A:2195046.33;A':2195017.45 Easting: A:6116789.01;A':6116848.04 Elevation: A:466.38;A':464.57
Recorded by: ROD LAZO Date: 10/17/02 Checked by: CW Date: JAN 2002



1"=40' CONTOUR INTERVAL 2' PREVIOUSLY REVISED ESTIMATED EXTENT OF WASTE PLACEMENT



Soil Description, Site Observations:

0-7 ft.: Fill, silty gravelly sand (SM); yellowish brown (10YR5/6), 70 % medium- to fine-grained sand, 15% medium-plasticity silt, 15% subangular gravel up to 3 inches, moderately compacted, with scattered cobbles, trace concrete and some spent sand bags, slighty moist.
7-10 ft. (TD): Massive major concrete debris with asphalt, wood, dry.

Field Monitoring

FID (ppm): 0.0
Dust (mg/m³): 0.58 to 0.09
Radioactivity (cpm): 4,700 to 11,700
Photograph Numbers: 100 - 1945 through 1948
Geotechnical Samples n/a

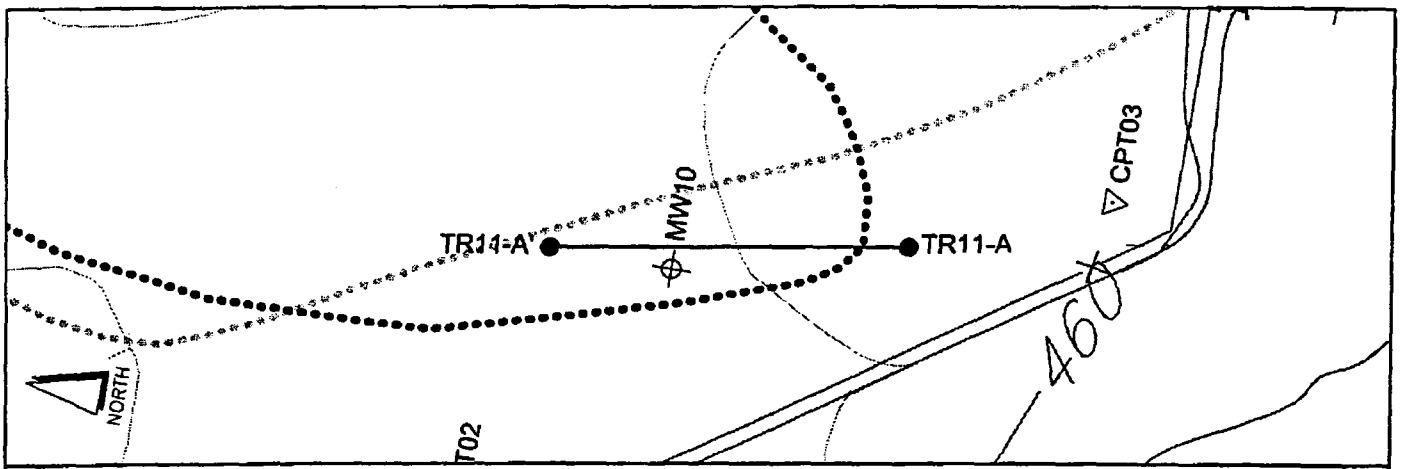
Remarks: n/a

Reference: Field Book, Pg.: 17
Attachments:

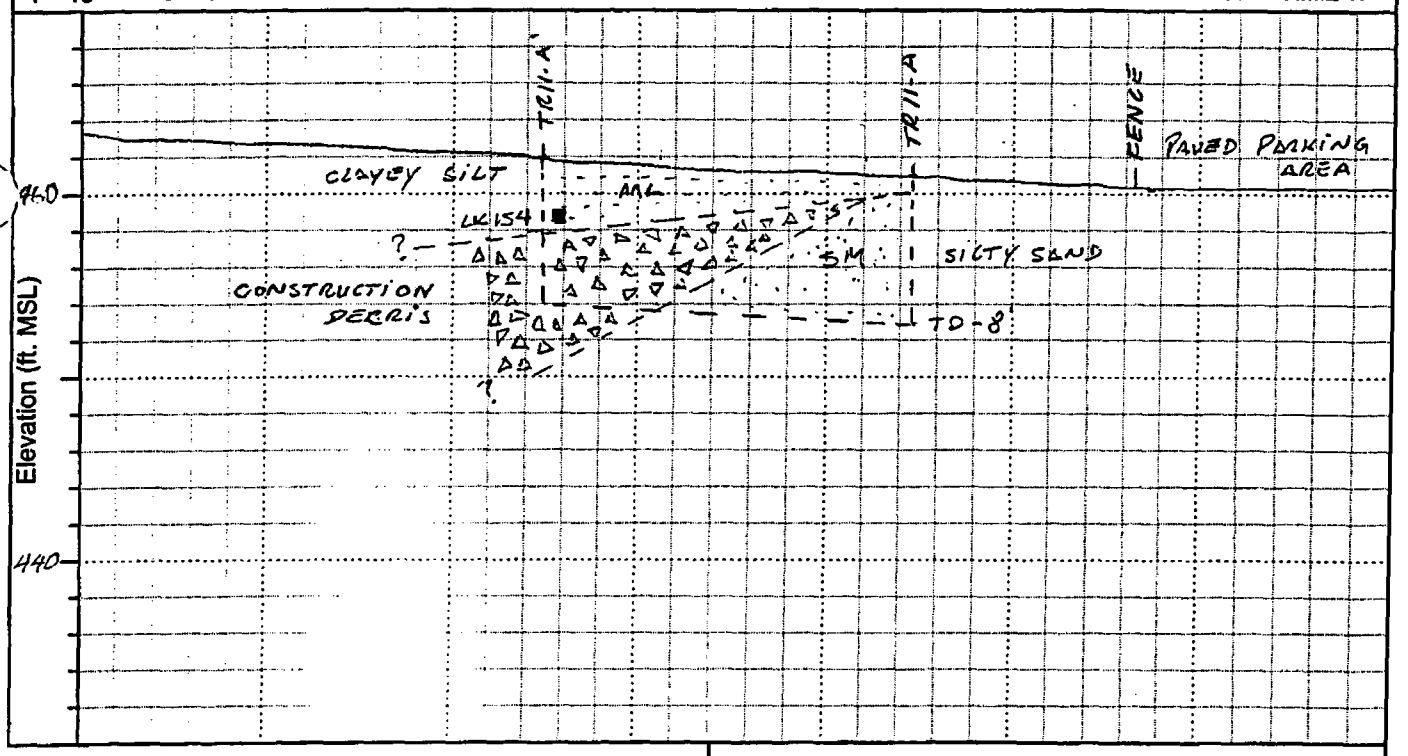
EARTH TECH
A EXPONENT INTERNATIONAL LTD. COMPANY

Excavation Log

Project Name: PREDESIGN INVESTIGATION, ANOMALY AREA 3, MCAS EL TORO Project Number: 37380
Location: ANOMALY AREA 3 - A3TR11 A-A'
Northing: A:2194806.77;A':2194882.49 Easting: A:6116851.10;A':6116838.33 Elevation: A:460.91;A':462.18
Recorded by: ROD LAZO Date: 10/22/02 Checked by: CW Date: JAN 2002



1"=40' CONTOUR INTERVAL 2' PREVIOUSLY REVISED ESTIMATED EXTENT OF WASTE PLACEMENT



Soil Description, Site Observations:

0-4 ft.: Clayey silt with sand (ML), light yellowish brown, (10YR6/4), 85% medium-plasticity silt, 15% medium- to fine-grained sand, stiff, dry, no debris.
1-8 ft. (TD): Silty sand (SM), light olive brown, (2.5YR5/4), 85% medium- to fine-grained sand, 15% medium-plasticity silt, stiff, slighty moist.
4-8 ft. (TD): Debris, mostly asphalt concrete, rebar, bricks, some wire, mixed with gravel-cement slurry, dry.

Field Monitoring

FID (ppm): 0.0
Dust (mg/m^3): 0.05 to 0.08
Radioactivity (cpm): 4,900 to 10,400
Photograph Numbers: 100 - 1981 through 1984
Geotechnical Samples LK154 (0-4')

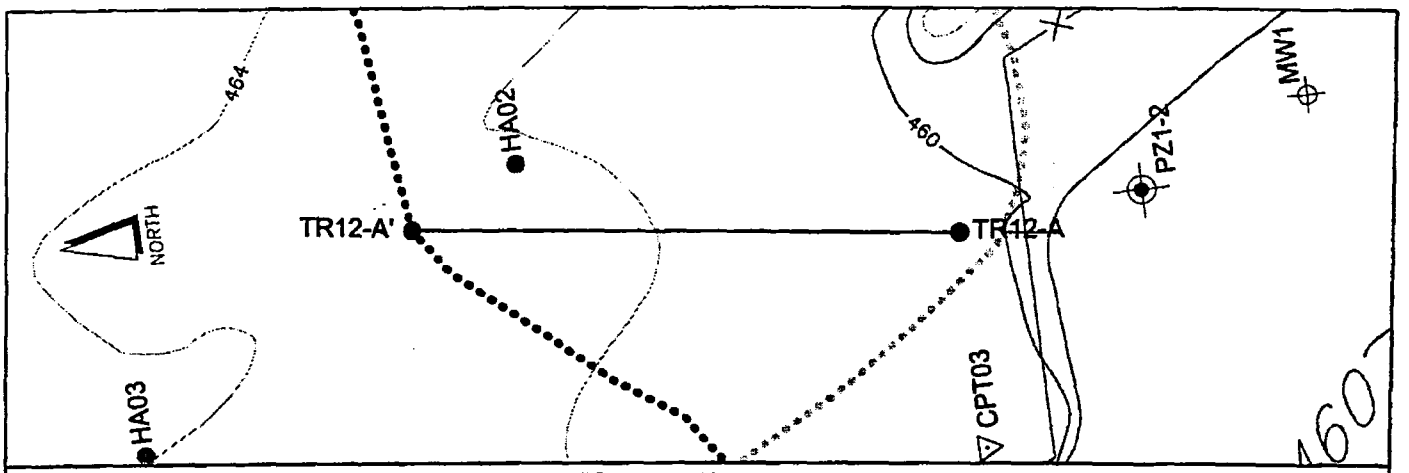
Remarks: n/a

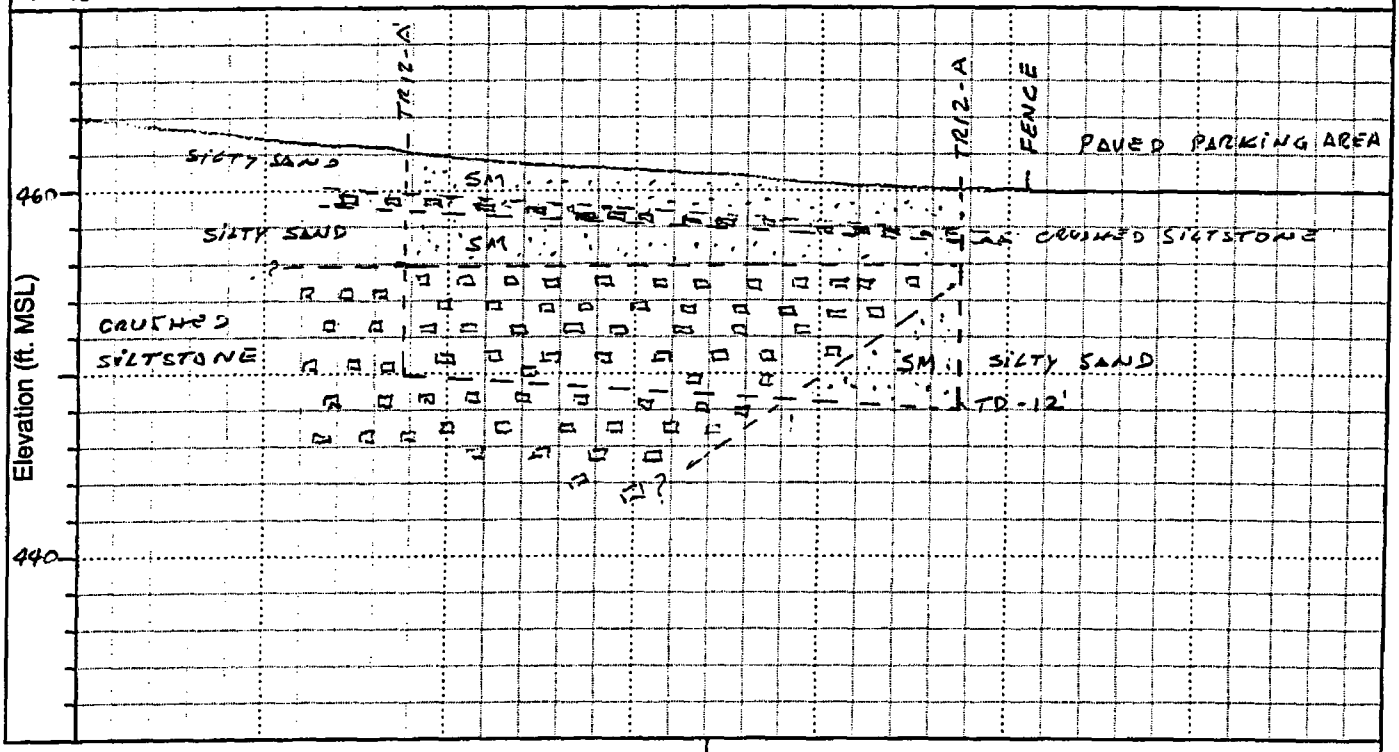
Reference: Field Book, Pg.: 31
Attachments:

EARTH TECH
A TYCO INTERNATIONAL LTD. COMPANY

Excavation Log

Project Name: PREDESIGN INVESTIGATION, ANOMALY AREA 3, MCAS EL TORO Project Number: 37380
Location: ANOMALY AREA 3 - A3TR12 A-A'
Northing: A:2194766.18;A':2194882.89 Easting: A:6116915.49;A'6116930.73 Elevation: A:460.10;A':462.59
Recorded by: ROD LAZO Date: 10/22/02 Checked by: CW Date: JAN 2002





Soil Description, Site Observations:

0-2 ft.: Silty sand (SM-ML), light olive brown (2.5Y5/4), medium- to fine-grained sand with some low plasticity silt slighty moist, no debris.
2-6 ft.: Silty sand (SM), light olive brown (2.5Y5/4), 85% medium- to fine-grained sand, 15% medium-plasticity silt, stiff, slightly moist, trace asphalt, brick debris, concrete.
4-12 ft. (TD): Crushed bedrock (siltstone), greenish in color, breaks down to clayey sand (SC), to sandy clay (CL), no debris.

Field Monitoring

FID (ppm): 0.0
Dust (mg/m^3): 0.07 to 0.09
Radioactivity (cpm): 4,800 to 10,300
Photograph Numbers: 100 - 1975 through 1980
Geotechnical Samples n/a

Remarks: n/a

Reference: Field Book, Pg.: 30
Attachments:

Appendix A2
Groundwater Monitoring Logs

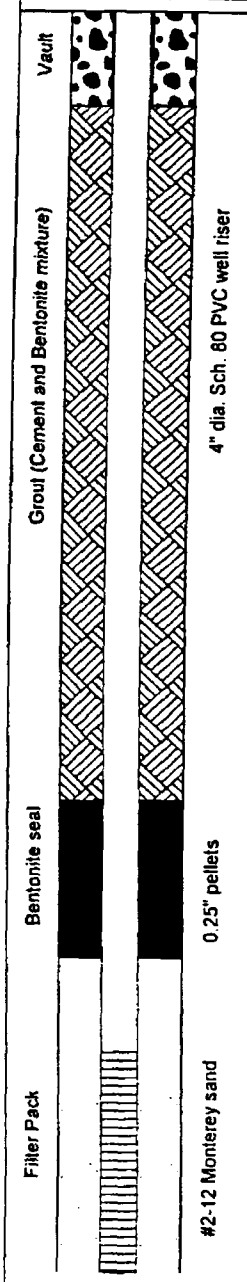
Geologic Log of Boring MSC R1-MW01

Project	MCAS, El Toro	Northing	2,194,690.809	Drilling Company	Water Development Corporation
Project Number		Easting	6,116,938.126	Drill Rig	SpeedStar
Client	SWDiv	TOC Elevation	455.02	Driller	Rod Koch
Location		GS Elevation	455.36	Drill Method	ARCH
Geologist	G. Berger	Hammer Weight & Drop	280 lb, 30 inches		
Borehole Diameter	10 inches	Total Depth of Borehole	51.5 feet	Depth to Water	24.3 feet bgs

Begin Drilling: 10/12/99
End Drilling: 10/12/99
Well Completion Date: 10/13/99

DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 in.	Recovery (inches)
Top 10-feet hand augered for underground utilities clearance	0	SM					
	1						
	2						
	3						
	4						
Based on soil cuttings **Silty Sand (SM)**: Brown (10 YR 5/3); 85% fine to medium iron coated sand grains, 15% silt, dry, loose.	5	SM					
	6						
	7						
	8						
	9						
	10						
	11						
	12						
	13						
	14						
Clayey Sand (SC): Brown (10YR 4/3); 80% fine sand, 20% fines, moist, dense.	15	SC				13	6
	16					24	6
						28	6
	17						
Based on soil cuttings from cyclone **Silty Sand (SM)**: Brown (10YR 4/3); 85% fine sand, 15% fines, trace gravel, very moist, micaceous.	18	SM					
	19						
	20						

WELL DETAIL



OHM Remediation Services Corp.

GEOL_WELL_EL_TORO.GPJ EL_TORO.GDT 12/16/99

Geologic Log of Boring MSC R1-MW01

Project	MCAS, El Toro	Northing	2,194,690.809	Drilling Company	Water Development Corporation
Project Number		Easting	6,116,938.126	Drill Rig	SpeedStar
Client	SWDiv	TOC Elevation	455.02	Driller	Rod Koch
Location		GS Elevation	455.36	Drill Method	ARCH
Geologist	G. Berger	Hammer Weight & Drop	280 lb, 30 inches		
Borehole Diameter	10 inches	Total Depth of Borehole	51.5 feet	Depth to Water	24.3 feet bgs

Begin Drilling: 10/12/99
End Drilling: 10/12/99
Well Completion Date: 10/13/99

DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 in.	Recovery (inches)	WELL DETAIL
	20							
Based on soil cuttings from cyclone Silty Sand (SM): Brown (10YR 4/3); 85% fine sand, 15% fines, trace gravel, very moist, micaceous.	21	SM						
	22							
	23							
	24 ▼							
Clayey Sand (SC): Brown (10YR 4/3); 60% fine sand, 40% fines, wet, loose, micaceous.	25	SC				2	6	
	26					3	6	
Based on soil cuttings. Clayey Sand to Sandy Clay (SC/CL): Brown (10YR 4/3); 50% fine sand, 50% fines, wet.		SC/CL				3	6	
	27							
	28							
	29							
Poorly to Well Graded Sand (SP-SW): Grayish brown (10YR 3/2), 90% fine to medium to coarse sand, 10% gravel, wet, very dense, very micaceous. Becomes gravelly toward base, some clay clasts present.	30	SP-SW				18	6	
	31					50	6	
		SP				50	6	
	32							
	33							
	34							
Sand (SP): Light yellowish brown (2.5Y 6/4), 90% medium to coarse sand.	35	SP				18	6	
						20	6	
Silty Sand (SM): Light olive brown (2.5Y 5/6), 80% fine sand, 20% silt.	36	SM				20	6	
		SM						
	37							
	38							
	39							
	40							

4" dia. 0.020" wire-wound continuous wrap stainless steel screen

OHM Remediation Services Corp.

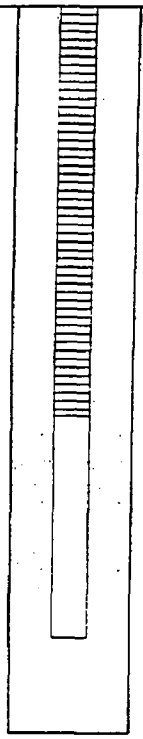
GEOL_WELL_EL_TORO.GPJ EL_TORO.GDT 12/16/99

Geologic Log of Boring MSC R1-MW01

Project: MCAS, El Toro	Northing: 2,194,690.809	Drilling Company: Water Development Corporation	
Project Number	Easting: 6,116,938.126	Drill Rig: SpeedStar	Begin Drilling: 10/12/99
Client: SWDiv	TOC Elevation: 455.02	Driller: Rod Koch	End Drilling: 10/12/99
Location	GS Elevation: 455.36	Drill Method: ARCH	Well Completion Date: 10/13/99
Geologist: G. Berger	Hammer Weight & Drop: 280 lb, 30 inches		
Borehole Diameter: 10 inches	Total Depth of Borehole: 51.5 feet	Depth to Water: 24.3 feet bgs	

DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 in.	Recovery (inches)
	40						
	41						
	42						
	43						
	44						
Silty Sand (SM); Light yellowish brown (2.5Y 6/3) mottled to dark yellowish brown (10YR 4/6); 90% fine sand, 10% silt, trace gravel; wet, dense.	45	SM			0	29	6
						50	6
Weathered sandstone; Light greenish gray (5GY 7/1) mottled brownish yellow (10YR 6/8) silty fine sand, moist, very dense. Niguel Formation (Pliocene).	46	SS				50	6
		SS					
	47						
	48						
	49						
Sandstone, consolidatd Sand; Very dark gray (N3); very fine sand, micaceous, horizontally laminated; consolidated weakly indurated, very dense. Niguel Formation (Pliocene).	50					50	6
						50	6
	51					50/1	6

WELL DETAIL



Boring Ends at 51.5 ft.

GEOL_WELL EL_TORO.GPJ EL_TORO.GDT 12/16/99

Geologic Log of Boring MSC R1-MW02

Project	MCAS, El Toro	Northing	2,194,900.426	Drilling Company	Water Development Corporation
Project Number		Easting	6,116,747.858	Drill Rig	SpeedStar
Client	SWDiv	TOC Elevation	459.71	Driller	Rod Koch
Location		GS Elevation	460.19	Drill Method	ARCH
Geologist	G. Berger	Hammer Weight & Drop	280 lb, 30 inches		
Borehole Diameter	10 inches	Total Depth of Borehole	56.0 feet	Depth to Water	35.5 feet bgs

Begin Drilling	10/14/99
End Drilling	10/14/99
Well Completion Date	10/15/99

DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 in.	Recovery (inches)	WELL DETAIL
Hand auger to 10' for subsurface utility clearance.	0							Vault
	1							
	2							
	3							
Based on cuttings 5' to 10'.	4	SP-SM						
Poorly Graded Sand with Silt (SP-SM); Dark yellowish brown (10YR 4/4); 90% fine sand, 10% silt, micacious, moist.	5							
	6							Grout (cement and bentonite mixture)
	7							
	8							
	9							4" dia. Sch 40 PVC well riser
Based on cuttings 10' to 15'.	10	SP-SW						
Poorly to Well Graded Sand (SP-SW); Brown (10YR 5/3); 95%+ fine to medium grain quartz sand, trace dark minerals, trace fines, micaceous, dry.	11							
	12							
	13							
	14							
Gravelly Sand (SW); Brown (10YR 5/3); 90%+ fine to course iron coated quartz sand, 10% gravel, max. dia. 1", dry, dense.	15	SW			0	13	6	
	16					25	6	Bentonite Seal
						29	6	
Based on cuttings. **Gravelly Sand (SW-SM)**; Dark yellowish brown (10Y 4/4).	17	SW						3/8" pellets - coated
	18							
	19							Filter Pack
	20							#2-12 sand

OHM Remediation Services Corp.

GEOL WELL EL TORO GPJ EL TORO GDT 12/16/99

DRAFT

Geologic Log of Boring MSC R1-MW02

Project: MCAS, El Toro	Northing: 2,194,900.426	Drilling Company: Water Development Corporation	
Project Number	Easting: 6,116,747.858	Drill Rig: SpeedStar	Begin Drilling: 10/14/99
Client: SWDiv	TOC Elevation: 459.71	Driller: Rod Koch	End Drilling: 10/14/99
Location	GS Elevation: 460.19	Drill Method: ARCH	Well Completion Date: 10/15/99
Geologist: G. Berger	Hammer Weight & Drop: 280 lb, 30 inches		
Borehole Diameter: 10 inches	Total Depth of Borehole: 56.0 feet	Depth to Water: 35.5 feet bgs	

DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 in.	Recovery (inches)	WELL DETAIL
Based on soil cuttings. **Gravelly Sand (SW)**	20, 21, 22, 23, 24	SW						
Gravelly Sand (SW); Brown (10YR 5/3); 90% fine to course quartz sand, 10% gravel, black, angular, max. dia. 3/4", moist, dense.	25, 26	SW		X	0	25, 31, 54	6, 6, 6	
Based on cuttings. **Gravelly Sand (SW-SM)**; similar to above, moist.	27, 28, 29, 30, 31, 32, 33, 34	SW						4" dia. 0.020" wire-wound continous wrap stainless steel screen
Poorly Graded Sand with Silt (SP-SM); Brown (10YR 4/3); 85% fine to medium sand, 10% silt, 5% gravel, micacious, wet, dense.	35, 36	SP-SM		X	0	18, 27, 39	6, 6, 6	
	37, 38, 39, 40	SP-SM						

OHM Remediation Services Corp.

GEOL WELL EL TORO.GPJ EL_TORO.GDT 12/16/99

DRAFT

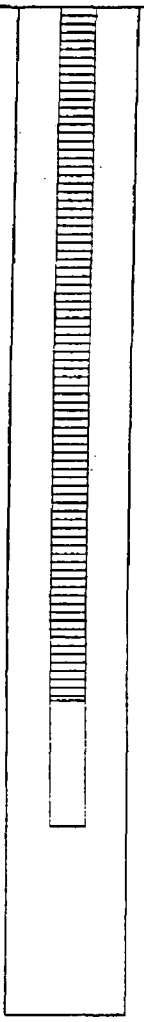
Geologic Log of Boring MSC R1-MW02

Project	MCAS, El Toro	Northing	2,194,900.426	Drilling Company	Water Development Corporation
Project Number		Easting	6,116,747.858	Drill Rig	SpeedStar
Client	SWDiv	TOC Elevation	459.71	Driller	Rod Koch
Location		GS Elevation	460.19	Drill Method	ARCH
Geologist	G. Berger	Hammer Weight & Drop	280 lb, 30 inches		
Borehole Diameter	10 inches	Total Depth of Borehole	56.0 feet	Depth to Water	35.5 feet bgs

Begin Drilling: 10/14/99
End Drilling: 10/14/99
Well Completion Date: 10/15/99

DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 in.	Recovery (inches)
Well Graded Sand (SW); Grayish brown (10YR 5/2); 90% fine to coarse sand, 10% gravel, wet, medium dense.	40	SW				7	6
					0	18	6
Silty Sand (SM); Dark grayish brown (10YR 6/2); 80% fine to medium sand, 20% silt with some clay, trace gravel, 1" max. dia., wet, medium dense.	41	SM				24	6
	42						
	43						
	44	SP					
	45						
Poorly Graded Sand (SP); Brown (10YR 5/3); 100% fine to coarse sand, wet, medium dense.	46	SP				7	6
					0	13	6
Silty Sand with Gravel (SM); 60% fine to medium sand, 20% silt and clay, 20% gravel, wet medium dense.	47	SM				25	6
	48						
Weathered bedrock and Alluvium contact at 49'.	49	GW					
Well Graded Gravel with Sand (GW); 60% gravel, 2" max. dia.	50					25	6
						50	6
Weathered Sandstone; Light brownish gray (2.5Y 6/2), mottled to olive yellow (2.5Y 6/6). Niguel Formation (Pliocene).	51	SS					0
	52						
	53						
	54						
Weathered Sandstone; Light gray (2.5Y 7/3) mottled to yellowish brown (10YR 6/8); fine grained well sorted sand. Niguel Formation (Pliocene).	55	SS				39	6
						50	6
	56						0
Boring Ends at 56.5 ft.							

WELL DETAIL



OHM Remediation Services Corp.

GEOL_WELL EL_TORO.GPJ EL_TORO.GDT 12/16/99

DRAFT

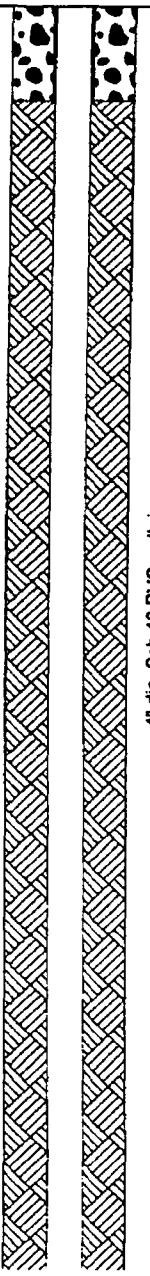
Geologic Log of Boring MSC R1-MW03

Project	MCAS, El Toro	Northing	2,195,723.495	Drilling Company	Water Development Corporation
Project Number		Easting	6,117,525.667	Drill Rig	SpeedStar
Client	SWDiv	TOC Elevation	500.31	Driller	Rod Koch
Location		GS Elevation	500.85	Drill Method	ARCH
Geologist	G. Berger	Hammer Weight & Drop	280 lb, 30 inches		
Borehole Diameter	10 inches	Total Depth of Borehole	86.5 feet	Depth to Water	59.5 feet bgs

Begin Drilling	10/18/99
End Drilling	10/19/99
Well Completion Date	10/19/99

DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 in.	Recovery (inches)
Note: This boring is in units of the Niguel Formation (Pliocene).	0	SP-SM					
Hand augered to 10' for subsurface utility clearance.	1						
Based on cuttings 0' - 5' **Poorly Graded Sand with Silt (SP-SM)**: Light yellowish brown (2.5Y 6/4); 90% fine sand, well sorted, 10% silt, moist, appears similar to Niguel Formation (Pliocene).	2						
	3						
	4						
	5						
	6						
	7						
Based on cuttings 5' - 10'. **Poorly Graded Sand with Silt (SP-SM)**: Light olive brown (2.5Y 5/3); 90% fine to medium grain sand, 10% silt, trace gravel, max dia. 0.25".	8	SP-SM					
	9						
	10						
	11						
	12						
	13						
	14						
Siltstone, Niguel Formation, comprised of interbedded laminae: **Sandy Silt (ML)**: Light olive brown (2.5Y 5/3); 60% silt, 40% fine sand.	15	ML				36	6
Silty Sand (SM): Light brown gray (2.5Y 6/2) mottles light yellowish brown (2.5Y 6/4); 60% fine sand, 40% silt.	16	SM			0	50	6
Sandy Clay (CL): Olive gray (5Y 5/2); 60% clay - stiff hard, 40% silt and sand, few gravel.		CL				80	6
Based on cuttings. **Silty Sand/Sandy Silt (SM/ML)**: Dark grayish brown (10YR 4/2); 50% silt 50% fine sand, moist, micaceous.	17	SM/ML					
	18						
	19						
	20						

WELL DETAIL



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Geologic Log of Boring MSC R1-MW03

Project	MCAS, El Toro	Northing	2,195,723.495	Drilling Company	Water Development Corporation
Project Number		Easting	6,117,525.667	Drill Rig	SpeedStar
Client	SWDiv	TOC Elevation	500.31	Driller	Rod Koch
Location		GS Elevation	500.85	Drill Method	ARCH
Geologist	G. Berger	Hammer Weight & Drop	280 lb, 30 inches		
Borehole Diameter	10 inches	Total Depth of Borehole	86.5 feet	Depth to Water	59.5 feet bgs

Begin Drilling: 10/18/99
End Drilling: 10/19/99
Well Completion Date: 10/19/99

DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 in.	Recovery (inches)	WELL DETAIL
Based on cuttings. Silty Sand/Sandy Silt (SM/ML); Dark grayish brown (10YR 4/2); 50% silt, 50% fine sand, moist, micaceous.	20	SM/ML						
	21							
	22							
	23							
	24							
Claystone, Niguel Formation, comprised of interbedded: Clayey Silt/Silty Clay (ML/CL); Brown (10YR 5/3); 50% clay, 50% silt, moist, soft.	25	ML/CL				5	6	
Clayey Sand (SC); Brown (10YR 4/2); 50% fine sand, 50% silt and clay, micaceous.	26	SC			0	8	6	
Clay (CH); Brown (10YR 4/5); clay, very moist-plastic.		CH				16	6	
	27							
	28							
Based on soil cuttings. Silty Sand (SM)	29	SM						
	30							
	31							
	32							
	33							
	34							
Sandstone, Niguel Formation, comprised of: Very Silty Sand (SM); Light olive brown (2.5Y 5/4); 60% fine sand, 40% silt with small amount of clay.	35	SM				10	6	
	36				0	16	6	
						21	6	
	37							
	38							
	39							
	40							

Grout (cement and benonite mixture)

4" dia. Sch 40 PVC well riser

GEOL_WELL EL_TORO.GPJ EL_TORO.GDT 12/16/99

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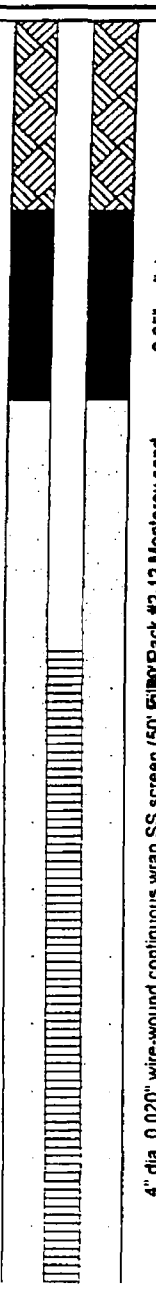
Geologic Log of Boring MSC R1-MW03

Project	MCAS, El Toro	Northing	2,195,723.495	Drilling Company	Water Development Corporation
Project Number		Easting	6,117,525.667	Drill Rig	SpeedStar
Client	SWDiv	TOC Elevation	500.31	Driller	Rod Koch
Location		GS Elevation	500.85	Drill Method	ARCH
Geologist	G. Berger	Hammer Weight & Drop	280 lb, 30 inches		
Borehole Diameter	10 inches	Total Depth of Borehole	86.5 feet	Depth to Water	59.5 feet bgs

Begin Drilling: 10/18/99
End Drilling: 10/19/99
Well Completion Date: 10/19/99

DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 in.	Recovery (inches)
Sandstone, Niguel Formation, comprised of:	40						
	41						
	42						
	43						
	44						
Poorly Graded Sand (SP); Olive yellow (10YR 6/6); 90% sand, 10% fine to med gravel, moist, some iron staining, very dense.	45	SP		X		25	6
					0	34	6
	46					56	6
	47						
	48						
Based on cuttings. **Well Graded Sand (SW)**; Light olive brown (10YR 5/4); 90% fine to coarse sand, 10% gravel, moist.	49	SW					
	50						
	51						
	52						
	53						
	54						
Well Graded Sand (SW); Light olive brown (2.5Y 5/4) mottled olive yellow; fine to coarse sand and gravelly in places, some iron staining. Niguel Formation (Pliocene).	55	SW		X		32	6
						50	6
	56					50	6
	57						
Based on soil cuttings. **Poorly Graded Sand (SP)**; Yellow brown (10YR 5/6); 100% fine to medium sand, wet, possible water table.	58	SP					
	59						
	60						

WELL DETAIL



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Geologic Log of Boring MSC R1-MW03

Project MCAS, El Toro	Northing 2,195,723.495	Drilling Company Water Development Corporation			
Project Number	Easting 6,117,525.667	Drill Rig SpeedStar		Begin Drilling 10/18/99	
Client SWDiv	TOC Elevation 500.31	Driller Rod Koch		End Drilling 10/19/99	
Location	GS Elevation 500.85	Drill Method ARCH		Well Completion Date 10/19/99	
Geologist G. Berger	Hammer Weight & Drop 280 lb, 30 inches				
Borehole Diameter 10 inches	Total Depth of Borehole 86.5 feet	Depth to Water 59.5 feet bgs			

DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 in.	Recovery (inches)	WELL DETAIL
Based on soil cuttings. **Poorly Graded Sand (SP)**: Yellow brown (10YR 5/6); 100% fine to medium sand, wet.	60	SP						4" dia. 0.010" wire-wound continuous wrap SS screen (70' to 80')
	61							
	62							
	63							
	64							
Poorly Graded Sand with Silt (SP-SM): Light olive brown (2.5Y 5/4); *fine to medium sand, dense. Becomes gravelly towards the base, iron stained.*	65	SP-SM				12	6	
	66					26	6	
						46	6	
Based on cuttings. **Poorly Graded Sand (SP)**: Fine to coarse sand with clay pebbles.	67	SP						
	68							
	69							
Gravelly Silty Sand (SM): Mottled olive yellow (2.5Y 6/8), dark yellow (10YR 6/8), light brown (2.5Y 5/4); 70% fine sand, 15% silt, 15% gravel, wet, dense.	70	SM				15	6	
	71				0	26	6	
						30	6	
	72	SM						
	73							
	74							
Silty Sand (SM): Light olive brown (2.5Y 5/4); 83% fine sand, 10% silt, 7% gravel, max. dia. 1", wet.	75	SM					0	
	76				0		0	
							0	
Based on cuttings. **Silty Sand (SM)**: Gravel becomes coarser with depth.	77	SM						
	78							
	79							
	80							

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Geologic Log of Boring MSC R1-MW03

Project	MCAS, El Toro	Northing	2,195,723.495	Drilling Company	Water Development Corporation
Project Number		Easting	6,117,525.667	Drill Rig	SpeedStar
Client	SWDiv	TOC Elevation	500.31	Driller	Rod Koch
Location		GS Elevation	500.85	Drill Method	ARCH
Geologist	G. Berger	Hammer Weight & Drop	280 lb, 30 inches		
Borehole Diameter	10 inches	Total Depth of Borehole	86.5 feet	Depth to Water	59.5 feet bgs

Begin Drilling: 10/18/99
End Drilling: 10/19/99
Well Completion Date: 10/19/99

DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 in.	Recovery (inches)	WELL DETAIL
Silty Sand (SM); Olive (5Y 5/4), mottled olive yellow (2.5Y 6/8); 85% very fine sand, 15% silt, trace gravel, wet, very dense.	80	SM		X		27	6	4" dia. stainless steel sump
	81					40	6	
						50	6	
		SM						
	82							
	83							
	84							
Silty Sand (SM); Pale olive (5Y 6/4); 80% very fine to fine sand, 10% silt, 10% gravel, max. dia. 2", wet.	85	SM		X			0	
	86						0	
							0	
Boring Ends at 86.5 ft.								

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Geologic Log of Boring MSC R1-MW04

Project: MCAS, El Toro	Northing: 2,195,127.846	Drilling Company: Water Development Corporation	
Project Number	Easting: 6,116,912.976	Drill Rig: SpeedStar	Begin Drilling: 10/20/99
Client: SWDiv	TOC Elevation: 464.24	Driller: Rod Koch	End Drilling: 10/20/99
Location	GS Elevation: 464.87	Drill Method: ARCH	Well Completion Date: 10/21/99
Geologist: J. Jameson	Hammer Weight & Drop: 280 lb, 30 inches		
Borehole Diameter: 10 inches	Total Depth of Borehole: 56.5 feet	Depth to Water: 28.8 feet bgs	

DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 in.	Recovery (inches)	WELL DETAIL
Top 10 feet hand augered for subsurface utility clearance.	0							Vault; Grout (cement and bentonite mixture); 4" dia. Sch 40 PVC well riser
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
	13							
	14							
Poorly Graded Sand with Silt (SP-SM): Light brown (7.5YR 6/4), 85% fine to medium grained sand, 15% fines, trace fine subrounded gravel, slightly moist, very dense.	15	SP-SM			0	25	6	
	16					50	6	
		SP-SM				25	6	
	17							
	18							
	19							
	20							

OHM Remediation Services Corp.

GEOL_WELL_EL_TORO.GPJ EL_TORO.GDT 12/16/99

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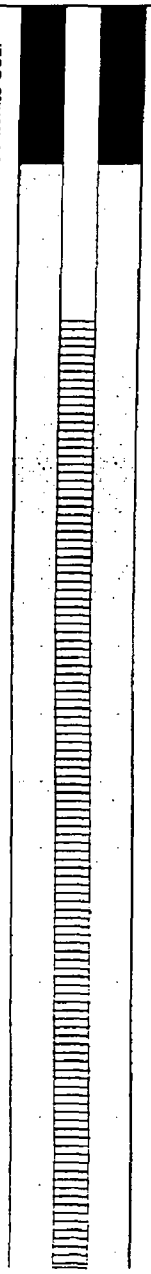
Geologic Log of Boring MSC R1-MW04

Project	MCAS, El Toro	Northing	2,195,127.846	Drilling Company	Water Development Corporation
Project Number		Easting	6,116,912.976	Drill Rig	SpeedStar
Client	SWDiv	TOC Elevation	464.24	Driller	Rod Koch
Location		GS Elevation	464.87	Drill Method	ARCH
Geologist	J. Jameson	Hammer Weight & Drop	280 lb, 30 inches		
Borehole Diameter	10 inches	Total Depth of Borehole	56.5 feet	Depth to Water	28.8 feet bgs

Begin Drilling	10/20/99
End Drilling	10/20/99
Well Completion Date	10/21/99

DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 in.	Recovery (inches)
	20	SP-SM					
	21						
	22						
	23						
	24						
Claystone: Olive (5Y 5/3), 100% low plastic fines, trace fine grained sand and fine gravel,slightly moist, very stiff. Niguel Formation (Pliocene).	25	CL		X	0	10	6
	26			X		10	6
				X		10	6
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
Claystone: Olive (5Y 5/3), 100% low plastic fines, trace fine grained sand and fine gravel,slightly moist, very stiff. Niguel Formation (Pliocene).	35	CL		X	0	10	6
	36			X		10	6
				X		10	6
	37						
	38						
	39						
	40						

WELL DETAIL



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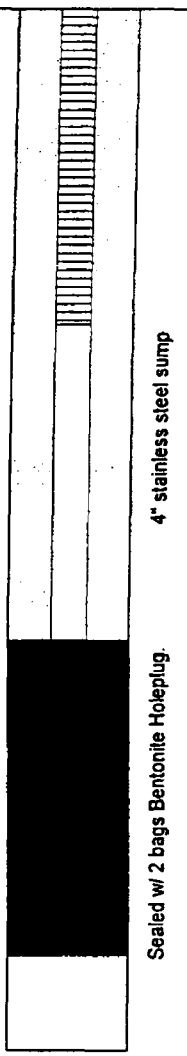
Geologic Log of Boring MSC R1-MW04

Project	MCAS, El Toro	Northing	2,195,127.846	Drilling Company	Water Development Corporation
Project Number		Easting	6,116,912.976	Drill Rig	SpeedStar
Client	SWDiv	TOC Elevation	464.24	Driller	Rod Koch
Location		GS Elevation	464.87	Drill Method	ARCH
Geologist	J. Jameson	Hammer Weight & Drop	280 lb, 30 inches		
Borehole Diameter	10 inches	Total Depth of Borehole	56.5 feet	Depth to Water	28.8 feet bgs

Begin Drilling: 10/20/99
End Drilling: 10/20/99
Well Completion Date: 10/21/99

DESCRIPTION	Depth (feet)	Soil Group	Graphic Log	Samples	PID/FID (ppm)	Blows/6 in.	Recovery (inches)
Claystone; Olive (5Y 5/3); high plasticity; 50% dark olive brown to black silty clay, laminated, wet, very stiff. Niguel Formation (Pliocene).	40	CL			0	10	6
						10	6
	41					10	6
	42						
	43						
	44						
Claystone; Very dark gray (5Y 5/1); silty clay, moist, hard, low plasticity. Niguel Formation (Pliocene).	45	CL				15	6
	46					25	6
						27	6
	47						
	48						
	49						
Claystone; Very dark gray (5Y 3/1); slightly moist, hard, low plasticity. Niguel Formation (Pliocene).	50	CL				11	6
	51					15	6
						22	6
	52						
	53						
	54						
Claystone; Very dark gray; silty clay, dry, hard, low plasticity. Niguel Formation (Pliocene).	55	CL				13	6
	56					18	6
						33	6
Boring Ends at 56.5 ft.							

WELL DETAIL



OHM Remediation Services Corp.

GEOL_WELL EL_TORO.GPJ EL_TORO.GDT 12/16/99

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EARTH TECH

Borehole/Well Constuction Log

t Name: MCAS EL TORO AA-3	Project Number: 37380	Borehole Number: MW-05	
Borehole Location: Anomaly Area A-3	*Northing:* 2195039.24	*Easting:* 6117525.41	Sheet *1* of *2*
Drilling Agency: Valley Well Drilling	Driller: Tomas Fernandez		
Drilling Equipment: Mobile Drill B-90	Date Started: 11/5/2002	Total Depth (feet): 58.5	
Drilling Method: Hollow Stem Auger	Number of Samples: 12	Date Finished: 11/7/2002	Depth to Bedrock (feet):
Drilling Fluid: None	Borehole Diameter (in): 10	Depth to Water: *Drilling (FT BGS):* 30.0	*Static (FT TOC):*
Completion Information: 4" PVC Monitoring Well, screened 40-55'.		Elevation (feet MSL): *Ground:*	*Top of Casing:* 473.07
		Logged By: E.Vicente	Checked By: Crispin Vanyoike

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
			5 8 13		1005					SP	POORLY GRADED SAND (SP); pale yellow (2.5Y7/8), medium to fine, medium dense, dry.		2' pipe stick up above ground surface (w/monument casing).
										SP	POORLY GRADED SAND (SP); As above, but very dense.		Low sample recovery, only one sleeve.
			12 28 30		1015					SM	SILTY SAND (SM); yellowish brown (10YR5/8), medium to fine, some non plastic fines, moist.		
10			9 12 18		1026					SM	SILTY SAND (SM); As above.		
										SP-SM	POORLY GRADED SAND WITH SILT (SP-SM); yellowish-brown (10YR 5/8), medium to fine, dense, with non plastic fines, moist.		
15			9 15 20		1035					SP-SM	POORLY GRADED SAND WITH SILT (SP-SM); As above.		
20			49 50		1042					SP	POORLY GRADED SAND (SP); pale brown (10YR6/3), medium to coarse, trace low plasticity fines, fine gravel (up to 0.5 inches), very dense, dry to moist.		
25			30 50/5		1050					SP	POORLY GRADED SAND (SP); As above.		Water encountered @ 30' bgs.
30													

EAFB_Well(SB)\A-... by Area A-3\MCAS EL TORO AA-3\37380

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS EL TORO AA-3	Project Number: 37380	Borehole Number: MW-05
Borehole Location: Anomaly Area A-3		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
			11 50/5		1100					ML	SANDY SILT (ML); dark yellowish brown (10YR3/6), low plasticity, very dense, trace fine sand, wet.		
35			45/5		1110					ML	SILT (ML); pale olive (5Y6/4), cohesive, hard, wet.		Hard drilling.
40			14 19 21		1125					ML	SILT (ML); As above.		Sampling with SPT sampler with no sleeves.
45			18 35 41		1225					CL-ML	SILTY CLAY (CL-ML); pale olive (5Y6/4), hard, wet, medium plasticity.		
50			18 30 39		1240								No sample recovery.
55			30 50/5		1415								Pocket Penetrometer =1.5 to 1.9 TSF.
			18 20 25		1455								Pocket Penetrometer = 2.5 to 3.0 TSF.
										ML	SILT (ML); olive gray (5Y6/2), hard, occasional rust staining.		

Total Depth = 58.5 feet

B_Wells\SB\Anomaly Area A-3\MCAS EL TORO AA-3\37380

EARTH TECH

Borehole/Well Constuction Log

Project Name: MCAS EL TORO AA-3	Project Number: 37380	Borehole Number: MW-06	
Borehole Location: Anomaly Area A-3	*Northing:* 2195353.27	*Easting:* 6117642.83	Sheet *1* of *2*
Drilling Agency: Valley Well Drilling	Driller: Tomas Fernandez		
Drilling Equipment: Mobile Drill B-90	Date Started: 11/4/2002	Total Depth (feet): 40.5	
Drilling Method: Hollow Stem Auger	Number of Samples: 9	Date Finished: 11/5/2002	Depth to Bedrock (feet):
Drilling Fluid: None	Borehole Diameter (in): 10	Depth to Water: *Drilling (FT BGS):* 30.0	*Static (FT TOC):* 26.00
Completion Information: 4" PVC Monitoring Well, screened 20-40'.		Elevation (feet MSL) : *Ground:*	*Top of Casing:* 475.72
		Logged By: R. Lazo	Checked By: Crispin Vanyoike

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
			15 22 22		1412					ML	SILT (ML); pale yellow (2.5Y7/4), non plastic, hard, dry, trace fine to medium sand (5%).		2' pipe stick up above ground surface (w/monument casing).
5			15 15 18		1435					ML	SILT (ML); As above, but 10% sand, trace subrounded gravel up to 3/4", moist.		
10			8 14 5		1445					ML	SILT(ML); olive brown (2.5Y5/4), low plasticity, very stiff, trace fine to medium sand (5%), moist.		
15			8 11 10		1455					ML	SILT (ML); olive brown (2.5Y5/4), very stiff, 10% medium plasticity clay, trace coarse sand, trace wood, moist.		
20			12 15 15		1500					GP	POORLY GRADED GRAVEL (GP); light olive gray (5Y6/2), chunks of siltstone, subangular, dense, moist.		
			5 7 10		1520					SP	POORLY GRADED SAND WITH GRAVEL (SP); dark olive gray (5Y3/2); medium to coarse, medium dense, moist.		Water @ 26' bgs (11/05/02). Water encountered @ 30'.

FB Well[SB]\Anomaly Area A-3\MCAS EL TORO AA-3\37380

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS EL TORO AA-3	Project Number: 37380	Borehole Number: MW-06
Borehole Location: Anomaly Area A-3		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
			15 15 20		1530					SP	POORLY GRADED SAND WITH GRAVEL (SP); light yellowish brown (2.5Y6/4), medium coarse, dense, some subangular to subrounded gravel up to 1", wet.		
35			9 20 50		1600					ML	SILT (ML); olive yellow (2.5Y6/2), breaks down to non-plastic silt, hard, wet.		Hard drilling.
40			70/6		0805					ML	SILT (ML); olive yellow (2.5Y6/2), hard, wet, low plasticity silt with medium plasticity clay. Total Depth = 40.5 feet		

EARTH TECH

Borehole/Well Constuction Log

Project Name: MCAS EL TORO AA-3	Project Number: 37380	Borehole Number: MW-07	
Borehole Location: Anomaly Area A-3	*Northing:* 2195265.46	*Easting:* 6117176.68	Sheet *1* of *2*
Drilling Agency: Valley Well Drilling	Driller: Tomas Fernandez		
Drilling Equipment: Mobile Drill B-90	Date Started: 11/4/2002	Total Depth (feet): 50.5	
Drilling Method: Hollow Stem Auger	Number of Samples: 10	Date Finished: 11/4/2002	Depth to Bedrock (feet):
Drilling Fluid: None	Borehole Diameter (in): 10	Depth to Water: *Drilling (FT BGS):* 45.0	*Static (FT TOC):* 36.00
Completion Information: 4" PVC Monitoring Well, screened 30-50'.	Elevation (feet MSL): *Ground:*	*Top of Casing:* 475.60	
	Logged By: R. Lazo	Checked By: Crispin Vanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
			10 15 18		0915					SM	SILTY SAND (SM); light yellowish-brown, (2.5Y6/4), fine to medium, dry.		2' pipe stick up above ground surface (w/monument casing).
			8 8 14		0923					SM	SILTY SAND (SM); As above, medium dense, but less fines.		
10			11 10 12		0935					SP-SM	POORLY GRADED SAND WITH SILT (SP-SM); light yellowish-brown, (2.5Y6/4), fine to medium, medium dense, trace fine gravel up to 0.5", moist.		
15			20 50/4		0940					SP	POORLY GRADED SAND (SP); As above.		Very dense.
													No Recovery
20			50/5							SP	POORLY GRADED SAND (SP); some cobbles.		Lithology from cuttings. Cobbles up to 8".
													Hard drilling.
			50/4		1000					SM	SILTY SAND WITH GRAVEL (SM); light olive-brown (2.5Y5/4), coarse to fine, some subangular to subrounded gravel (10%) up to 2", very dense, moist.		Rig shatters. Cobbles. Lithology from cuttings.

FB_Well(SB)\Anomaly Area A-3\MCAS EL TORO AA-3\37380

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS EL TORO AA-3	Project Number: 37380	Borehole Number: MW-07
Borehole Location: Anomaly Area A-3		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
			30 40 30		1050					SP	POORLY GRADED SAND (SP); light olive-brown (2.5Y5/4); coarse to fine sand, very dense, moist, some subangular gravel up to 2".		Silt on tip of sampler.
										Br	SILTSTONE; pale yellow (2.5Y7/4), cohesive, weathered, breaks to non-plastic silts, moist.		Weathered Bedrock.
35			15 30 50/5		1115					Br	SILTSTONE; As above.		Water level sounded @ 36' bgs. (11/04/02, 12:15).
40			15 50/4		1124								
45			15 15 20		1135					Br	SILTSTONE; pale yellow (2.5Y7/4), weathered, dense, breaks to non-plastic silt, wet.		Water encountered @ 45' during drilling.
50			50/6		1150					Br	SANDSTONE; olive-yellow (2.5Y6/40), very dense, breaks down to fine grained sand, wet. Total Depth = 50.5 feet		Total Depth 50.5'.

Wells\SB1\Anomaly Area A-3\MCAS EL TORO AA-3\37380

EARTH TECH

Borehole/Well Constuction Log

Name: MCAS EL TORO AA-3	Project Number: 37380	Borehole Number: MW-08	
Borehole Location: Anomaly Area A-3	*Northing:* 2194877.08	*Easting:* 6117254.83	Sheet *1* of *2*
Drilling Agency: Valley Well Drilling	Driller: Tomas Fernandez		
Drilling Equipment: Mobile Drill B-90	Date Started: 11/6/2002	Total Depth (feet): 55.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 11	Date Finished: 11/6/2002	Depth to Bedrock (feet):
Drilling Fluid: None	Borehole Diameter (in): 10	Depth to Water: *Drilling (FT BGS):* 26.8	*Static (FT TOC):* 26.20
Completion Information: 4" PVC Monitoring Well, screened 45-55'.		Elevation (feet MSL): *Ground:*	*Top of Casing:* 469.65
		Logged By: C.Wong	Checked By: Crispin Vanyoike

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
			7 7 10		0800					SM	SILTY SAND (SM); pale brown (10YR6/3) to grayish brown (10YR5/2); 80% fine sand, 20% silt; some medium grains, medium dense, dry to slightly moist.		2' pipe stick up above ground surface (w/monument casing).
			17 26 27		0820					ML	SILT WITH SAND (ML); brown (10Y4/3); 20% fine sand, 80% silt; low plasticity, hard, fungal mycelia present.		
10			5 15 20		0830					SM	SILTY SAND (SM); pale brown; 70% fine to medium sand, 30% silt; moist, no odor.		
15			15 18 22		0835					SP	POORLY GRADED SAND (SP); light yellowish brown (10YR6/4); 90% fine to medium sand; some coarse grains, 10% silt; dense, no odor.		
20			14 46 40		0840					SM	SILTY SAND (SM); light yellowish brown (10YR6/4); 75% fine sand, 25% silt; very dense, no odor.		
			13 16 23		0850					SP	POORLY GRADED SAND (SP); light yellowish-brown; 95% fine to medium sand, 5% silt; no odor, dense, saturated.		Water @ 26.2'. Water enountered @ 26.8'.

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EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS EL TORO AA-3	Project Number: 37380	Borehole Number: MW-08
Borehole Location: Anomaly Area A-3		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
			5 20 36		0900					SM	SILTY SAND (SM); yellowish brown (10YR5/6); 80% fine to coarse sand, 20% silt; very dense, saturated.		
35			50/5		0905					SP	POORLY GRADED SAND (SP); light olive-brown (2.5Y5/4); 95% fine to medium sand, 5% silt; very dense, saturated.		
40			60/6		0915					SM	SILTY SAND (SM); light yellowish-brown (2.5Y6/4); 85% medium sand, 15% silt; very dense, saturated.		
45					0930					ML	SANDY SILT (ML); light yellow (5Y7/2) and brownish yellow (10YR6/8); 60% silt, 40% fine to medium sand; mottled, weak to moderate cementation, very stiff, saturated.		Hard drilling @ 45'.
50			49 50/3							ML	SANDY SILT (ML); As above, but fine grains only.		
55											Total Depth = 55.0 feet		

FB Wells(SB)\Anomaly Area A-3\MCAS EL TORO AA-3\37380

EARTH TECH

Borehole/Well Constuction Log

Project Name: MCAS EL TORO AA-3	Project Number: 37380	Borehole Number: MW-09	
Borehole Location: Anomaly Area A-3	*Northing:* 2194780.36	*Easting:* 6117099.87	Sheet *1* of *3*
Drilling Agency: Valley Well Drilling	Driller: Tomas Fernandez		
Drilling Equipment: Mobile Drill B-90	Date Started: 10/29/2002	Total Depth (feet): 80.0	
Drilling Method: Air Rotary	Number of Samples: 17	Date Finished: 10/31/2002	Depth to Bedrock (feet):
Drilling Fluid: None	Borehole Diameter (in): 12	Depth to Water: *Drilling (FT BGS):* 30.0	*Static (FT TOC):* 26.70
Completion Information: Dual compition 2x2" PVC Monitoring Wells, screened 20-50' and 60-75'.	Elevation (feet MSL): *Ground:*	*Top of Casing:* 466.52	
	Logged By: E.Vicente	Checked By: Crispin Vanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
			20 50/6		1135					ML	SANDY SILT (ML); light yellowish brown (2.5Y6/3), hard, dry.		2' pipe stick up above ground surface (w/monument casing).
			19 22 21		1150					SM	SILTY SAND (SM); olive yellow (2.5Y6/6), fine to medium, dense, dry.		
10			10 20 25		1205					SM	SILTY SAND (SM); As above but coarser.		
15			5 7 14		1215					SP-SM	POORLY GRADED SAND WITH SILT(SP-SM); light brown, medium to coarse, medium dense, moist.		
20			10 15 18		1245					ML	SANDY SILT (ML); light brown, fine to medium, hard, moist.		
			7 20 25		1315					ML	SANDY SILT (ML); As above, but medium to coarse.		Water @ 26.7'. Water encountered @ 30'.

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EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS EL TORO AA-3	Project Number: 37380	Borehole Number: MW-09
Borehole Location: Anomaly Area A-3		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
			26 40 40		1415					GP-GM	POORLY GRADED GRAVEL WITH SILT (GP-GM); subangular grains up to 1.5", very dense, wet.		
35			10 15 21		1435					GP-GM	POORLY GRADED GRAVEL WITH SILT (GP-GM); As above, dense.		
										SP	POORLY GRADED SAND (SP); yellowish brown, medium to coarse, dense to very dense, wet.		
40			50/4		1530								
45			22 50/4		0810					SP-SM	POORLY GRADED SAND WITH SILT (SP-SM); As above, but fine to medium.		
50			8 50/2		0925					SP-SM	POORLY GRADED SAND WITH SILT (SP-SM); As above.		
55			6 12 18		1007					SP	POORLY GRADED SAND (SP); As above, but medium to coarse.		
60			9 13 20		1130					SP	POORLY GRADED SAND (SP); As above medium to coarse, but less fines.		

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS EL TORO AA-3	Project Number: 37380	Borehole Number: MW-09
Borehole Location: Anomaly Area A-3		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
					1325					SP	POORLY GRADED SAND (SP); As above, but medium grained.		Lithology from cuttings.
70					1345					SP	POORLY GRADED SAND (SP); As above.		Lithology from cuttings.
75					1402					SP-SM	POORLY GRADED SAND WITH SILT (SP-SM); yellowish brown, medium grained, wet.		
80					1408					SP-SM	POORLY GRADED SAND WITH SILT (SP-SM); As above. Total Depth = 80.0 feet		

3_Wells\SB\Anomaly ... A-3\MCAS EL TORO AA-3\37380

EARTH TECH

Borehole/Well Constuction Log

Project Name: MCAS EL TORO AA-3	Project Number: 37380	Borehole Number: MW-10	
Borehole Location: Anomaly Area A-3	*Northing:* 219455.82	*Easting:* 6116838.02	Sheet *1* of *3*
Drilling Agency: Valley Well Drilling	Driller: Tomas Fernandez		
Drilling Equipment: Mobile Drill B-90	Date Started: 10/31/2002	Total Depth (feet): 76.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 8	Date Finished: 11/1/2002	Depth to Bedrock (feet): 56.0
Drilling Fluid: None	Borehole Diameter (in): 10	Depth to Water: *Drilling (FT BGS):* 40.0	*Static (FT TOC):* 37.60
Completion Information: 4" monitoring Well, screened 60-75'		Elevation (feet MSL): *Ground:*	*Top of Casing:* 463.76
		Logged By: C.Wong	Checked By: Crispin Vanyoike

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
			8 25 16		1220					ML	SANDY SILT (ML); light olive brown (2.5Y5/4), hard, low plasticity, dry to moist.		2' pipe stick up above ground surface (w/monument casing).
5			26 39 26		1310					ML	SANDY SILT (ML); As above, but sandier.		
10			26 26 33		1325					ML	SILT WITH CLAY (ML); light olive gray (5Y6/2), some gravel, very dense, medium plasticity clay, dry to moist.		Traces of subangular gravel (claystone, siltstone).
15			30 30 35		1340					ML	SILT WITH CLAY (ML); As above.		
20			50/5		1415					SP	POORLY GRADED SAND (SP); yellowish brown (10YR5/4), fine to coarse, fine subrounded to rounded gravel up to 2", very dense, moist, trace silt, some cobbles.		
25			9 14 15		1425					SP	POORLY GRADED SAND (SP); yellowish brown (10YR5/4); 90% medium to coarse sand with fine grains, 10% fine to coarse, subangular to subrounded gravel up to 1.5"; medium dense, moist.		

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EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS EL TORO AA-3	Project Number: 37380	Borehole Number: MW-10
Borehole Location: Anomaly Area A-3		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
			14 10 15		1450					SP	POORLY GRADED SAND (SP); As above, rounded, elongated cobbles up to 3".		
										ML	SILT (ML); dark brown (10YR3/3), very stiff, medium plasticity, some fine sand, moist, no odor.		
35			5 6 13		1505					ML	GRAVELLY SILT WITH SAND (ML); dark brown (10YR3/3); 60% silt, 30% fine to coarse, subangular to rounded gravel up to 2", 10% fine to coarse sand; very stiff, moist, no odor.		Water @37.50, 11/01/02, 15:00.
										SP-SM	POORLY GRADED SAND WITH SILT (SP-SM); yellowish brown (10YR5/8) to pale olive (5Y6/3); 90% fine to medium sand, 10% silt; sharp contact, very dense, saturated.		Sharp contact.
40			22 50/6		1545								Water encountered @ 40'.
45										SP-SM	POORLY GRADED SAND WITH SILT (SP-SM); As above.		
													Lithology from cuttings.
50										SP-SM	POORLY GRADED SAND WITH SILT (SP-SM); As above.		
55													No more sand from cyclone.
										Br	SHALE; very dark gray, angular rock fragments, hard drilling conditions.		Hard drilling.
													Lithology from cuttings.
										Br	SANDSTONE; fine to medium sand, dark gray, softer drilling at 62'.		Softer drilling @ 62'.

FB_Wells(SB)\Anomaly Area A-3\MCAS EL TORO AA-3\37380

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS EL TORO AA-3	Project Number: 37380	Borehole Number: MW-10
Borehole Location: Anomaly Area A-3		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										Br	SANDSTONE; As above.		
70										SP	POORLY GRADED SAND (SP); dark gray; 95% fine to medium sand, 5% silt; very dense, saturated.		Lithology from cuttings.
75			50/6		1120								
											Total Depth = 76.0 feet		

. Wells(SB)\Anomaly Area A-3\MCAS EL TORO AA-3\37380

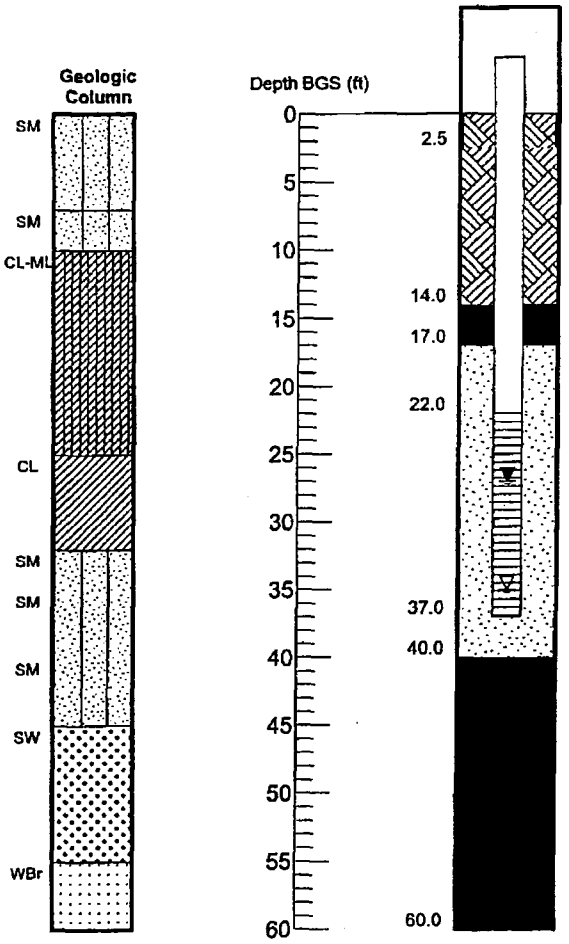
Monitoring Well Construction Log

Project Name: MCAS El Toro	Project Number: 37380	Sheet 1 of 1
Well Location: Anomaly Area 3 Northing: 6117008.111 Easting: 2194974.72	Well Number: AA3-MW11	Well Depth (ft): 60.0
Driller: Steve Huston	Borehole Diameter (in): 10	Depth to Water (ft): Static: 27.00 Drilling: 35.00
Drilling Agency: Water Development Corp.	Date Started: 1/31/2005	
Drilling Equipment: CME 95	Date Finished: 2/1/2005	Elevation: ft MSL
Drilling Method: Hollow Stem Auger	Logged by: R. Lazo	Checked by: W. McClenney
Drilling Fluid: None	Number of Soil Samples: 0	Date Checked:

Elevation (TOC): 467.35 ft MSL

Stick-up Height: ft

Ground Surface Elevation: ft MSL



PROTECTIVE CASING
Material/Type: Steel vault
Diameter (in): 18
Depth (ft BGS): 2.5

GUARD POSTS
No: 0 Type: NA

SURFACE PAD
Composition and Size: 2'x2' concrete pad

RISER PIPE
Type and Thickness: Sch 40 PVC
Diameter (in): 4"
Total Length (ft TOC to TOS): 25
Ventilated Cap:

GROUT
Composition and Proportions: 95% Portland Cement/ 5% Bentonite chips
Tremied:
Interval (ft BGS): 0-14

CENTRALIZERS
Depths (ft):

SEAL
Type: Medium Bentoninte Chips - 7 bags
Source: Sinclair
Hydration Time: 30 minutes Vol. of Fluid Added: 10 gal
Tremied: Interval (ft BGS): 14-17

FILTER PACK
Type: #2/12 Monterrey Sand
Amount Used: 35 bags
Tremied:
Source: Lapis Lustre, Sinclair
Grain Size Dist.: #2/12 Interval (ft BGS): 17-40

SCREEN
Type and Thickness: Sch 40 PVC slotted
Diameter (in): 4" Slot Size (in): 0.020
Interval (ft BGS): 22-37

WELL FOOT
Interval (ft BGS):

BACKFILL/PLUG
Interval (ft BGS): 40-60 Material: Bentonite chips
Hydration Time: 12 hours

Comments:

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EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: AA3-MW11	
Borehole Location: Anomaly Area 3	*Northing:* 6117008.111	*Easting:* 2194974.72	Sheet *1* of *2*
Drilling Agency: Water Development Corp.	Driller: Steve Huston		
Drilling Equipment: CME 95	Date Started: 1/31/2005	Total Depth (feet): 60.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 0	Date Finished: 2/1/2005	Depth to Bedrock (feet): 55
Drilling Fluid: None	Borehole Diameter (in): 10	Depth to Water (feet): *Drilling:* 35.00	*Static:* 27.00
Completion Information: Completed as a 4 inch Sch 40 PVC monitoring well		Elevation (feet MSL): *Ground:*	*Top of Casing:* 467.35
		Logged By: R. Lazo	Checked By: W. McClenney

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
										SM	SILTY SAND (SM); brown (7.5Y 4/4); 85% fine to medium, well rounded sand; 15% low plasticity silt; moist		0 to 40 feet, lithology from drill cuttings
5					0945								Fill
										SM	SILTY SAND (SM); pale olive (5Y 6/4); 85% fine to medium sand; 155 low plasticity silt; moist		Brick fragments, trace concrete chips, fill
10					1000					CL-ML	SILTY CLAY (CL); gray (5Y 6/1); 80% moderate plasticity clay; 15% silt; 5% subangular gravel and sand; moist		Breathing Zone (BZ) Downhole (DH) CH4 = 0% CO2 = 0.1% O2 =20.5% BZ=DH
15													
20					1015						SILTY CLAY (CL) as above; subangular sandstone and siltstone clasts		Fill
25					1027					CL	CLAY (CL); greenish gray (1GLEY 5/1); 95% medium plasticity clay; 5% angular siltstone/sandstone gravel; moist		Fill Water at 27 feet (2/1/05)
30													

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EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: AA3-MW11
Borehole Location:		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
					1035								CH4 = 0% CO2 = 0.1% O2 = 20.6%
										SM	SILTY SAND (SM); very dark (5Y 3/1); 80% medium to coarse, subrounded, quartz sand; trace subrounded gravel, max dia. 0.5", igneous origin; 20% moderate plasticity silt		Native alluvium
35										SM	SILTY SAND (SM) as above; saturated		First water at 35 feet
40				100	1500					SM	SILTY SAND (SM); light olive brown (2.5Y 5/3); 80% medium to coarse, subrounded, quartz sand; 10% low plasticity silt; 5% subangular gravel (dia. = 0.5"); trace subrounded cobbles; saturated		Continuous core from 40 feet to toatal depth Clasts and cobbles at 44 feet
45				75	1515					SW	Well graded SAND (SW); olive yellow (2.5Y 6/6); 95% fine to coarse, subrounded, quartz sand; 5% subagular gravel, dia. = 0.5"		
50				30	1525						Well graded SAND (SW); yellow (2.5Y 3/8); 95% fine to coarse, subangular, quartz sand; trace angular gravel (up to 1"); loose; FeO staining; saturated		
55				20	1550					WBr	BEDROCK - SANDSTONE; light gray (5Y 7/1); 95% fine grained quartz/feldspar sand; trace low plasticity silt; dense; weakly cemented; slightly moist; trace FeO oxidation		Hard drilling at 55 feet - Bedrock CH4 = 0% CO2 = 0.1% O2 = 20.5%
60											Total depth = 60 feet		

EAFB Wells\SB\Anomaly Area 2\MCAS El Toro\37380

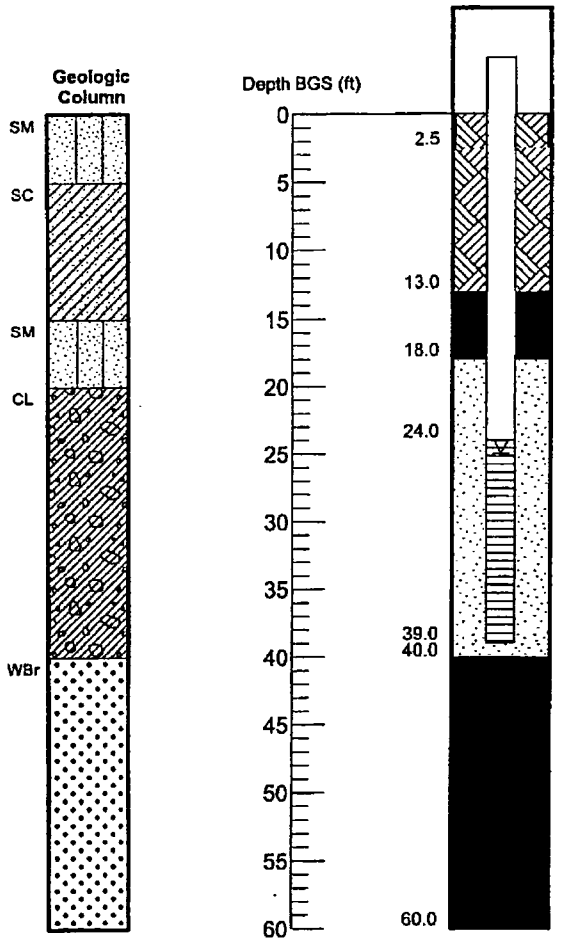
Monitoring Well Construction Log

Project Name: MCAS El Toro	Project Number: 37380	Sheet 1 of 1
Well Location: Anomaly Area 3 Northing: 6117495.47 Easting: 2195227.469	Well Number: AA3-MW12	Well Depth (ft): 40.0
Driller: Steve Huston	Borehole Diameter (in): 10	Depth to Water (ft): Static: Drilling: 25.00
Drilling Agency: Water Development Corp.	Date Started: 2/1/2005	
Drilling Equipment: CME 95	Date Finished: 2/2/2005	Elevation: ft MSL
Drilling Method: Hollow Stem Auger	Logged by: R. Lazo	Checked by: W. McClenney
Drilling Fluid: None	Number of Soil Samples: 0	Date Checked:

Elevation (TOC): 475.87 ft MSL

Stick-up Height: ft

Ground Surface Elevation: ft MSL



PROTECTIVE CASING
Material/Type: Steel vault
Diameter (in): 18
Depth (ft BGS): 2.5

GUARD POSTS
No: 0 Type: NA

SURFACE PAD
Composition and Size: 2'x2' concrete pad

RISER PIPE
Type and Thickness: Sch 40 PVC
Diameter (in): 4"
Total Length (ft TOC to TOS): 27
Ventilated Cap:

GROUT
Composition and Proportions: 95% Portland Cement/ 5% Bentonite chips - 12/2 bags
Tremied:
Interval (ft BGS): 0-13

CENTRALIZERS
Depths (ft): NA

SEAL
Type: Medium Bentoninte Chips - 5 bags
Source: Sinclair
Hydration Time: 30 minutesVol. of Fluid Added: 10 gal
Tremied: Interval (ft BGS): 13-18

FILTER PACK
Type: #2/12 Monterrey Sand
Amount Used: 30
Tremied:
Source: Lapis Lustre, Sinclair
Grain Size Dist.: #2/12 Interval (ft BGS): 18-40

SCREEN
Type and Thickness: Sch 40 PVC slotted
Diameter (in): 4" Slot Size (in): 0.020
Interval (ft BGS): 24-39

WELL FOOT
Interval (ft BGS):

BACKFILL/PLUG
Interval (ft BGS): 40-60 Material: Bentonite chips
Hydration Time: 12 hours

Comments:

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EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: AA3-MW12	
Borehole Location: Anomaly Area 3	*Northing:* 6117495.47	*Easting:* 2195227.469	Sheet *1* of *2*
Drilling Agency: Water Development Corp.		Driller: Steve Huston	
Drilling Equipment: CME 95		Date Started: 2/1/2005	Total Depth (feet): 60.0
Drilling Method: Hollow Stem Auger	Number of Samples: 0	Date Finished: 2/2/2005	Depth to Bedrock (feet): 40
Drilling Fluid: None	Borehole Diameter (in): 10	Depth to Water (feet): *Drilling:* 25.00	*Static:*
Completion Information: Completed as a 4 inch Sch 40 PVC monitoring well		Elevation (feet MSL): *Ground:*	*Top of Casing:* 475.87
		Logged By: R. Lazo	Checked By: W. McClenney

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
					1400					SM	SILTY SAND (SM); dark yellowish brown (10YR 3/3); 85% fine to medium sand; 15% low plasticity silt; loose; moist		0-40 ft bgs, no sampling; lithology from soil cuttings Fill
5					1404					SC	CLAYEY SAND (SC); olive (5Y 4/4); 85% fine sand; 15% medium plasticity clay; loose; moist		No HCl reaction Fill
10					1410	0.0					CLAYEY SAND (SC) as above; trace concrete chips and wire		CH4 = 0.0% CO2 = 0.2% O2 = 20.5% Wire
15					1416	0.0				SM	SILTY SAND (SM) and Concrete Debris (mostly 1 to 3 inch diameter, some 4 to 6 inch diameter; with trace wood; moist		Rebar at 15 ft BZ = DH CH4 = 0.0% CO2 = 0.1% O2 = 20.5
20					1421					CL	GRAVELLY CLAY (CL); dark olive gray (5Y 3/2); 95% medium high plasticity clay; trace subangular gravel (up to 1 inch); soft; very moist		Fill; no HCl reaction
25						0.0					GRAVELLY CLAY (CL); dark olive gray (5Y 3/2); 95% medium to high plasticity clay; trace subangular gravel (up to 1 inch); soft; water saturated		1st water @ 25 ft BZ = DH CH4 = 0.0% CO2 = 0.2% O2 = 20.6%
30													

EAFB_Well\SB\Anomaly Area 3\MCAS El Toro\37380

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: AA3-MW12
Borehole Location:		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
					1430						GRAVELLY CLAY (CL) as above with concrete fragments up to 2 inches		No HCl reaction Fill
35					1445						GRAVELLY CLAY (CL) as above; concrete fragments up to 3 inches		
40				80	1510					WBr	WEATHERED SANDSTONE (WBr); light gray (5Y 7/2); 95% feldspar; trace subangular quartz; moist		Continous coring with 8" auger from 40 ft down to TD Moderate HCl reaction
											SILTSTONE		No HCl reaction at 44 ft
45				90	1533	0.0					WEATHERED SANDSTONE (WBr) as above		BZ = DH CH4 = 0.0% CO2 = 0.1% O2 = 20.5% No HCl reaction
											Grading to slightly moist		Stron HCl reaction
50				90	1543						Grading to moist; some FeO staining		No HCl reaction
											SILTSTONE; fracture zone		Water Zone
											Blackish SANDSTONE		No HCl reaction
											SILTSTONE; olive; massive		No HCl reaction
											SANDSTONE; olive green		No HCL reaction
											SILTSTONE; dark olive		No HCL reaction
55				80	1600						CLAYSTONE/SILSTONE; very dark gray; fine grained; micaceous; thin bedding; white stringers		No HCL reaction; White stringers - moderate HCl reaction
60											Total depth = 60 feet		

EAFB Wells(SB)\Anomaly Area 3\MCAS El Toro\37380

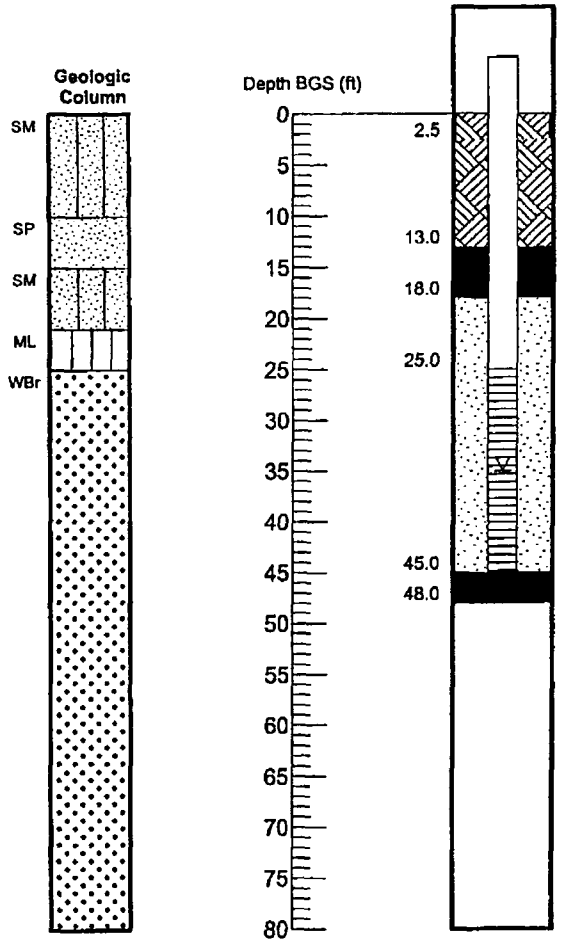
Monitoring Well Construction Log

Project Name: MCAS El Toro	Project Number: 37380	Sheet 1 of 1
Well Location: Anomaly Area 3 Northing: 6117520.993 Easting: 2195487.055	Well Number: AA3-MW13	Well Depth (ft): 48.0
Driller: Steve Huston	Borehole Diameter (in): 10	Depth to Water (ft): Static: Drilling: 35.00
Drilling Agency: Water Development Corp.	Date Started: 2/2/2005	
Drilling Equipment: CME 95	Date Finished: 2/3/2005	Elevation: ft MSL
Drilling Method: Hollow Stem Auger	Logged by: R. Lazo	Checked by: W. McClenney
Drilling Fluid: None	Number of Soil Samples: 0	Date Checked:

Elevation (TOC): 479.39 ft MSL

Stick-up Height: ft

Ground Surface Elevation: ft MSL



PROTECTIVE CASING
Material/Type: Steel vault
Diameter (in): 18
Depth (ft BGS): 2.5

GUARD POSTS
No: 0 Type: NA

SURFACE PAD
Composition and Size: 2'x2' concrete pad

RISER PIPE
Type and Thickness: Sch 40 PVC
Diameter (in): 4"
Total Length (ft TOC to TOS): 28
Ventilated Cap:

GROUT
Composition and Proportions: 95% Portland Cement/ 5% Bentonite chips
Tremied:
Interval (ft BGS): 0-13

CENTRALIZERS
Depths (ft): NA

SEAL
Type: Medium Bentoninte Chips
Source: Sinclair
Hydration Time: 30 minutesVol. of Fluid Added: 10 gal
Tremied: Interval (ft BGS): 13-18

FILTER PACK
Type: #2/12 Monterrey Sand
Amount Used: 20
Tremied:
Source: Lapis Lustre, Sinclair
Grain Size Dist.: #2/12 Interval (ft BGS): 18-45

SCREEN
Type and Thickness: Sch 40 PVC slotted
Diameter (in): 4" Slot Size (in): 0.020
Interval (ft BGS): 25-45

WELL FOOT
Interval (ft BGS):

BACKFILL/PLUG
Interval (ft BGS): 45-48 Material: Bentonite chips
Hydration Time: 12 hours

Comments:

EAFBREMAQ(SB)Anomaly Area 3\MCAS El Toro\37380

EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: AA3-MW13	
Borehole Location: Anomaly Area 3	*Northing:* 6117520.993	*Easting:* 2195487.055	Sheet *1* of *3*
Drilling Agency: Water Development Corp.		Driller: Steve Huston	
Drilling Equipment: CME 95		Date Started: 2/2/2005	Total Depth (feet): 80.0
Drilling Method: Hollow Stem Auger	Number of Samples: 0	Date Finished: 2/3/2005	Depth to Bedrock (feet): 25
Drilling Fluid: None	Borehole Diameter (in): 10	Depth to Water (feet): *Drilling:* 35.00	*Static:*
Completion Information: Completed as a 4 inch Sch 40 PVC monitoring well		Elevation (feet MSL): *Ground:*	*Top of Casing:* 479.39
		Logged By: R. Lazo	Checked By: W. McClenney

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
				80	1325					SM	SILTY SAND (SM); olive brown (2.5Y 4/4); 85% fine to medium sand; 15% low plasticity silt; loose; slightly moist; root zone		Continuous coring from ground surface to total depth
5				90	1332						SILTY SAND (SM); light olive brown (2.5 Y 5/4); grading to 90% fine, subrounded quartz sand; 10% low plasticity silt; loose; slightly moist		CH4 = 0% CO2 = 0.1% O2 = 20.5%
10				50	1345					SP	Poorly Graded SAND (SP); yellowish brown (2.5Y 6/4); 95% fine to medium, subangular, quartz sand; trace subrounded gravel up to 2 inches; trace low plasticity silt; loose; slightly moist		Native alluvium
15				50	1350					SM	SILTY SAND (SM); dark yellowish brown (10YR 4/6); 80% fine, subangular quartz sand; 20% low plasticity silt; moist		
20				75	1357					ML	CLAYEY SILT (ML); dark yelowish brown (10YR 4/6); 20% moderate plasticity clay; trace subrounded quarz gravel; white stains, secondary deposition due to root decay; moist		CH4
25				80	1405					WBr	Moderately WEATHERED SILTSTONE (WBr); light olive brown (2.5Y 5/6); 85% fine sand; 15% nonplastic silt; moderate density; moist		Bedrock
30													

EATB_WellFSB\Anomaly Area 3\MCAS El Toro\37380

EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: AA3-MW13
Borehole Location:		Sheet 2 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
				50	1410						SILSTONE (WBr) as above; grading to moderate to severly weathered; trace FeO staining; increasing moisture		CH4 = 0.0% CO2 = 0.1% O2 = 20.5%
35				60	1421						Modeartely WEATHERED SILTSTONE (WBr); interbedded; light gray (2.5Y 7/2) and olive yellow (2.5Y 6/8); silt; trace FeO staining; moderate density; water saturated		First water at 35 feet
40				20	1430						SILTSTONE (WBr); grading to light olive brown (2.5Y 5/6); water saturated; moderate density		
45				60	1436						SILTSTONE (WBr), interbedded with fine sand; saturated		CH4 = 0.0% CO2 = 0.1% O2 = 20.5%
50				30	1446						SILSTONE (WBr); light olive brown		
55				50	1453						WEATHERED SILTSTONE (WBr) with interbedded sand; light olive brown; saturated; moderate density		
60				20	1510						SILTSTONE (WBr); same as above; color change to pale yellow (5Y 7/4); 85% fien sand; 15% low plasticity silt; saturated; moderate density		CH4 = 0.0% CO2 = 0.2% O2 = 20.4%
65													

EAFB_Weld(99)\Anomaly Area 3\MCAS El Toro\37380

EARTH TECH

Borehole/Well Construction Log
(Continuation Sheet)

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: AA3-MW13
Borehole Location:		Sheet 3 of 3

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
											WEATHERED SILTSTONE (WBr) as above		
70				10	1537						WEATHERED SILTSTONE (WBr) as above		Hard drilling at 70 feet
75				50	1545						WEATHERED SILTSTONE (WBr) as above		Black siltstone on sampler tip
80											Total Depth = 80 feet		

EAFB_Weld/SB\Anomaly Area 3\MCAS El Toro\37380

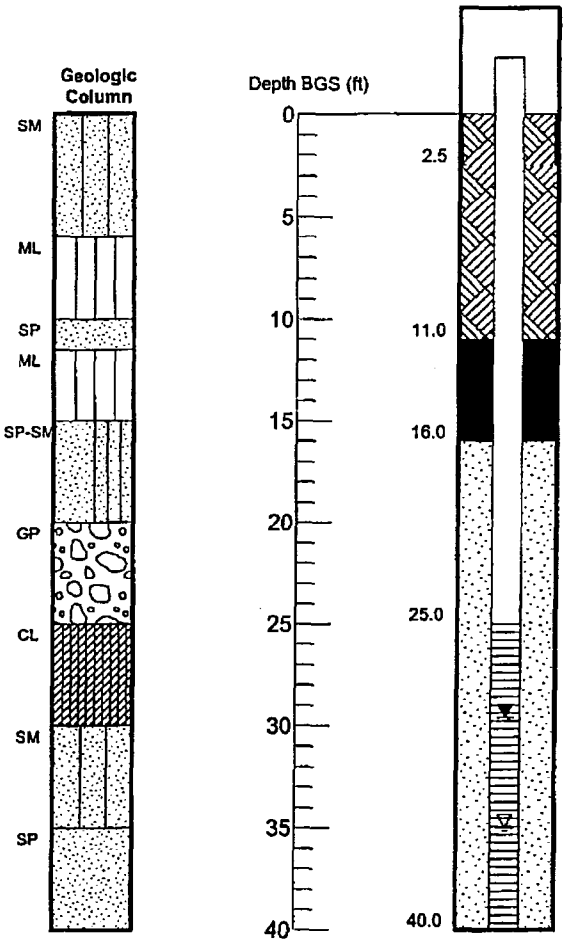
Monitoring Well Construction Log

Project Name: MCAS El Toro	Project Number: 37380	Sheet 1 of 1
Well Location: Anomaly Area 3 Northing: 617203.852 Easting: 2195170.273	Well Number: AA3-MW14	Well Depth (ft): 40.0
Driller: Steve Huston	Borehole Diameter (in): 10	Depth to Water (ft): Static: 29.60 Drilling: 35.00
Drilling Agency: Water Development Corp.	Date Started: 2/4/2005	
Drilling Equipment: CME 95	Date Finished: 2/4/2005	Elevation: ft MSL
Drilling Method: Hollow Stem Auger	Logged by: R. Lazo	Checked by: W. McClenney
Drilling Fluid: None	Number of Soil Samples: 0	Date Checked:

Elevation (TOC): 474.10 ft MSL

Stick-up Height: ft

Ground Surface Elevation: ft MSL



Comments:

PROTECTIVE CASING
Material/Type: Steel vault
Diameter (in): 18
Depth (ft BGS): 2.5

GUARD POSTS
No: 0 Type: NA

SURFACE PAD
Composition and Size: 2'x2' concrete pad

RISER PIPE
Type and Thickness: Sch 40 PVC
Diameter (in): 4"
Total Length (ft TOC to TOS): 28
Ventilated Cap:

GROUT
Composition and Proportions: 95% Portland Cement/ 5% Bentonite chips
Tremied:
Interval (ft BGS): 0-11

CENTRALIZERS
Depths (ft): NA

SEAL
Type: Medium Bentoninte Chips
Source: Sinclair
Hydration Time: 30 minutesVol. of Fluid Added: 20 gal
Tremied: Interval (ft BGS): 11-16

FILTER PACK
Type: #2/12 Monterrey Sand
Amount Used: 11.5 bags
Tremied:
Source: Lapis Lustre, Sinclair
Grain Size Dist.: #2/12 Interval (ft BGS): 16-40

SCREEN
Type and Thickness: Sch 40 PVC slotted
Diameter (in): 4" Slot Size (in): 0.020
Interval (ft BGS): 25-40

WELL FOOT
Interval (ft BGS):

BACKFILL/PLUG
Interval (ft BGS): Material:
Hydration Time:

EAFBREMAG(58)\Anomaly Area 3\MCAS El Toro\37380

EARTH TECH

Borehole/Well Construction Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: AA3-MW14	
Borehole Location: Anomaly Area 3	*Northing:* 617203.852	*Easting:* 2195170.273	Sheet *1* of *2*
Drilling Agency: Water Development Corp.	Driller: Steve Huston		
Drilling Equipment: CME 95	Date Started: 2/4/2005	Total Depth (feet): 40.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 0	Date Finished: 2/4/2005	Depth to Bedrock (feet): NA
Drilling Fluid: None	Borehole Diameter (in): 10	Depth to Water (feet): *Drilling:* 35.00	*Static:* 29.60
Completion Information: Completed as a 4 inch Sch 40 PVC monitoring well		Elevation (feet MSL): *Ground:*	*Top of Casing:* 474.10
		Logged By: R. Lazo	Checked By: W. McClenney

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
				50	0823					SM	SILTY SAND (SM); dark yellowish brown (10YR 3/6); 85% fine to medium, subrounded quartz sand; loose; 15% nonplastic silt; moist		Continuous coring
5				30	0830								Fill
										ML	CLAYEY SILT (ML); olive gray (5Y 5/2); 85% silt; 15% medium plasticity clay; soft; moist		CH4 = 0.0% CO2 = 0.1% O2 = 20.6%
10				90	0838					SP	SILTY SAND (SM); pale olive (5Y 6/3); fine sand; trace nonplastic silt; loose; moist		
										ML	CLAYEY SILT (ML); olive gray (5Y 5/2); moderate plasticity silt and clay; stiff; moist Trace gravel and concrete chips		Trace wood Buried tree at 14 feet
15				50	0845					SP-SM	GRAVELLY SAND with SILT (SP-SM); dark olive gray (5Y 3/2); 85% mdelum sand; 15% subangular gravel; trace concrete fragments; moderate density; slightly moist		Fill
20				50						GP	GRAVEL (GP); black; cemented; asphalt-like; dense; slightly moist		Concrete at 20 feet shows paint/stucco Fill
25				60						CL	SILT CLAY (CL); olive gray; moderate plasticity; trace angular gravel; moderate stiffness; moist		Trace wood at 29 feet
30													

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EARTH TECH

Borehole/Well Construction Log (Continuation Sheet)

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: AA3-MW14
Borehole Location:		Sheet 2 of 2

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analysis: FID (ppm) Sample/Background	Field Analysis: PID (ppm) Sample/Background	Field Analysis: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
				50						SM	SILTY SAND (SM); grayish brown (2.5Y 5/2); 85% fine, subrounded quartz sand; 15% low plasticity silt; trace subrounded gravel up to 3 inches; loose; wet; trace mica		Native alluvium
35				60	0900					SP	Poorly Graded SAND (SP); grayish brown (2.5Y 5/2); fine to medium, subrounded quartz sand; loose; trace mica; saturated		First water at 35 feet
40											Total depth = 40 feet		

EAFB WellMSB\Anomaly Area 3\MCAS El Toro\37380

Appendix A3
Perimeter Gas Monitoring Well Logs

OHM REMEDIATION SERVICES CORP.

LOCATION: MSCR1 - PZ-1

DATE: 10/18/99

BOREHOLE NUMBER: 4 PZ1

SHEET ___ OF 1

Logged by: J JAMISON

Drill Co: [illegible]
Drill Rig Model: CMEES
Method: Hollow Stem
Hole Dia: 4"

TIME	DEPTH	PID/FID HNU OVA (PPM)	BLOWS/ 6 IN PRESSURE (PSI)	RECOVERY	SAMPLE NUMBER	SAMPLE INTERVAL	WELL DETAIL	SOIL/ROCK SYSMBO	GRAPHIC LOG	FIELD SOIL DESCRIPTION
										Hand Auger to 10'
										10YR 5/3 Brown silty sand, subrounded to subangular, dry, micaceous.
1145	10			100%						10YR 5/3 Brown silty sand, subrounded to subangular, dry, micaceous
50	15			100%						10YR 4/3 Brown silty sand, fine, moderate moisture.
1200	20			100%						10YR 4/3 Brown silty sand, moderate moisture, micaceous.
										TD: 22'
										SI: 17-22'
										Filter to 16'
	5									
	0									

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OHM REMEDIATION SERVICES CORP.

LOCATION: [illegible]-2

DATE: 10 97

BOREHOLE NUMBER: [illegible]-2

SHEET ___ OF 2

TIME	DEPTH	PID/FID HNU OVA (PPM)	BLOWS/ 6 IN PRESSURE (PSI)	RECOVERY	SAMPLE NUMBER	SAMPLE INTERVAL	WELL DETAIL	SOIL/ROCK SYSMI	GRAPHIC LOG	FIELD SOIL DESCRIPTION
										Logged by: J. Jamison Drill Rig: CME 85 Method: Hollowstem Hole Dia: 7"
	15		4 7 4							10YR 5/3 brown clean sand, fine to medium, moderate to low moisture
	20		5 11 14							10YR 4/4 Dark yellowish brown clayey sand w/ low plasticity and moderate moisture
	15		10 10 17							10YR 5/3 brown gravelly sand approx 5-10% subangular gravel (3%) angular gravel approx 1/2" to 1" diameter
	20		9 14 15							
	25		10 11 20							10YR 5/3 Brown gravelly sands, fine to coarse sands approx 30% angular to sub-angular gravel
	30		8 10 15							10YR 4/4 Dark yellowish brown gravelly sands, fine to coarse sands approx 10% angular to sub angular brick gravel
										TD 30' SI 25'-30' Water @ 24'
	40									
	50									

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OHM REMEDIATION SERVICES CORP.

LOCATION: PZ-3

DATE:

BOREHOLE NUMBER: PZ3

1 OF 1

Proj # 92C24C
Logged by Jim Jansen

Drill Rig: 31
Drilling Method: Hollow Stem
Hole Diam: 4"

TIME	DEPTH	PID/FID HNU OVA (PPM)	BLOWS/6 IN PRESSURE (PSI)	RECOVERY	SAMPLE NUMBER	SAMPLE INTERVA	WELL DETAIL	SOIL/ROCK SYSMBO	GRAPHIC LOG	FIELD SOIL DESCRIPTION
	5		6 11 12							10YR 5/3 Brown clayey sand, low moisture, low plasticity, micaceous.
	10		10 12 14							10YR 4/3 Brown silty clay, low moisture, low plasticity, micaceous.
	15		9 14 16							10YR 4/3 Brown silty clay, low moisture, low plasticity.
	20		10 14 16				sand			10YR 4/3 Brown gravelly sand wet 30% subangular gravel ranging from 1/4 to 1" in diameter.
							Backfill			
	30									
	40									
	50									

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EARTH TECH

Borehole/Well Constuction Log

Project Name: MCAS EL TORO AA-3	Project Number: 37380	**Borehole Number:**	**PG-01**
Borehole Location: Anomaly Area A-3	*Northing:* 2195391.23	*Easting:* 6117668.36	Sheet *1* of *1*
Drilling Agency: Valley Well Drilling	Driller: Tomas Fernandez		
Drilling Equipment: Mobile Drill B-90	Date Started: 11/7/2002	Total Depth (feet): 25.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 5	Date Finished: 11/7/2002	Depth to Bedrock (feet):
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water: *Drilling (FT BGS):*	*Static (FT TOC):*
Completion Information: Three 1" PVC Gas Wells, screened: 5-7'; 14-16'; 22-25'.		Elevation (feet MSL): *Ground:*	*Top of Casing:* 475.91
		Logged By: R. Lazo	Checked By: Crispin Vanyoike

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
			6 12 18		1025					ML	SANDY SILT WITH GRAVEL (ML); yellowish brown (10YR4/4), low plasticity, very stiff, some angular to subrounded gravel up to 1.5", dry.		2' pipe stick up above ground surface (w/monument casing).
5			15 25 50/4		1035					SM	SILTY SAND (SM); olive-yellow (2.5Y6/8), medium to fine, very dense,		
10			35 35 30		1040					ML	SILT (ML); olive-yellow (2.5Y6/8), hard, with gravelly fragments of silt, non-plastic, moist.		
15			20 21 25		1048					ML	SILT (ML); As above.		
20			18 25 32		1102					SP-SM	POORLY GRADED SAND, SILTY SAND (SP-SM); light olive brown (2.5Y5/4), coarse to fine, very dense with 15% non plastic fines, 5% fine subangular to angular gravel up to 0.5", moist.		Possible contact @ 18'.
			50/4		1115					SP-SM	POORLY GRADED SAND, SILTY SAND (SP-SM); As above, but wet.		No recovery, Silty Sand on tip of sampler.
25											Total Depth = 25.0 feet		

AFB_Well(SB)\Anomaly Area A-3\MCAS EL TORO AA-3\37380

EARTH TECH

Borehole/Well Constuction Log

Project Name: MCAS EL TORO AA-3	Project Number: 37380	Borehole Number: PG-02	
Borehole Location: Anomaly Area A-3	*Northing:* 2195223.12	*Easting:* 6117097.76	Sheet *1* of *1*
Drilling Agency: Valley Well Drilling	Driller: Tomas Fernandez		
Drilling Equipment: Mobile Drill B-90	Date Started: 11/7/2002	Total Depth (feet): 30.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 7	Date Finished: 11/7/2002	Depth to Bedrock (feet):
Drilling Fluid: None	Borehole Diameter (in): 8	Depth to Water: *Drilling (FT BGS):*	*Static (FT TOC):*
Completion Information: Three 1" PVC Gas Wells, screened: 5-7'; 14-16'; 28-30'.		Elevation (feet MSL): *Ground:*	*Top of Casing:* 474.39
		Logged By: R. Lazo	Checked By: Crispin Vanyoike

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Well Construction Diagram	Remarks
			14 35 30		0800					SM	SILTY SAND (SM); yellowish brown (10YR5/4), medium to fine, 15% non plastic fines, very dense, dry to moist.		2' pipe stick up above ground surface (w/monument casing).
			9 12 17		0812					ML	SANDY SILT (ML); pale brown (10YR6/3), medium dense, low plasticity, 10% very fine sand, dry to moist.		
10			7 17 19		0840					SM	SILTY SAND (SM); yellowish brown (10YR5/4), medium to fine, dense, 15% non plastic fines, moist.		
15			15 21 30		0845					SP-SM	POORLY GRADED SAND WITH SILT (SP-SM); medium to coarse, less than 10% non plastic fines, very dense, moist.		
20			10 10 25		0850					SM	SILTY SAND (SM); yellowish brown (10YR5/4); fine, dense, 15% non-plastic fines, moist.		
			16 25 30		0900					SP	POORLY GRADED SAND (SP); yellowish brown (10YR5/8), coarse to fine, with subangular to subrounded gravel up to 3/4 inch, very dense, moist.		2" cobbles prevented full sample recovery.
			50/5		0905					ML	SILT (ML); yellow (10YR7/8); dense, moist.		Total Depth 30'.

EAFB_Well(SB)\Anomaly Area A-3\MCAS EL TORO AA-3\37380

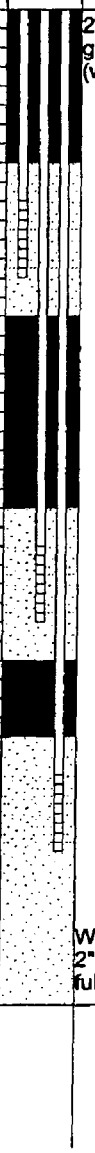
EARTH TECH

Borehole/Well Constuction Log

Project Name: MCAS EL TORO AA-3	Project Number: 37380	Borehole Number: PG-03	
Borehole Location: Anomaly Area A-3	*Northing:* 2194858.25	*Easting:* 6117239.91	Sheet *1* of *1*
Drilling Agency: Valley Well Drilling	Driller: Tomas Fernandez		
Drilling Equipment: Mobile Drill B-90	Date Started: 11/6/2002	Total Depth (feet): 26.0	
Drilling Method: Hollow Stem Auger	Number of Samples: 6	Date Finished: 11/6/2002	Depth to Bedrock (feet):
Drilling Fluid: None	Borehole Diameter (in): 10	Depth to Water: *Drilling (FT BGS):*	*Static (FT TOC):*
Completion Information: Three 1" PVC Gas Wells, screened: 5-7'; 14-16'; 20-22'.		Elevation (feet MSL): *Ground:*	*Top of Casing:* 469.42
		Logged By: C.Wong	Checked By: Crispin Vanyoike

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
			15 14 25	85	1435					ML	SANDY SILT (ML); 35% fine to medium sand, 65% silt, brown, hard, dry, roots.	2' pipe stick up above ground surface (w/monument casing).
5			20 20 25	70	1440					ML	SANDY SILT (ML); As above, brown, moist, white fungal traces.	
10			10 14 15	75	1445					ML	SANDY SILT (ML); 45% fine sand, 55% silt, brown (10YR5/3), very stiff, moist, no odor, trace roots.	
15			16 18 25	70	1450					ML	SANDY SILT (ML); As above, but more silt, 70% silt, 30% fine sand, hard, no odor.	
20			16 30 35	75	1455					ML	SILT (ML); brown (10YR3/4), 80% silt, 20% fine sand, hard.	
										SM	SILTY SAND (SM); light yellowish brown (2.5Y6/4), 80% medium to coarse sand, 20% silt, 5% gravel and cobles, very dense, wet.	
25			22 50/4	25	1510					SM	SILTY SAND (SM); light olive brown (2.5Y5/3), 70% fine to coarse sand, 25% silt, 5% gravel and cobles, very dense, wet.	Water @ 25'. 2" cobbles prevented full sample recovery.
											Total Depth = 26.0 feet	

Well Construction Diagram



FB_Well[SB]\Anomaly Area A-3\MCAS EL TORO AA-3\37380

Appendix A4
Soil/Soil Gas Survey Borehole Logs

EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-01	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2194801.136104	*Easting:* 6116997.017406	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/9/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/9/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* *461.41*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
	LK 017				1340	0.0				SM	SILTY SAND (SM); light olive-brown (2.5Y5/4), 85% medium to fine sand, 15% low plasticity silt, dense/compacted, dry.	2' Soil sample
	LK 018				1400	1.2					Refusal at 8' in monitoring borehole. Move to a new location to collect 15' soil-gas sample.	5' Soil-gas sample: CH4=0.0% CO2=2.6% O2=18.2% LEL=0.0%
10												
	LK 019				1425	1.4						15' Soil-gas sample: CH4=0.0% CO2=6.3% O2=14.7% LEL=0.0%
15											Total Depth = 15.0 feet	
20												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-02	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2194859.287557	*Easting:* 6116942.144253	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/9/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/9/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL) : *Ground:* *462.14*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
	LK 020				1210	0.0				SP	POORLY GRADED SAND; pale yellow (5Y7/3), 100% fine grained sand, dense/compacted, dry, no debris.	2' Soil sample
										SP	POORLY GRADED SAND; As above.	
5	LK 021				1230	5.5						5' Soil-gas sample: CH4=0.0% CO2=3.4% O2=17.1% LEL=0.0%
10												15' Soil-gas sample: CH4=0.0% CO2=0.3% O2=30.0% LEL=0.0%
15	LK 022				1325	18.2					Total Depth = 15.0 feet	
20												
25												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-03	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2194945.493665	*Easting:* 6116889.231762	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/9/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/9/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* *464.17*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
	LK 023				1010	0.0				SM	SILTY SAND (SM); light olive brown (2.5Y5/4), 85% medium to fine sand, 15% low plasticity silt, dry, trace subangular gravel up to 1.5 inches, compacted.	2' Soil sample
										SM	SILTY SAND (SM); As above.	
	LK 024				1030	0.0						5' Soil-gas sample: CH4=0.0% CO2=4.5% O2=16.1% LEL=0.0%
10												
	LK 025				1100	20.0						15' Soil-gas sample: CH4=0.0% CO2=11.8% O2=9.7% LEL=0.0%
15											Total Depth = 15.0 feet	
20												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	**Borehole Number:**	**HA-04**
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195027.446025	*Easting:* 6116867.30293	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/9/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/9/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* *464.87*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
	LK 026				0820	0.0				SM	SILTY SAND (SM); light olive brown (2.5Y5/4), 85% sand, 15% low plasticity silt, loose, trace subangular gravel.	2' Soil sample
5	LK 027				0925	0.0						5' Soil-gas sample: CH4=0.0% CO2=0.0% O2=0.0% LEL=0.0%
10												15' Soil-gas sample: CH4=0.0% CO2=6.6% O2=13.6% LEL=0.0%
15	LK 028				0955	3.0					Total Depth = 15.0 feet	
20												
25												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-05	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2194824.48429	*Easting:* 6117077.743828	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/9/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/9/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* *463.78*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
	LK 029				1445	0.0					POORLY GRADED SAND (SP); light yellowish brown (2.5Y6/4), 95% medium to fine sand, 5% low plasticity silt, loose, dry.	2' Soil sample
	LK 030				1500	0.0						5' Soil-gas sample: CH4=0.0% CO2=0.6% O2=19.7% LEL=0.0%
10												
	LK 031				1525	0.0						15' Soil-gas sample: CH4=0.0% CO2=0.9% O2=19.5% LEL=0.0%
15											Total Depth = 15.0 feet	
20												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-06	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2194911.15745	*Easting:* 6117025.439413	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/9/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/9/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* *464.97*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
	LK 032				1540	0.0				SM	SILTY SAND (SM); light olive brown (2.5Y5/4), 60% fine sand, 40% low plasticity silt, loose, dry.	2' Soil sample
5	LK 033				1600	0.7						5' Soil-gas sample: CH4=0.0% CO2=2.0% O2=18.5% LEL=0.0%
10												15' Soil-gas sample: CH4=0.0% CO2=4.9% O2=17.0% LEL=0.0%
15	LK 034				1700	0.0					Total Depth = 15.0 feet	
20												
25												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-07	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2194994.455743	*Easting:* 6116974.70844	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/10/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/10/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* *465.98*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
	LK 035				0800	0.0				SM	SILTY SAND (SM); light olive brown (2.5Y5/4), 60% fine sand, 40% low plasticity silt, compacted, dry.	2' Soil sample
										SC/CLS	CLAYEY SAND TO SANDY CLAY (SC/CLS); greenish olive gray, moderate plasticity, slightly moist, no debris.	
	LK 036				0815	1.8						5' Soil-gas sample: CH4=0.0% CO2=1.3% O2=18.9% LEL=0.0%
10												15' Soil-gas sample: CH4=0.0% CO2=17.0% O2=2.0% LEL=0.0%
	LK 037				0925	1.0						
15											Total Depth = 15.0 feet	
20												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	**Borehole Number:**	**HA-08**
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195085.590049	*Easting:* 6116926.24749	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/10/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/10/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL) : *Ground:* *466.81*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
										SM	SILTY SAND (SM); light olive brown (2.5Y5/4), 60% fine sand, 40% low plasticity silt, dry.	
	LK 038				0945	0.0						2' Soil sample
5	LK 039				0950	0.0						5' Soil-gas sample: CH4=0.0% CO2=1.4% O2=18.4% LEL=0.0%
10												15' Soil-gas sample: CH4=0.0% CO2=4.3% O2=14.9% LEL=0.0%
15	LK 040				1057	3.1						
											Total Depth = 15.0 feet	
20												
25												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-09	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2194876.134784	*Easting:* 6117161.995472	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/10/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/10/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* *466.37*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
	LK 041				1550	0.0				SP	POORLY GRADED SAND (SP); pale yellow (2.5Y7/3), 95% medium to fine sand, 5% low plasticity silt, loose, dry.	2' Soil sample
	LK 042				1600	0.0						5' Soil-gas sample: CH4=0.0% CO2=0.0% O2=20.3% LEL=0.0%
10												15' Soil-gas sample: CH4=0.0% CO2=1.9% O2=18.5% LEL=0.0%
15	LK 043				1612	0.0					Total Depth = 15.0 feet	
20												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	**Borehole Number:**	**HA-10**
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2194961.776858	*Easting:* 6117112.493148	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/10/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/10/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL) : *Ground:* *467.25*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
	LK 044				1445	0.0				SM	SILTY SAND (SM); light olive brown (2.5Y5/4), 60% fine sand, 40% low plasticity silt, trace subangular gravel up to 2 inches, no debris.	2' Soil sample
										SM	SILTY SAND (SM); As above.	
5	LK 045				1510	0.0						5' Soil-gas sample: CH4=0.0% CO2=0.9% O2=19.4% LEL=0.0%
10												15' Soil-gas sample: CH4=0.0% CO2=30.7% O2=2.8% LEL=0.0%
15	LK 046				1520	17.0					Total Depth = 15.0 feet	
20												
25												

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EARTH TECH

Borehole Log

Facility Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-11	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195049.015585	*Easting:* 6117059.854151	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/10/2002	Total Depth (ft bgs): 25.0	
Drilling Method: Direct Push	Number of Samples: 4	Date Finished: 10/10/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* *468.04*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
										SM	SILTY SAND (SM); light olive brown (2.5Y5/4), 60% fine sand, 40% low plasticity silt, trace subangular gravel up to 1.5 inches, dry.	
	LK 047				1135	0.0						2' Soil sample
	LK 048				1140	6.0						5' Soil-gas sample: CH4=0.0% CO2=1.0% O2=19.4% LEL=0.0%
10												
15	LK 049				1150	>2000						15' Soil-gas sample: CH4=1.4% CO2=27.1% O2=1.8% LEL=28.0%
20												
	LK 29				1415	350						25' Soil-gas sample: CH4=0.1% CO2=1.8% O2=18.7% LEL=0.0%
											Total Depth = 25.0 feet	

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-12	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195138.539485	*Easting:* 6117066.138621	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/11/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 5	Date Finished: 10/11/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL) : *Ground:* *469.17*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
	LK 050				1025	0.0				SM	SILTY SAND (SM); light yellowish brown (2.5Y6/3), 85% fine sand, 15% low plasticity silt,loose, dry.	
	LK 117				1030	0.0				ML	SILT TO SILTY SAND (ML/SM); brown (10YR4/3), low plasticity silt, slightly moist, no debris.	2' Soil sample Collect duplicate soil sample
5	LK 051				1045	0.0						5' Soil-gas sample: CH4=0.0% CO2=3.2% O2=16.7% LEL=0.0%
10	LK 052											15' Soil-gas sample: CH4=0.0% CO2=9.1% O2=5.7% LEL=0.0%
	LK 121				1050 1052	0.0 0.0						Collect duplicate soil-gas sample.
15											Total Depth = 15.0 feet	
20												
25												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-13	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2194939.745019	*Easting:* 6117236.8487	Sheet 1 of 1
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/10/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 5	Date Finished: 10/10/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.		Elevation (feet MSL): *Ground:* 467.36	*Top of Casing:*
		Logged By: Rod Lazo	Checked By: C.Wanyoike

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
	LK 053				1635	0.0				SM	SILTY SAND (SM); light brown (2.5Y5/6), 60% fine sand, 40% low plasticity silt, loose, slightly moist.	2' Soil sample
	LK 116				1640	0.0						Collect duplicate soil sample
	LK 054				1700	0.0						5' Soil-gas sample: CH4=0.0% CO2=0.9% O2=19.3% LEL=0.0%
10												15' Soil-gas sample: CH4=0.0% CO2=9.5% O2=10.9% LEL=0.0%
	LK 055											
	LK 120				1707 1710	0.0 0.0						Collect duplicate soil-gas sample
15											Total Depth = 15.0 feet	
20												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-14	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195012.406251	*Easting:* 6117197.851707	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/11/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/11/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL) : *Ground:* *469.19*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
	LK 056				0750	0.0				SM	SILTY SAND (SM); olive brown (2.5Y4/4), 60% fine sand, 40% low plasticity silt, trace subangular gravel up to 2 inches, moderately compacted, dry.	2' Soil sample
5	LK 057				0815	0.0						5' Soil-gas sample: CH4=0.0% CO2=0.0% O2=20.6% LEL=0.0%
10												15' Soil-gas sample: CH4=15.7% CO2=32.0% O2=0.6% LEL=316.0%
	LK 058				0825	>2000						
15											Total Depth = 15.0 feet	
20												
25												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-15	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195098.351752	*Easting:* 6117147.93891	Sheet 1 of 1
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/11/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/11/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* 470.23	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
	LK 059				0915	0.0				SM	SILTY SAND (SM); olive brown (2.5Y4/4), 60% fine sand, 40% low plasticity silt, dry.	2' Soil sample
										SM	SILTY SAND (SM); As above, but slightly moist.	
	LK 060				0945	4.2						5' Soil-gas sample: CH4=0.0% CO2=0.1% O2=20.3% LEL=0.0% / 4.2%
10												15' Soil-gas sample: CH4=0.0% CO2=0.0% O2=20.5% / 20.6% LEL=0.0% / 20.0%
	LK 061				1000	20.0						
15											Total Depth = 15.0 feet	
20												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-16	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2194974.412673	*Easting:* 6117334.30625	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/11/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/11/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* *468.26*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
										SM	SILTY SAND (SM); light olive brown (2.5Y5/4), 85% fine sand, 15% low plasticity silt, dry.	
	LK 062				1445	0.0						2' Soil sample
5	LK 063				1505	0.0						5' Soil-gas sample: CH4=0.0% CO2=0.4% O2=19.0% LEL=0.0%
10												15' Soil-gas sample: CH4=0.0% CO2=7.7% O2=12.5% LEL=0.0%
	LK 064				1512	2.0						
15											Total Depth = 15.0 feet	
20												
25												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-17	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195063.274182	*Easting:* 6117284.180591	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/11/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/11/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* *470.56*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
	LK 065				1400	0.0				SM	SILTY SAND (SP); light olive brown (2.5Y5/4), 60% fine sand, 40% low plasticity silt, medium dense, dry.	2' Soil sample
										MLS/SM	SANDY SILT TO SILTY SAND (MLS/SM); brown (10YR4/3), low plasticity silt, with fine sand, slightly moist, no debris.	
	LK 066				1420	0.0						5' Soil-gas sample: CH4=0.0% CO2=0.5% O2=20.1% LEL=0.0%
10												15' Soil-gas sample: CH4=0.0% CO2=0.0% O2=20.7% LEL=0.0%
	LK 067				1430	12.0						
15											Total Depth = 15.0 feet	
20												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-18	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195149.301082	*Easting:* 6117234.237239	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/11/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 4	Date Finished: 10/11/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL) : *Ground:* *471.27*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
										SM	SILTY SAND (SM); light olive brown (2.5Y5/3), 60% fine sand, 40% low plasticity silt, dry.	
	LK 068				1250	0.0						2' Soil sample
5	LK 069				1320	0.0						5' Soil-gas sample: CH4=0.0% CO2=16.3% O2=2.9% LEL=0.0%
10	LK 070				1340	>2000						15' Soil-gas sample: CH4=23.0% CO2=37.8% O2=0.3% LEL=460.0%
15	LK 122				1345	>2000						Collect duplicate soil-gas sample
											Total Depth = 15.0 feet	
20												
25												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-19	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195237.030364	*Easting:* 6117185.107831	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/11/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/11/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* *473.70*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
										SM	SILTY SAND (SM); light olive brown (2.5Y5/6), 85% fine sand, 15% low plasticity silt, loose.	
	LK 071				1110	0.0						2' Soil sample
	LK 072				1130	0.0						5' Soil-gas sample: CH4=0.0% CO2=0.8% O2=19.4% LEL=0.0%
10											Refusal at 8' in monitoring borehole. Move to a new location to collect 15' soil-gas sample.	
	LK 073				1137	6.9						15' Soil-gas sample: CH4=0.0% CO2=7.5% O2=12.0% LEL=6.9%
15											Total Depth = 15.0 feet	
20												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-20	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195027.82	*Easting:* 6117420.73	Sheet 1 of 1
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/14/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/14/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* 0.00	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
	LK 074				0800	0.0				SM	SILTY SAND (SM); light yellowish brown (2.5Y6/3), 85% fine sand, 15% low plasticity silt, loose, trace gravel, dry.	2' Soil sample
										SP	POORLY GRADED SAND (SP); light yellowish brown (10YR6/4), medium to fine sand with low plasticity silt, slightly moist, no debris.	
5	LK 075				0810	1.4						5' Soil-gas sample: CH4=0.0% CO2=2.4% O2=17.3% LEL=0.0%
10												15' Soil-gas sample: CH4=0.0% CO2=3.9% O2=15.3% LEL=0.0%
15	LK 076				0819	13.0						
											Total Depth = 15.0 feet	
20												
25												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-21	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195113.491137	*Easting:* 6117366.756024	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/14/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/14/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* *471.91*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
										SM	SILTY SAND (SM); olive brown (2.5Y4/4), 60% fine sand, 40% medium plasticity silt, compacted, slightly moist.	
	LK 077				0850	0.0						2' Soil sample
	LK 078				0922	0.0						5' Soil-gas sample: CH4=0.0% CO2=3.2% O2=13.7% LEL=0.0%
10											Refusal at 12'. Move to a new location to collect 15' soil-gas sample.	15' Soil-gas sample: CH4=13.3% CO2=14.2% O2=0.7% LEL=268.0%
	LK 079				0955	>2000						
15											Total Depth = 15.0 feet	
20												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-22	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195200.77304	*Easting:* 6117319.823982	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/14/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/14/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* *473.47*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
	LK 080				1020	0.0				SM	SILTY SAND (SM); light olive brown (2.5Y5/4), 85% fine sand, 15% low plasticity silt, medium compacted, dry.	2' Soil sample
										MLS	SANDY SILT (MLS); light olive brown (2.5Y5/4), non-plastic silt, slightly moist, no debris.	
5	LK 081				1035	0.0						5' Soil-gas sample: CH4=0.0% CO2=1.9% O2=18.4% LEL=0.0%
											Refusal at 8'. Move to a new location to collect 15' soil-gas sample.	
10												15' Soil-gas sample: CH4=0.0% CO2=8.3% O2=0.4% LEL=0.0%
	LK 082				1105	0.0						
15											Total Depth = 15.0 feet	
20												
25												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-23	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195286.958889	*Easting:* 6117268.53952	Sheet 1 of 1
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/14/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 4	Date Finished: 10/14/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* 474.89	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
										SM	SILTY SAND (SM); light olive brown (2.5Y5/4), 85% fine sand, 15% low plasticity silt, dry.	
	LK 083				1120	0.0						2' Soil sample
	LK 084				1130	0.0						5' Soil-gas sample: CH4=0.0% CO2=2.4% O2=18.0% LEL=0.0%
10												
	LK 085				1145	0.0						15' Soil-gas sample: CH4=0.0% CO2=9.9% O2=5.6% LEL=0.0%
	LK 123				1147	0.0						Collect duplicate soil-gas sample
15											Total Depth = 15.0 feet	
20												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-24	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195078.653503	*Easting:* 6117508.45613	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/14/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/14/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* *470.61*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
	LK 086				1645	0.0				SM	SILTY SAND (SM); yellowish brown (10YR5/4), 60% fine sand, 40% low plasticity silt, moderately compacted, dry.	2' Soil sample
5	LK 087				1655	0.0						5' Soil-gas sample: CH4=0.0% CO2=0.3% O2=18.6% LEL=0.0%
10												15' Soil-gas sample: CH4=0.0% CO2=6.4% O2=11.5% LEL=0.0%
	LK 088				1700	0.0						
15											Total Depth = 15.0 feet	
20												
25												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-25	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195157.577113	*Easting:* 6117450.879087	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/14/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 4	Date Finished: 10/14/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* *471.76*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
	LK 089				1425	0.0				SM	SILTY SAND (SM); yellowish brown (10YR5/4), 60% fine sand, 40% low plasticity silt, compacted, dry.	2' Soil sample
										SM	SANDY SILT TO SILTY SAND (MLS/SM); light yellowish brown (2.5Y6/3).	
	LK 090				1450	0.0						5' Soil-gas sample: CH4=0.0% CO2=0.1% O2=20.3% LEL=0.0%
											Refusal at 8'. Move to a new location to collect 15' soil-gas sample.	
10												15' Soil-gas sample: CH4=1.0% CO2=4.4% O2=0.3% LEL=20.0%
	LK 091				1615	980						
	LK 125				1617	980						Collect duplicate soil-gas sample
15											Total Depth = 15.0 feet	
20												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-26	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195250.479553	*Easting:* 6117405.425834	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/14/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 5	Date Finished: 10/14/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* *474.38*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
	LK 092				1340	0.0				SP	POORLY GRADED SAND (SP); yellow (2.5Y7/6), loose, 95% medium to fine sand, 5% low plasticity silt, dry.	
	LK 118				1335	0.0						2' Soil sample Collect duplicate soil sample
5	LK 093				1345	0.9						5' Soil-gas sample: CH4=0.0% CO2=6.8% O2=13.8% LEL=0.0%
10												
	LK 094				1355 1400	800 800						15' Soil-gas sample: CH4=0.6% CO2=1.9% O2=0.3% LEL=12.0% Collect duplicate soil-gas sample
	LK 138											
15											Total Depth = 15.0 feet	
20												
25												

FB_Bore(SB)\MCAS El Toro AA - 3\MCAS El Toro\37380

EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-27	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195336.41379	*Easting:* 6117353.554747	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/14/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 4	Date Finished: 10/14/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* 475.82	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
	LK 095				1245	0.0				SM	SILTY SAND (SM); dark yellowish brown (10YR4/4), 60% finie sand, 40% low plasticity silt; compacted, dry.	2' Soil sample
										SM	SILTY SAND (SM); brown (10Y4/3), low plasticity silt, slightly moist, no debris.	
	LK 096				1305	0.0						5' Soil-gas sample: CH4=0.0% CO2=8.5% O2=10.9% LEL=0.0%
10												
	LK 097				1310	1460						15' Soil-gas sample: CH4=0.0% CO2=4.9% O2=11.1% LEL=0.0%
					1312	1460						
	LK 124											Collect duplicate soil-gas sample
15											Total Depth = 15.0 feet	
20												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-28	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195130.010726	*Easting:* 6117593.059268	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/15/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/15/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* *472.20*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
	LK 098				0805	0.0				SM	SILTY SAND (SM); light olive brown (2.5Y5/4), 60% fine sand, 40% low plasticity silt, trace subangular gravel up to 2 inches, dry.	2' Soil sample
										ML	SILT (ML); light yellowish brown (2.5Y6/3), medium plasticity, slightly moist, no debris.	
5	LK 099				0512	0.0						5' Soil-gas sample: CH4=0.0% CO2=5.9% O2=13.4% LEL=0.0%
10												15' Soil-gas sample: CH4=0.0% CO2=0.0% O2=19.1% LEL=0.0%
15	LK 100				0820	250						
											Total Depth = 15.0 feet	
20												
25												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-29	
Borehole Location: MCAS El Toro AA - 3.	*Northing:*	*Easting:*	Sheet *1* of *1*
Drilling Agency: Fugro Environmental		Driller: Daniel Garza/Marlon Moore	
Drilling Equipment: Geoprobe GEO-3		Date Started: 10/15/2002	Total Depth (ft bgs): 15.0
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/15/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.		Elevation (feet MSL): *Ground:*	*Top of Casing:*
		Logged By: Rod Lazo	Checked By: C.Wanyoike

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
	LK 101				0835	0.0				SP	POORLY GRADED SAND (SP): olive yellow (2.5Y6/6), 95% medium to fine sand, 5% low plasticity silt; dry.	2' Soil sample
	LK 102				0850	0.0						5' Soil-gas sample: CH4=0.0% CO2=6.3% O2=14.3% LEL=0.0%
10												15' Soil-gas sample: CH4=0.6% CO2=11.6% O2=0.4% LEL=12.0%
	LK 103				0900	680						
15											Total Depth = 15.0 feet	
20												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-30	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195301.64	*Easting:* 6117491.57	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/15/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/15/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL) : *Ground:* *0.00*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
	LK 104				0920	0.0				SP	POORLY GRADED SAND (SP); light yellowish brown (10YR6/4), 95% fine grained sand, 5% low plasticity silt; moderately compacted, dry.	2' Soil sample
										MLS	SANDY SILT (MLS); light yellowish brown (2.5Y6/3), medium plasticity silt with medium to fine sand, slightly moist, no debris.	
5	LK 105				0930	0.0						5' Soil-gas sample: CH4=0.0% CO2=5.4% O2=14.8% LEL=0.0%
10												15' Soil-gas sample: CH4=0.8% CO2=5.9% O2=1.9% LEL=16.0%
	LK 106				0938	>2000						
15											Total Depth = 15.0 feet	
20												
25												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-31	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195387.076487	*Easting:* 6117441.589264	Sheet 1 of 1
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/15/2002	Total Depth (ft bgs): 12.0	
Drilling Method: Direct Push	Number of Samples: 4	Date Finished: 10/15/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* 476.96	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
	LK 107				1000	0.0				SM	SILTY SAND (SM); light yellowish brown (2.5Y6/4), 85% fine sand, 15% low plasticity silt; compacted, dry.	2' Soil sample
	LK 108				1012	0.0					Refusal at 5'. Move to a new location to collect 5' soil-gas sample.	5' Soil-gas sample: CH4=0.0% CO2=1.6% O2=15.9% LEL=0.0%
10	LK 109				1045	0.0					Refusal at 9'. Move to a new location to collect 15' soil-gas sample.	12' Soil-gas sample: CH4=0.0% CO2=11.1% O2=5.3% LEL=0.0%
	LK 126				1047	0.0					Refusal at 10'. Move to a new location to collect 15' soil-gas sample. Refusal at 12'. Collect 12' soil-gas sample.	Collect duplicate soil-gas sample
											Total Depth = 12.0 feet	
15												
20												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	**Borehole Number:**	**HA-32**
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195266.24752	*Easting:* 6117627.39018	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/15/2002	Total Depth (ft bgs): 15.0	
Drilling Method: Direct Push	Number of Samples: 3	Date Finished: 10/15/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL) : *Ground:* *473.59*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Samples: Type	Samples: Blow Count	Samples: Percent Recovery	Samples: Time	Field Analyses: FID (ppm) Sample/Background	Field Analyses: PID (ppm) Sample/Background	Field Analyses: Additional Tests	Log: Graphic	Log: USCS or Rock Type	Lithologic Description	Remarks
	LK 110				1305	0.0				SM	SILTY SAND (SM); light olive brown (2.5Y5/4), 60% medium to fine sand, 40% low plasticity silt; loose, dry.	2' Soil sample
5	LK 111				1315	0.5						5' Soil-gas sample: CH4=0.0% CO2=7.9% O2=13.4% LEL=0.0%
10												15' Soil-gas sample: CH4=0.0% CO2=19.9% O2=1.8% LEL=0.0%
	LK 112				1330	0.0						
15											Total Depth = 15.0 feet	
20												
25												

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EARTH TECH

Borehole Log

Project Name: MCAS El Toro	Project Number: 37380	Borehole Number: HA-33	
Borehole Location: MCAS El Toro AA - 3.	*Northing:* 2195349.070898	*Easting:* 6117573.761066	Sheet *1* of *1*
Drilling Agency: Fugro Environmental	Driller: Daniel Garza/Marlon Moore		
Drilling Equipment: Geoprobe GEO-3	Date Started: 10/15/2002	Total Depth (ft bgs): 15.0	
Drilling Method: *Direct Push*	Number of Samples: 5	Date Finished: 10/15/2002	Depth to Bedrock (ft bgs):
Drilling Fluid: None	Borehole Diameter (in): 2	Depth to Water (feet): *Drilling:*	*Static:*
Completion Information: Direct push hole was backfilled with bentonite.	Elevation (feet MSL): *Ground:* *474.38*	*Top of Casing:*	
	Logged By: Rod Lazo	Checked By: C.Wanyoike	

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: FID (ppm) Sample/Background	PID (ppm) Sample/Background	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
	LK 113				1110	0.0				SM	SILTY SAND (SM); light olive brown (2.5Y5/4), 85% fine grained sand, 15% low plasticity silt, moderately compacted, dry.	
	LK 119				1115	0.0						2' Soil sample Collect duplicate soil sample.
	LK 114				1133	0.0						5' Soil-gas sample: CH4=0.0% CO2=4.5% O2=15.7% LEL=0.0%
10												
	LK 115				1140	7.0						15' Soil-gas sample: CH4=0.0% CO2=8.6% O2=11.3% LEL=0.0% Collect duplicate soil-gas sample
	LK 127				1142	7.0						
15											*Total Depth = 15.0 feet*	
20												

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Appendix A5
Photographs of Continuous Cores – MW11 through MW14 and BH01

Continuous Core Sample from AA3-MW11
Depth of Drilling - 40 to 50 feet bgs

Continuous Core Sample from AA3-MW11
Depth of Drilling - 50 to 60 feet bgs

Continuous Core Sample from AA3-MW12
Depth of Drilling - 0 to 25 feet bgs

Continuous Core Sample from AA3-MW12
Depth of Drilling - 25 to 45 feet bgs

Continuous Core Sample from AA3-MW12
Depth of Drilling - 45 to 55 feet bgs

Continuous Core Sample from AA3-MW12
Depth of Drilling - 55 to 60 feet bgs

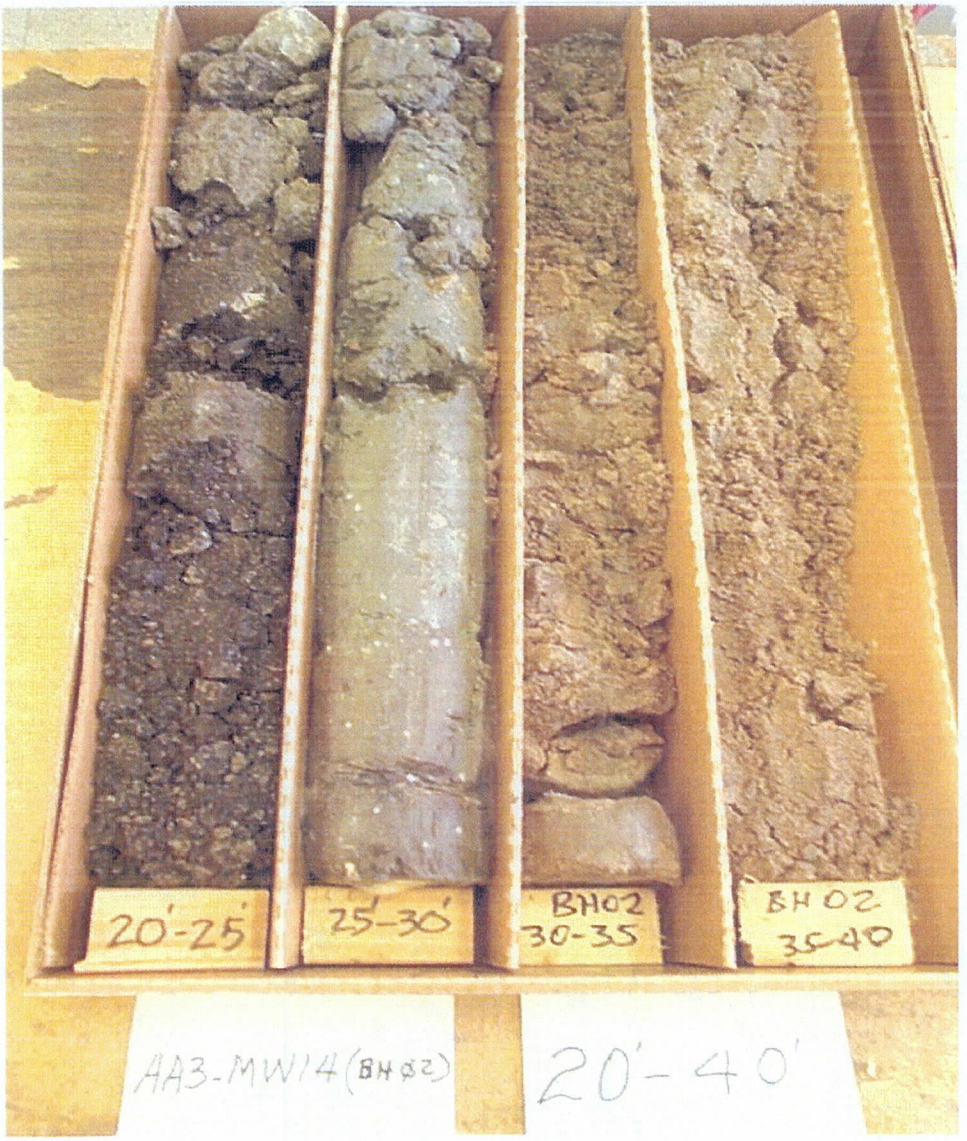
Continuous Core Sample from AA3-MW13
Depth of Drilling – 0 to 25 feet bgs

Continuous Core Sample from AA3-MW13
Depth of Drilling – 25 to 45 feet bgs

Continuous Core Sample from AA3-MW13
Depth of Drilling – 45 to 70 feet bgs

Continuous Core Sample from AA3-MW13
Depth of Drilling – 70 to 80 feet bgs

Continuous Core Sample from AA3-MW14 (AA3-BH02)
Depth of Drilling - 0 to 20 feet bgs



Continuous Core Sample from AA3-MW14 (AA3-BH02)
Depth of Drilling - 20 to 40 feet bgs

Continuous Core Sample from AA3-BH01
Depth of Drilling - 0 to 20 feet bgs

Continuous Core Sample from AA3-BH01
Depth of Drilling - 20 to 35 feet bgs

Appendix B
Sampling Information

Appendix B1
Air Sampling Information

Table D-1: Details of Ambient Air Sampling – RSE Investigation

Batch #	Location	Location Based on Wind Pattern	EPA ID	Earth Tech ID	Date of Start	Time Started	Time Stopped	Initial Pressure (psi)	Final Pressure (psi)
1	A1- NE corner	Upwind	LK001	AA 3-A1SG-S01-D000	10/8/2002	18:45	6:39	28.2	6.5
	A2 - Center	Downwind	LK002	AA 3-A2SG-S01-D000	10/8/2002	18:52	6:42	27	6.5
	A3 - SW corner	Downwind	LK003	AA 3-A3SG-S01-D000	10/8/2002	18:56	6:46	29	6.5
		Downwind	LK004	AA 3-A3SG-D02-D000	10/8/2002	18:56	6:46	27	0
2	A1 - NE corner	Downwind	LK014	AA 3-A1SG-S02-D000	10/9/2002	7:30	18:30	Unknown*	5
	A2 - Center	Downwind	LK015	AA 3-A2SG-S02-D000	10/9/2002	7:14	18:40	28.5	7.5
	A3 - SW corner	Upwind	LK016	AA 3-A3SG-S03-D000	10/9/2002	7:07	18:35	25.5	5.5

NOTES:

Even though the canister was adequately pressurized, the gauge reading was not indicating appropriate pressure reading due to malfunction, therefore, the initial pressure reading could not recorded.

psi = pounds per square inch

Table D-2: Ambient Air Sample Analytical Results- RSE Investigation

Parameter	Sample ID:	LK001	LK002	LK003	LK004	LK014	LK015	LK016
	Location ID:	AA3-A01	AA3-A02	AA3-A03	AA3-A03	AA3-A01	AA3-A02	AA3-A03
	Sample Type:	Regular	Regular	Regular	Duplicate	Regular	Regular	Regular
	Sample Date:	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002
VOCs (EPA Method TO-14)	Units							
1,1,1-Trichloroethane	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
1,1,2,2-Tetrachloroethane	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
1,1,2-Trichloroethane	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
1,1-Dichloroethane	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
1,1-Dichloroethene	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
1,2,4-Trichlorobenzene	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.6 U	3.6 U
1,2,4-Trimethylbenzene	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
1,2-Dibromoethane (EDB)	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
1,2-Dichlorobenzene	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
1,2-Dichloroethane	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
1,2-Dichloropropane	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
1,3,5-Trimethylbenzene	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
1,3-Butadiene	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.6 U	3.6 U
1,3-Dichlorobenzene	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
1,4-Dichlorobenzene	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
1,4-Dioxane	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.6 U	3.6 U
2-Butanone (Methyl Ethyl Ketone)	ppb_v	3.4 U	3.4 U	3.4 U	6.5	3.4 U	3.6 U	3.6 U
2-Hexanone	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.6 U	3.6 U
2-Propanol	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.6 U	3.6 U
4-Ethyltoluene	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.6 U	3.6 U
4-Methyl-2-pentanone	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.6 U	3.6 U
Acetone	ppb_v	5.8	12	5.7	9.6	7.5	6.2	7.8
alpha-Chlorotoluene	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
Benzene	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
Bromodichloromethane	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.6 U	3.6 U
Bromoform	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.6 U	3.6 U

Table D-2: Ambient Air Sample Analytical Results- RSE Investigation

	Sample ID:	LK001	LK002	LK003	LK004	LK014	LK015	LK016
	Location ID:	AA3-A01	AA3-A02	AA3-A03	AA3-A03	AA3-A01	AA3-A02	AA3-A03
	Sample Type:	Regular	Regular	Regular	Duplicate	Regular	Regular	Regular
Parameter	Sample Date:	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002
Bromomethane	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
Carbon Disulfide	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.6 U	3.6 U
Carbon Tetrachloride	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
Chlorobenzene	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
Chloroethane	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
Chloroform	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
Chloromethane	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 UJ	0.9 UJ	0.9 UJ
cis-1,2-Dichloroethene	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
cis-1,3-Dichloropropene	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
Cyclohexane	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.6 U	3.6 U
Dibromochloromethane	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.6 U	3.6 U
Ethanol	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	5.5	4	5.4
Ethyl Benzene	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
Freon 11	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
Freon 113	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
Freon 114	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
Freon 12	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
Heptane	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.6 U	3.6 U
Hexachlorobutadiene	ppb_v	3.4 UJ	3.4 UJ	3.4 UJ	3.4 UJ	3.4 U	3.6 U	3.6 U
Hexane	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.6 U	3.6 U
m,p-Xylene	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
Methyl tert-Butyl Ether	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.6 U	3.6 U
Methylene Chloride	ppb_v	1.3	1.4	1.1	0.9	0.98	1	1
o-Xylene	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
Propylene	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.6 U	3.6 U
Styrene	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
Tetrachloroethene	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U

Table D-2: Ambient Air Sample Analytical Results- RSE Investigation

Parameter	Sample ID:	LK001	LK002	LK003	LK004	LK014	LK015	LK016
	Location ID:	AA3-A01	AA3-A02	AA3-A03	AA3-A03	AA3-A01	AA3-A02	AA3-A03
	Sample Type:	Regular	Regular	Regular	Duplicate	Regular	Regular	Regular
	Sample Date:	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002
Tetrahydrofuran	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.6 U	3.6 U
Toluene	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.9	0.93	0.9 U
trans-1,2-Dichloroethene	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.6 U	3.6 U
trans-1,3-Dichloropropene	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
Trichloroethene	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
Vinyl Acetate	ppb_v	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.6 U	3.6 U
Vinyl Chloride	ppb_v	0.84 U	0.84 U	0.84 U	0.86 U	0.86 U	0.9 U	0.9 U
Fixed Gases (ASTM D-1946)	Units							
Carbon Dioxide	%	0.045	0.047	0.046	0.047	0.044	0.042	0.043
Carbon Monoxide	%	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0017 U	0.0018 U	0.0018 U
Hydrogen	%	0.017 U	0.017 U	0.017 U	0.017 U	0.017 U	0.018 U	0.018 U
Methane	%	0.00021	0.00020	0.00022	0.00022	0.0002	0.0002	0.00026
Nitrogen	%	78	78	78	78	80	80	80
Oxygen	%	22	22	22	22	20	20	20

NOTES:
ppb_v = parts per billion (volume)
% = percent
VOCs = volatile organic compounds
AA3 = Anomaly Area 3
RSE = Removal Site Evaluation
U = indicates the analyte was not detected at or above the stated limit.
UJ = indicates the analyte was not detected at or above the stated limit. The sample detection limit is an estimated value.

Table D-3: Details of Integrated Air Sampling – RSE Investigation

Grid #	Sampling Date	Starting and Ending Time	Time (mins)	Flame ionization Detector Reading (ppm)	Carbon Dioxide (ppm)	Lower Explosive Limit (%)	Oxygen (%)	Methane (%)	Sample ID	Earth Tech Sample ID	Canister Initial Pressure (psi)	Canister Final Pressure (psi)
1	10/8/2002	13:10	Start	27.3	0	0	20.9	0				
		13:34	24	44	0	0	21	0	LK005	AA 3-IN1SG-S01-D000	28.5	10.7
2	10/8/2002	14:00	Start	0	0	0	—	0				
		14:25	25	4.8	0	0	21.2	0	LK006	AA 3-IN2SG-S01-D000	26.5	12.7
3	10/9/2002	8:20	Start	0	0	0	20.7	0				
		8:45	25	0	0	0	20.9	0	LK007	AA 3-IN3SG-S01-D000	28.7	10.5
4	10/9/2002	9:14	Start	—	—	—	—	—				
		9:39	25						LK008	AA 3-IN4SG-S01-D000	>30	15
5	10/9/2002	10:48	Start	—	—	—	—	—				
		11:13	25	—	—	—	—	—	LK009	AA 3-IN5SG-S01-D000	29.5	10
6	10/9/2002	12:34	Start	—	—	—	—	—				
		12:59	25	—	—	—	—	—	LK010	AA 3-IN6SG-S01-D000	27.6	8.2
7	10/9/2002	13:30	Start	—	—	—	—	—				
		13:55	25	—	—	—	—	—	LK011	AA 3-IN7SG-S01-D000	29.5	11.5
8	10/9/2002	14:10	Start	—	—	—	—	—				
		14:35	25	—	—	—	—	—	LK012	AA 3-IN8SG-S01-D000	27.2	10.8
8	10/9/2002	14:10	Start	—	—	—	—	—				
		14:35	25	—	—	—	—	—	LK013	AA 3-IN8SG-D02-D000	27	10.5

NOTES:
ID = identification
% = percent
psi = pounds per square inch

Table D-4: Integrated Air Sample Analytical Results - RSE Investigation

Parameter	Sample ID:	LK005	LK006	LK007	LK008	LK009	LK010	LK011	LK012	LK013
	Location ID:	AA3-ING01	AA3-ING02	AA3-ING03	AA3-ING04	AA3-ING05	AA3-ING06	AA3-ING07	AA3-ING08	AA3-ING08
	Sample Type:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate
	Sample Date:	10/8/2002	10/8/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002
VOCs (EPA Method TO-14)	Units									
1,1,1-Trichloroethane	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
1,1,2,2-Tetrachloroethane	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
1,1,2-Trichloroethane	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
1,1-Dichloroethane	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
1,1-Dichloroethene	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
1,2,4-Trichlorobenzene	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	4.3 U
1,2,4-Trimethylbenzene	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
1,2-Dibromoethane (EDB)	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
1,2-Dichlorobenzene	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
1,2-Dichloroethane	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
1,2-Dichloropropane	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
1,3,5-Trimethylbenzene	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
1,3-Butadiene	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	4.3 U
1,3-Dichlorobenzene	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
1,4-Dichlorobenzene	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
1,4-Dioxane	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	4.3 U
2-Butanone (Methyl Ethyl Ketone)	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	4.3 U
2-Hexanone	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	4.3 U
2-Propanol	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	6
4-Ethyltoluene	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	4.3 U
4-Methyl-2-pentanone	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	4.3 U
Acetone	ppb_v	16	13	5.3	6.4	8.8	13	10	9.4	10
alpha-Chlorotoluene	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
Benzene	ppb_v	6	6.4	3.7	7	15	43	42	33	25
Bromodichloromethane	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	4.3 U
Bromoform	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	4.3 U
Bromomethane	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
Carbon Disulfide	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	4.3 U
Carbon Tetrachloride	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
Chlorobenzene	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
Chloroethane	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
Chloroform	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U

Table D-4: Integrated Air Sample Analytical Results - RSE Investigation

	Sample ID:	LK005	LK006	LK007	LK008	LK009	LK010	LK011	LK012	LK013
	Location ID:	AA3-ING01	AA3-ING02	AA3-ING03	AA3-ING04	AA3-ING05	AA3-ING06	AA3-ING07	AA3-ING08	AA3-ING08
	Sample Type:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate
Parameter	Sample Date:	10/8/2002	10/8/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002
Chloromethane	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 UJ
cis-1,2-Dichloroethene	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
cis-1,3-Dichloropropene	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
Cyclohexane	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	4.3 U
Dibromochloromethane	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	4.3 U
Ethanol	ppb_v	5.1	6.6	3.8 U	6.6	4.5	7.1	6.2	5.4	12
Ethyl Benzene	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
Freon 11	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
Freon 113	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
Freon 114	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
Freon 12	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
Heptane	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	4.3 U
Hexachlorobutadiene	ppb_v	4.5 UJ	4.3 UJ	3.8 UJ	4.7 UJ	4 UJ	4.2 UJ	4.2 UJ	4.3 UJ	4.3 U
Hexane	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	4.3 U
m,p-Xylene	ppb_v	2.7	1.5	0.96 U	1.2 U	1.8	2.4	1.7	1.6	1.9
Methyl tert-Butyl Ether	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	4.3 U
Methylene Chloride	ppb_v	1.1	1.3	1.2	1.2 U	1	1.4	1.2	1.4	1.1 U
o-Xylene	ppb_v	1.3	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
Propylene	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	4.3 U
Styrene	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
Tetrachloroethene	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
Tetrahydrofuran	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	4.3 U
Toluene	ppb_v	3.6	1.8	0.96 U	1.2 U	2.2	2.7	2.2	1.7	2.5
trans-1,2-Dichloroethene	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	4.3 U
trans-1,3-Dichloropropene	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
Trichloroethene	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
Vinyl Acetate	ppb_v	4.5 U	4.3 U	3.8 U	4.7 U	4 U	4.2 U	4.2 U	4.3 U	4.3 U
Vinyl Chloride	ppb_v	1.1 U	1.1 U	0.96 U	1.2 U	1 U	1.1 U	1.1 U	1.1 U	1.1 U
Fixed Gases (ASTM D-1946)										
Carbon Dioxide	%	0.047	0.046	0.044	0.045	0.048	0.045	0.044	NA	0.042
Carbon Monoxide	%	0.0022 U	0.0022 U	0.0019 U	0.0024 U	0.002 U	0.0021 U	0.0021 U	NA	0.0022 U
Hydrogen	%	0.022 U	0.022 U	0.019 U	0.024 U	0.02 U	0.021 U	0.021 U	NA	0.022 U
Methane	%	0.0003	0.00022 U	0.00025	0.00024 U	0.0002 U	0.00021 U	0.00022	NA	0.00024

Table D-4: Integrated Air Sample Analytical Results - RSE Investigation

	Sample ID:	LK005	LK006	LK007	LK008	LK009	LK010	LK011	LK012	LK013
	Location ID:	AA3-ING01	AA3-ING02	AA3-ING03	AA3-ING04	AA3-ING05	AA3-ING06	AA3-ING07	AA3-ING08	AA3-ING08
	Sample Type:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate
Parameter	Sample Date:	10/8/2002	10/8/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002
Nitrogen	%	78	78	79	79	79	78	78	NA	80
Oxygen	%	22	22	21	21	21	22	22	NA	20

NOTES:

ppb_v = parts per billion (volume)

% = percent

VOCs = volatile organic compounds

AA3 = Anomaly Area 3

RSE = Removal Site Evaluation

U = indicates the analyte was not detected at or above the stated limit.

UJ = indicates the analyte was not detected at or above the stated limit. The sample detection limit is an estimated value.

NA = not analyzed. Due to a laboratory error, the canister containing sample LK012 was inadvertently evacuated prior to final analysis.

Appendix B2
Soil Gas Sampling Information

Table E-1: Details of Shallow Soil Gas Sampling – RSE Investigation

Location ID	Sample ID	Earth Tech ID	Date of Sample Collection	Depth of sample Collection (feet)	Sample Type	Laboratory Type	Analysis Type
HA01	LK018	AA 3-HA01SG-S01-D005'	10/9/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA02	LK021	AA 3-HA02SG-S01-D005'	10/9/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA03	LK024	AA 3-HA03SG-S01-D005'	10/9/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA04	LK027	AA 3-HA04SG-S01-D005'	10/9/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA05	LK030	AA 3-HA05SG-S01-D005'	10/9/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA06	LK033	AA 3-HA06SG-S01-D005'	10/9/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA07	LK036	AA 3-HA07SG-S01-D005'	10/10/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA08	LK039	AA 3-HA08SG-S01-D005'	10/10/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA09	LK042	AA 3-HA09SG-S01-D005'	10/10/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA10	LK045	AA 3-HA10SG-S01-D005'	10/10/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA11	LK048	AA 3-HA11SG-S01-D005'	10/10/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA12	LK051	AA 3-HA12SG-S01-D005'	10/11/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA13	LK054	AA 3-HA13SG-S01-D005'	10/10/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA14	LK057	AA 3-HA14SG-S01-D005'	10/11/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA15	LK060	AA 3-HA15SG-S01-D005'	10/11/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA16	LK063	AA 3-HA16SG-S01-D005'	10/11/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA17	LK066	AA 3-HA17SG-S01-D005'	10/11/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA18	LK069	AA 3-HA18SG-S01-D005'	10/11/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA19	LK072	AA 3-HA19SG-S01-D005'	10/11/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA20	LK075	AA 3-HA20SG-S01-D005'	10/14/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA21	LK078	AA 3-HA21SG-S01-D005'	10/14/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA22	LK081	AA 3-HA22SG-S01-D005'	10/14/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA23	LK084	AA 3-HA23SG-S01-D005'	10/14/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA24	LK087	AA 3-HA24SG-S01-D005'	10/14/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA25	LK090	AA 3-HA25SG-S01-D005'	10/14/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA26	LK093	AA 3-HA26SG-S01-D005'	10/14/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA27	LK096	AA 3-HA27SG-S01-D005'	10/14/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA28	LK099	AA 3-HA28SG-S01-D005'	10/15/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA29	LK102	AA 3-HA29SG-S01-D005'	10/15/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA30	LK105	AA 3-HA30SG-S01-D005'	10/15/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA31	LK108	AA 3-HA31SG-S01-D005'	10/15/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA32	LK111	AA 3-HA32SG-S01-D005'	10/15/2002	5	Regular	Mobile	EPA Method 8260 (VOC)
HA33	LK114	AA 3-HA33SG-S01-D005'	10/15/2002	5	Regular	Mobile	EPA Method 8260 (VOC)

Table E-2: Shallow Soil Gas Survey Sample Analytical Results - RSE Investigation

	Sample ID:	LK018	LK021	LK024	LK027	LK030	LK033	LK036	LK039	LK042	LK045	LK048	LK051	LK054	LK057	LK060	LK063	LK066	LK069	LK072	LK075
	Location ID:	AA3-HA01	AA3-HA02	AA3-HA03	AA3-HA04	AA3-HA05	AA3-HA06	AA3-HA07	AA3-HA08	AA3-HA09	AA3-HA10	AA3-HA11	AA3-HA12	AA3-HA13	AA3-HA14	AA3-HA15	AA3-HA16	AA3-HA17	AA3-HA18	AA3-HA19	AA3-HA20
	Sample Type:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular
	Sample Date:	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/10/2002	10/10/2002	10/10/2002	10/10/2002	10/10/2002	10/11/2002	10/10/2002	10/11/2002	10/11/2002	10/11/2002	10/11/2002	10/11/2002	10/11/2002	10/14/2002
Parameter	Sample Depth:	5'	5'	5'	5'	5'	5'	5'	5'	5'	5'	5'	5'	5'	5'	5'	5'	5'	5'	5'	5'
VOCs (8260B Modified)	Units																				
1,1,1,2-Tetrachloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-trifluoroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-ethoxy-2-methyl propane (ETBE)	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Hexanone	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone (MIBK)	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon tetrachloride	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Choromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Diisopropyl ether (DIPE)	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Hexachlorobutadiene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
meta- and para-Xylenes	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl ether (MTBE)	µg/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methylene chloride	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
ortho-Xylene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Butanol (TBA)	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl chloride	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Fixed Gases (ASTM D-1946)																					
Carbon Dioxide	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Monoxide	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methane	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrogen	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Oxygen	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table E-2: Shallow Soil Gas Survey Sample Analytical Results - RSE Investigation

	Sample ID:	LK078	LK081	LK084	LK087	LK090	LK093	LK096	LK099	LK102	LK105	LK108	LK111	LK114
	Location ID:	AA3-HA21	AA3-HA22	AA3-HA23	AA3-HA24	AA3-HA25	AA3-HA26	AA3-HA27	AA3-HA28	AA3-HA29	AA3-HA30	AA3-HA31	AA3-HA32	AA3-HA33
	Sample Type:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular
	Sample Date:	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002	0/15/2002
Parameter	Sample Depth:	5'	5'	5'	5'	5'	5'	5'	5'	5'	5'	5'	5'	5'
VOCs (8260B Modified)	Units													
1,1,1,2-Tetrachloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-trifluoroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-ethoxy-2-methyl propane (ETBE)	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Hexanone	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone (MIBK)	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon tetrachloride	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Choromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Diisopropyl ether (DIPE)	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Hexachlorobutadiene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
meta- and para-Xylenes	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl ether (MtBE)	µg/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methylene chloride	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
ortho-Xylene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Butanol (TBA)	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl chloride	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Fixed Gases (ASTM D-1946)														
Carbon Dioxide	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Monoxide	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methane	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrogen	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Oxygen	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NOTES:

µg/L = micrograms per liter

% = percent

VOCs = volatile organic compounds

AA3 = Anomaly Area 3

RSE = Removal Site Evaluation

NA = not analyzed; Only 10% of soil gas samples were proposed to be analyzed for fixed gas based on the field screening results of the gas monitor. Since none of the shallow soil gas field screening results showed indication of methane, none were sent to the laboratory.

U = indicates the analyte was not detected at or above the stated limit.

Table E-3: Details of Subsurface Soil Gas Sampling – RSE Investigation

Location ID	Sample ID	Earth Tech ID	Date of Sample Collection	Depth of sample Collection (feet)	Sample Type	Laboratory Type	Analysis Type
HA01	LK019	AA 3-HA01SG-S02-D015'	10/9/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
HA02	LK022	AA 3-HA02SG-S02-D015'	10/9/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
HA03	LK025	AA 3-HA03SG-S02-D015'	10/9/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
HA04	LK028	AA 3-HA04SG-S02-D015'	10/9/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
HA05	LK031	AA 3-HA05SG-S02-D015'	10/9/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
HA06	LK034	AA 3-HA06SG-S02-D015'	10/9/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
HA07	LK037	AA 3-HA07SG-S02-D015'	10/10/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
						Fixed	ASTM D1946 (methane)
HA08	LK040	AA 3-HA08SG-S02-D015'	10/10/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
HA09	LK043	AA 3-HA09SG-S02-D015'	10/10/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
HA10	LK046	AA 3-HA10SG-S02-D015'	10/10/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
HA11	LK049	AA 3-HA11SG-S02-D015'	10/10/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
						Fixed	ASTM D1946 (methane)
	LK129	AA 3-HA11SG-S03-D025'	10/10/2002	25	Regular	Mobile	EPA Method 8260 (VOC)
HA12	LK052	AA 3-HA12SG-S02-D015'	10/11/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
	LK121	AA 3-HA12SG-D03-D015'	10/11/2002	15	Duplicate of LK052	Mobile	EPA Method 8260 (VOC)
HA13	LK055	AA 3-HA13SG-S02-D015'	10/10/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
	LK120	AA 3-HA13SG-D03-D015'	10/10/2002	15	Duplicate of LK055	Mobile	EPA Method 8260 (VOC)
HA14	LK058	AA 3-HA14SG-S02-D015'	10/11/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
HA15	LK061	AA 3-HA15SG-S02-D015'	10/11/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
HA16	LK064	AA 3-HA16SG-S02-D015'	10/11/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
HA17	LK067	AA 3-HA17SG-S02-D015'	10/11/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
HA18	LK070	AA 3-HA18SG-S02-D015'	10/11/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
	LK122	AA 3-HA18SG-D03-D015'	10/11/2002	15	Duplicate of LK070	Mobile	EPA Method 8260 (VOC)
HA19	LK073	AA 3-HA19SG-S02-D015'	10/11/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
HA20	LK076	AA 3-HA20SG-S02-D015'	10/14/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
HA21	LK079	AA 3-HA21SG-S02-D015'	10/14/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
						Fixed	ASTM D1946 (methane)
HA22	LK082	AA 3-HA22SG-S02-D015'	10/14/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
HA23	LK085	AA 3-HA23SG-S02-D015'	10/14/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
	LK123	AA 3-HA23SG-D03-D015'	10/14/2002	15	Duplicate of LK085	Mobile	EPA Method 8260 (VOC)
HA24	LK088	AA 3-HA24SG-S02-D015'	10/14/2002	15	Regular	Mobile	EPA Method 8260 (VOC)

Table E-3: Details of Subsurface Soil Gas Sampling – RSE Investigation

Location ID	Sample ID	Earth Tech ID	Date of Sample Collection	Depth of sample Collection (feet)	Sample Type	Laboratory Type	Analysis Type
HA25	LK091	AA 3-HA25SG-S02-D015'	10/14/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
						Fixed	ASTM D1946 (methane)
	LK125	AA 3-HA25SG-D03-D015'	10/14/2002	15	Duplicate of LK091	Mobile	EPA Method 8260 (VOC)
HA26	LK094	AA 3-HA26SG-S02-D015'	10/14/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
						Fixed	ASTM D1946 (methane)
	LK138	AA 3-HA26SG-S03-D015'	10/14/2002	15	Duplicate of LK094	Fixed	ASTM D1946 (methane)
HA27	LK097	AA 3-HA27SG-S02-D015'	10/14/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
	LK124	AA 3-HA27SG-D03-D015'	10/14/2002	15	Duplicate of LK097	Mobile	EPA Method 8260 (VOC)
HA28	LK100	AA 3-HA28SG-S02-D015'	10/15/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
HA29	LK103	AA 3-HA29SG-S02-D015'	10/15/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
						Fixed	ASTM D1946 (methane)
HA30	LK106	AA 3-HA30SG-S02-D015'	10/15/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
						Fixed	ASTM D1946 (methane)
HA31	LK109	AA 3-HA31SG-S02-D015'	10/15/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
	LK126	AA 3-HA31SG-D03-D015'	10/15/2002	15	Duplicate of LK109	Mobile	EPA Method 8260 (VOC)
HA32	LK112	AA 3-HA32SG-S02-D015'	10/15/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
						Fixed	ASTM D1946 (methane)
HA33	LK115	AA 3-HA33SG-S02-D015'	10/15/2002	15	Regular	Mobile	EPA Method 8260 (VOC)
	LK127	AA 3-HA33SG-D03-D015'	10/15/2002	15	Duplicate of LK115	Mobile	EPA Method 8260 (VOC)

Table E-4: Subsurface Soil Gas Survey Sample Analytical Results - RSE Investigation

Parameter	Sample ID:	LK019	LK022	LK025	LK028	LK031	LK034	LK037	LK040	LK043	LK046	LK049	LK052	LK121	LK055	LK120	LK058	LK061	LK064	LK067	LK070	LK122
	Location ID:	AA3-HA01	AA3-HA02	AA3-HA03	AA3-HA04	AA3-HA05	AA3-HA06	AA3-HA07	AA3-HA08	AA3-HA09	AA3-HA10	AA3-HA11	AA3-HA12	AA3-HA12	AA3-HA13	AA3-HA13	AA3-HA14	AA3-HA15	AA3-HA16	AA3-HA17	AA3-HA18	AA3-HA18
	Sample Type:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular	Duplicate	Regular	Regular	Regular	Regular	Regular	Duplicate
	Sample Date:	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/10/2002	10/10/2002	10/10/2002	10/10/2002	10/10/2002	10/11/2002	10/11/2002	10/10/2002	0/10/2002	10/11/2002	10/11/2002	10/11/2002	10/11/2002	10/11/2002	10/11/2002
	Sample Depth:	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'
VOCs (8260B Modified)	Units																					
1,1,1,2-Tetrachloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-trifluoroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-ethoxy-2-methyl propane (ETBE)	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Hexanone	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone (MIBK)	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon tetrachloride	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Choromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Diisopropyl ether (DIPE)	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Hexachlorobutadiene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
meta- and para-Xylenes	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl ether (MTBE)	µg/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methylene chloride	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
ortho-Xylene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Butanol (TBA)	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl chloride	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Fixed Gases (ASTM D-1946)																						
Carbon Dioxide	%	NA	NA	NA	NA	NA	NA	17	NA	NA	NA	25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Monoxide	%	NA	NA	NA	NA	NA	NA	0.0022	NA	NA	NA	0.001 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methane	%	NA	NA	NA	NA	NA	NA	0.0068	NA	NA	NA	1.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrogen	%	NA	NA	NA	NA	NA	NA	82	NA	NA	NA	70	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Oxygen	%	NA	NA	NA	NA	NA	NA	2.3	NA	NA	NA	3.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table E-4: Subsurface Soil Gas Survey Sample Analytical Results - RSE Investigation

Parameter	Sample ID:	LK073	LK076	LK079	LK082	LK085	LK123	LK088	LK091	LK125	LK094	LK138	LK097	LK100	LK103	LK106	LK109	LK126	LK112	LK115	LK127	LK129
	Location ID:	AA3-HA19	AA3-HA20	AA3-HA21	AA3-HA22	AA3-HA23	AA3-HA23	AA3-HA24	AA3-HA25	AA3-HA25	AA3-HA26	AA3-HA26	AA3-HA27	AA3-HA28	AA3-HA29	AA3-HA30	AA3-HA31	AA3-HA31	AA3-HA32	AA3-HA33	AA3-HA33	AA3-HA11
	Sample Type:	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular	Regular	Duplicate	Regular	Duplicate	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular	Regular	Duplicate	Regular
	Sample Date:	10/11/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002	10/9/2002	0/10/2002
	Sample Depth:	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	15'	25'
VOCs (8260B Modified)	Units																					
1,1,1,2-Tetrachloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-trifluoroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-ethoxy-2-methyl propane (ETBE)	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Hexanone	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone (MIBK)	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon tetrachloride	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Choromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Diisopropyl ether (DIPE)	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Hexachlorobutadiene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
meta- and para-Xylenes	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl ether (MtBE)	µg/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	NA	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methylene chloride	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
ortho-Xylene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Butanol (TBA)	µg/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	NA	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl chloride	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Fixed Gases (ASTM D-1946)																						
Carbon Dioxide	%	NA	NA	13	NA	NA	NA	NA	4.8	NA	1.7	2.9	NA	NA	10	5.5	NA	NA	16	NA	NA	NA
Carbon Monoxide	%	NA	NA	0.001 U	NA	NA	NA	NA	0.001 U	NA	0.001 U	0.001 U	NA	NA	0.001 U	0.001 U	NA	NA	0.001 U	NA	NA	NA
Methane	%	NA	NA	13	NA	NA	NA	NA	1.7	NA	0.56	1.2	NA	NA	1	1.3	NA	NA	0.00083	NA	NA	NA
Nitrogen	%	NA	NA	63	NA	NA	NA	NA	82	NA	77	85	NA	NA	86	89	NA	NA	78	NA	NA	NA
Oxygen	%	NA	NA	1.7	NA	NA	NA	NA	1.5	NA	12	1.4	NA	NA	1.6	3.2	NA	NA	3.9	NA	NA	NA

NOTES:
µg/L = micrograms per liter
% = percent
VOCs = volatile organic compounds
AA3 = Anomaly Area 3
RSE = Removal Site Evaluation
NA = not analyzed; Only 10% of soil gas samples were proposed to be analyzed for fixed gas based on the field screening results of the gas monitor.
Nine subsurface soil gas samples were sent to the laboratory based on the field screening results.
U = indicates the analyte was not detected at or above the stated limit.

November 12, 2002

EST2091

Mr. Christopher Barr
Earth Tech, Inc.
9675 Business Park Avenue
San Diego, California 92131

Subject: Soil Gas Survey Report
CTO 78 – Anomaly Area 3
Former MCAS El Toro
Orange County, California

Dear Mr. Barr:

Environmental Support Technologies, Inc. (EST) is pleased to submit the results of the soil gas survey conducted at former MCAS El Toro, CTO 78 – Anomaly Area 3 in Orange County, California. On October 10, 11, 14, and 15, 2002, EST received soil gas samples in Tedlar™ bags together with chain-of-custody documentation from Earth Tech, Inc. personnel. The soil gas samples were analyzed on-site for a list of fifty-one (51) volatile organic compounds (VOCs) using gas chromatograph/mass spectrometer (GC/MS) analytical methods. The analytical testing was performed in general accordance with EPA Method 8260 as described in U.S. EPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846). The following references and guidance were also applicable:

- Los Angeles Regional Water Quality Control Board (LARWQCB) "Interim Guidance for Active Soil Gas Investigation" dated February 25, 1997.
- Naval Facilities Engineering Service Command (NFESC) "Installation Restoration Chemical Data Quality Manual, Port Hueneme, CA" dated October 1999.

Project quality control criteria for the analyses performed at this site are presented in Appendix A. Factors that may affect the distribution of VOCs in the subsurface are presented in Appendix B. Field analytical reports and chain-of-custody documentation are provided in Appendix C. EST's methods and procedures for the analysis of soil gas samples are provided in Appendix D.

EST appreciates the opportunity to assist Earth Tech, Inc. on this project. Should you have any questions or require additional information, please contact me at (949) 679-9500.

Sincerely,
Environmental Support Technologies, Inc.

Kevin B. Aardahl

Kevin B. Aardahl
Project Manager

360 Goddard • Irvine, California 92618-4601 • (949) 679-9500 • Fax (949) 679-9501

LIMITATIONS AND WARRANTIES

This letter report titled "Soil Gas Survey Report – CTO 78 – Anomaly Area 3 – Former MCAS El Toro, Orange County, California," has been prepared for the exclusive use of Earth Tech, Inc. and assigned interested parties. The report has been prepared in accordance with generally accepted environmental assessment practices. No other warranty, expressed or implied, is made. The information provided in this report is based on measurements performed in specific areas during a specific limited period of time.

Soil gas sample analyses were conducted using gas chromatography/mass spectrometer (GC/MS). Soil gas survey data should be used in conjunction with other site-specific data.

Kevin B. Aardahl
Project Manager

Ragi Abraham
Laboratory Manager

November 12, 2002

APPENDICES

Appendix A

PROJECT QUALITY CONTROL CRITERIA
(Included For Both Earth Tech and EST)

Earth Tech's Project Quality Control Criteria for Soil Vapor/Ambient Air Samples

Analyte	Project Decision Threshold[a]	Reporting Limit Required	Precision (RPD)	Accuracy (%R)[b]	
				MS/MSD	LCS
Volatile Organic Compounds (modified SW8260 or TO-14) (µg/L)					
1,1,1,2-Tetrachloroethane	1	1	20	n.a	75–125
1,1,1-Trichloroethane	1	1	40	n.a	60–140
1,1,2,2-Tetrachloroethane	1	1	20	n.a	75–125
1,1,2-Trichloroethane	1	1	20	n.a	75–125
1,1,2-trichlorofluoroethane (F113)	1	1	20	n.a	75–125
1,1-Dichloroethane	1	1	20	n.a	75–125
1,1-Dichloroethene	1	1	20	n.a	75–125
1,2-dichlorotetrafluoroethane (F114)	1	1	20	n.a	75–125
1,2-Dichloroethane	1	1	40	n.a	60–140
1,2-Dichloropropane	1	1	20	n.a	75–125
2-Butanone (MEK)	1	1	20	n.a	75–125
2-Hexanone	1	1	20	n.a	75–125
4-Methyl-2-Pentanone (MIBK)	1	1	20	n.a	75–125
Acetone	1	1	20	n.a	75–125
Benzene	1	1	20	n.a	75–125
Bromodichloromethane	1	1	20	n.a	75–125
Bromoform	1	1	20	n.a	75–125
Bromomethane	1	1	20	n.a	75–125
Carbon disulfide	1	1	20	n.a	75–125
Carbon Tetrachloride	1	1	20	n.a	75–125
Chlorobenzene	1	1	20	n.a	75–125
Chloroethane	1	1	20	n.a	75–125
Chloroform	1	1	20	n.a	75–125
Chloromethane	1	1	20	n.a	75–125
cis-1,2-Dichloroethene	1	1	40	n.a	60–140
cis-1,3-Dichloropropene	1	1	20	n.a	75–125
Dibromochloromethane	1	1	20	n.a	75–125
Dichlorodifluoromethane (F12)	1	1	20	n.a	75-125
di-Isopropyl ether	1	1	20	n.a	75-125
Ethyl tert-butyl ether	1	1	20	n.a	75-125
Ethylbenzene	1	1	20	n.a	75–125
Methyl tertiary butyl ether	1	1	20	n.a	75–125
Methylene chloride	1	1	20	n.a	75–125
Styrene	1	1	20	n.a	75–125
Tertiary amyl ether	1	1	20	n.a	75–125
Tertiary butyl alcohol	1	1	20	n.a	75–125

Earth Tech's Project Quality Control Criteria for Soil Vapor/Ambient Air Samples

Analyte	Project Decision Threshold[a]	Reporting Limit Required	Precision (RPD)	Accuracy (%R)[b]	
				MS/MSD	LCS
Tetrachloroethene	1	1	20	n.a	75–125
Toluene	1	1	20	n.a	75–125
trans-1,2-Dichloroethene	1	1	40	n.a	60–140
trans-1,3-Dichloropropene	1	1	20	n.a	75–125
Trichlorofluoromethane (F11)	1	1	20	n.a	75–125
Trichloroethene	1	1	20	n.a	75–125
Vinyl chloride	1	1	20	n.a	75–125
m-xylene	1	1	20	n.a	75–125
o-xylene	1	1	20	n.a	75–125
p-xylene	1	1	20	n.a	75–125
1,2,4-Trichlorobenzene	1	1	20	n.a	75–125
1,2-Dichlorobenzene	1	1	20	n.a	75–125
1,3-Dichlorobenzene	1	1	20	n.a	75–125
1,4-Dichlorobenzene	1	1	20	n.a	75–125
Hexachlorobutadiene	1	1	20	n.a	75–125
Atmospheric Gases (ASTM-1946) (ppmv)					
Oxygen	1000	1000	20	n.a	75–125
Nitrogen	1000	1000	20	n.a	75–125
Carbon dioxide	10	10	20	n.a	75–125
Carbon monoxide	10	10	20	n.a	75–125
Methane	1	1	20	n.a	75–125

Notes:

µg/L = micrograms per liter
LCS = laboratory control sample
EPA = U.S. Environmental Protection Agency
MS = matrix spike
ppmv = parts per million, volume
n.a. = not applicable
RPD = relative percentage of difference
% R = percent recovery
MSD = matrix spike duplicate

[a] Project Decision Threshold is equal to the Reporting Limit. Decision Threshold for the hot spot determination is 300 µg/L total VOC concentration.

[b] Laboratory-specific performance criteria.

[c] Target analytes for TO-14 only.

EST's Project Quality Control Criteria for Soil Vapor/Ambient Air Samples

Analyte	Project Decision Threshold[a]	Reporting Limit Required	Precision (RPD)	Accuracy (%R)[b]	
				MS/MSD	LCS
Volatile Organic Compounds (modified SW8260 or TO-14) (µg/L)					
1,1,1,2-Tetrachloroethane	1	1	20	n.a	75–125
1,1,1-Trichloroethane	1	1	40	n.a	60–140
1,1,2,2-Tetrachloroethane	1	1	20	n.a	75–125
1,1,2-Trichloroethane	1	1	20	n.a	75–125
1,1,2-trichlorofluoroethane (F113)	1	1	20	n.a	75–125
1,1-Dichloroethane	1	1	20	n.a	75–125
1,1-Dichloroethene	1	1	20	n.a	75–125
1,2-dichlorotetrafluoroethane (F114)	1	1	20	n.a	75–125
1,2-Dichloroethane	1	1	40	n.a	60–140
1,2-Dichloropropane	1	1	20	n.a	75–125
2-Butanone (MEK)	1	5	40	n.a	60–140
2-Hexanone	1	5	40	n.a	60–140
4-Methyl-2-Pentanone (MIBK)	1	5	40	n.a	60–140
Acetone	1	5	40	n.a	60–140
Benzene	1	1	20	n.a	75–125
Bromodichloromethane	1	1	20	n.a	75–125
Bromoform	1	1	20	n.a	75–125
Bromomethane	1	1	20	n.a	75–125
Carbon disulfide	1	1	30	n.a	70–130
Carbon Tetrachloride	1	1	20	n.a	75–125
Chlorobenzene	1	1	20	n.a	75–125
Chloroethane	1	1	20	n.a	75–125
Chloroform	1	1	20	n.a	75–125
Chloromethane	1	1	20	n.a	75–125
cis-1,2-Dichloroethene	1	1	40	n.a	60–140
cis-1,3-Dichloropropene	1	1	20	n.a	75–125
Dibromochloromethane	1	1	20	n.a	75–125
Dichlorodifluoromethane (F12)	1	1	20	n.a	75-125
di-Isopropyl ether	1	1	20	n.a	75-125
Ethyl tert-butyl ether	1	1	20	n.a	75-125
Ethylbenzene	1	1	20	n.a	75–125
Methyl tertiary butyl ether	1	2	30	n.a	70–130
Methylene chloride	1	1	20	n.a	75–125
Styrene	1	1	20	n.a	75–125
Tertiary amyl ether	1	1	30	n.a	70–130
Tertiary butyl alcohol	1	10	40	n.a	60–140

EST's Project Quality Control Criteria for Soil Vapor/Ambient Air Samples

Analyte	Project Decision Threshold[a]	Reporting Limit Required	Precision (RPD)	Accuracy (%R)[b]	
				MS/MSD	LCS
Tetrachloroethene	1	1	20	n.a	75–125
Toluene	1	1	20	n.a	75–125
trans-1,2-Dichloroethene	1	1	40	n.a	60–140
trans-1,3-Dichloropropene	1	1	20	n.a	75–125
Trichlorofluoromethane (F11)	1	1	20	n.a	75–125
Trichloroethene	1	1	20	n.a	75–125
Vinyl chloride	1	1	20	n.a	75–125
m-xylene	1	1	20	n.a	75–125
o-xylene	1	1	20	n.a	75–125
p-xylene	1	1	20	n.a	75–125
1,2,4-Trichlorobenzene	1	1	20	n.a	75–125
1,2-Dichlorobenzene	1	1	20	n.a	75–125
1,3-Dichlorobenzene	1	1	20	n.a	75–125
1,4-Dichlorobenzene	1	1	20	n.a	75–125
Hexachlorobutadiene	1	1	20	n.a	75–125
Atmospheric Gases (ASTM-1946) (ppmv)					
Oxygen	1000	1000	20	n.a	75–125
Nitrogen	1000	1000	20	n.a	75–125
Carbon dioxide	10	10	20	n.a	75–125
Carbon monoxide	10	10	20	n.a	75–125
Methane	1	1	20	n.a	75–125

Notes:

µg/L = micrograms per liter
LCS = laboratory control sample
EPA = U.S. Environmental Protection Agency
MS = matrix spike
ppmv = parts per million, volume
n.a. = not applicable
RPD = relative percentage of difference
% R = percent recovery
MSD = matrix spike duplicate

[a] Project Decision Threshold is equal to the Reporting Limit. Decision Threshold for the hot spot determination is 300 µg/L total VOC concentration.

[b] Laboratory-specific performance criteria.

[c] Target analytes for TO-14 only.

Analytes that are in bold type have modified LCS Percent Recovery values that were approved by the Earth Tech, Inc. Project Manager prior to the beginning of the project.

Appendix B

FACTORS AFFECTING THE GAS-PHASE DISTRIBUTION OF VOCs IN THE SUBSURFACE

Appendix B

FACTORS AFFECTING THE GAS-PHASE DISTRIBUTION OF VOCs IN THE SUBSURFACE

Soil and groundwater contamination by volatile organic compounds (VOCs) can often be detected by analyzing trace gases in soil just below ground surface. This technique is possible because many VOCs will volatilize and move by molecular diffusion away from source areas toward regions of lower concentrations. A gas phase concentration gradient from the source to adjacent areas is established.

The following factors affect the transport and gas phase distribution of VOCs in the subsurface.

1. The liquid-gas partitioning coefficient of the compounds of interest (the "volatility" of the compound).

2. The vapor diffusivity, which is a measure of how quickly an individual compound "spreads out" within a volume of gas.

3. Retardation of the individual compounds as they migrate in the soil gas. Retardation may be due to degradation, adsorption on the soil matrix, tortuosity of the soil profile. or entrapment in unconnected pores.

4. The presence of impeding layers, wetting fronts of freshwater. or perched water tables. between the regional water table and ground surface.

5. The presence of soil moisture around man-made structures such as clarifiers and sumps may suppress volatilization and diffusion of VOCs resulting in false negative or low soil gas concentrations.

6. The presence of contaminants from localized spills or in the ambient air.

7. Movement of soil gas in response to barometric pressure changes.

8. The preferential migration of gas through zones of greater permeability (e.g. natural lithologic variation or back-fill of underground utilities).

9. Soil temperature.

At most sites. many of these factors are unknown or poorly understood. Because of this uncertainty, soil gas sampling should be used in conjunction with other site-specific data.

Appendix C

ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS AND CHAIN-OF-CUSTODY DOCUMENTATION

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST

GC/MS # 2 2091-2-101002

Sample ID	Ambient Air	LK027	LK028	LK024	LK025	LK021	LK022	LK018
Date Analyzed	10/10/02	10/10/02	10/10/02	10/10/02	10/10/02	10/10/02	10/10/02	10/10/02
Time Analyzed	8:22	9:17	9:44	10:10	10:37	11:03	11:30	11:57
Sample Amount (ml)	10	10	10	10	10	10	10	10
Purge Volume (ml)	NA	NA	NA	NA	NA	NA	NA	NA
Vacuum (in. H_2O)	NA	NA	NA	NA	NA	NA	NA	NA
Dilution Factor	1	1	1	1	1	1	1	1
COMMENTS								
tert-Butanol (TBA)	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10
Dichlorodifluoromethane (Freon®-12)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichlorotetrafluoroethane (Freon®-114)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Vinyl Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromomethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Trichlorofluoromethane (Freon®-11)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2-Trichlorotrifluoroethane (Freon®-113)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Acetone	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Carbon Disulfide	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Methylene Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Methyl tert-butyl ether (MtBE)	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2
trans-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
cis-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
2-Butanone (MEK)	ND<5, P, QC	ND<5, P, QC	ND<5, P, QC	ND<5, P, QC	ND<5, P, QC	ND<5, P, QC	ND<5, P, QC	ND<5, P, QC
Diisopropyl Ether (DIPE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloroform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
2-ethoxy-2-methyl propane (ETBE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,1-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
tert-Amyl methyl ether (TAME)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Carbon tetrachloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Benzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Trichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichloropropane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromodichloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
cis-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
4-Methyl-2-Pentanone (MIBK)	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Toluene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
trans-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Tetrachloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1

Continued on next page

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST
(CONTINUED)

GC/MS # 2 — 2091-2-101002

Sample ID	Ambient Air	LK027	LK028	LK024	LK025	LK021	LK022	LK018
Sample Amount (ml)	10	10	10	10	10	10	10	10
Dilution Factor	1	1	1	1	1	1	1	1
2-Hexanone	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P
Dibromochloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,1,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Ethylbenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
meta- and para-Xylenes	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
ortho-Xylene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Styrene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromoform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,3-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,4-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2,4-Trichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Hexachlorobutadiene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
SURROGATES								
Dibromofluoromethane (Surrogate 1)	99%	123%	103%	110%	106%	115%	114%	116%
Toluene-d8 (Surrogate 2)	98%	101%	98%	101%	98%	102%	102%	105%
4-Bromofluorobenzene (Surrogate 3)	100%	110%	103%	105%	111%	105%	108%	112%

ml = milliliter
µg/L = microgram per liter
Concentrations reported in micrograms per liter (µg/L)
ND< = Not detected above the reported limit of quantitation
NA = Not Applicable

* = Exceeds quantitation range
B = Compound detected in blank
P = Precision out of Earth Tech Limits but within EST limits
QC = LCS out of Earth Tech limits but within EST limits
LCS = Laboratory Control Sample

ANALYST: Art Perez

REVIEWED BY: Ragi Abraham RA

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST

GC/MS # 2 2391-2-101002

Sample ID	LK019	LK049	LK030	LK031	LK033	LK034	LK036	LK037
Date Analyzed	10/10/02	10/10/02	10/10/02	10/10/02	10/10/02	10/10/02	10/10/02	10/10/02
Time Analyzed	12:24	12:51	13:19	13:46	14:13	14:40	15:08	15:35
Sample Amount (ml)	10	10	10	10	10	10	10	10
Purge Volume (ml)	NA	NA	NA	NA	NA	NA	NA	NA
Vacuum (in. H_2O)	NA	NA	NA	NA	NA	NA	NA	NA
Dilution Factor	1	1	1	1	1	1	1	1
COMMENTS								
tert-Butanol (TBA)	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10
Dichlorodifluoromethane (Freon®-12)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichlorotetrafluoroethane (Freon®-114)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Vinyl Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromomethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Trichlorofluoromethane (Freon®-11)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2-Trichlorotrifluoroethane (Freon®-113)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Acetone	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Carbon Disulfide	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Methylene Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Methyl tert-butyl ether (MtBE)	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2
trans-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
cis-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
2-Butanone (MEK)	ND<5, P, QC	ND<5, P, QC	ND<5, P, QC	ND<5, P, QC	ND<5, P, QC	ND<5, P, QC	ND<5, P, QC	ND<5, P, QC
Diisopropyl Ether (DIPE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloroform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
2-ethoxy-2-methyl propane (ETBE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,1-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
tert-Amyl methyl ether (TAME)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Carbon tetrachloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Benzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Trichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichloropropane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromodichloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
cis-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
4-Methyl-2-Pentanone (MIBK)	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Toluene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
trans-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Tetrachloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1

Continued on next page

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST
(CONTINUED)

GC/MS # 2 — 2091-2-101002

Sample ID	LK019	LK049	LK030	LK031	LK033	LK034	LK036	LK037
Sample Amount (ml)	10	10	10	10	10	10	10	10
Dilution Factor	1	1	1	1	1	1	1	1
2-Hexanone	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P
Dibromochloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,1,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Ethylbenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
meta- and para-Xylenes	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
ortho-Xylene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Styrene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromoform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,3-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,4-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2,4-Trichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Hexachlorobutadiene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
SURROGATES								
Dibromofluoromethane (Surrogate 1)	114%	109%	116%	112%	120%	118%	110%	117%
Toluene-d8 (Surrogate 2)	104%	104%	105%	103%	105%	105%	103%	104%
4-Bromofluorobenzene (Surrogate 3)	111%	109%	116%	110%	108%	114%	109%	112%

ml = milliliter
µg/L = microgram per liter
Concentrations reported in micrograms per liter (µg/L)
ND< = Not detected above the reported limit of quantitation
NA = Not Applicable

* = Exceeds quantitation range
B = Compound detected in blank
P = Precision out of Earth Tech Limits but within EST limits
QC = LCS out of Earth Tech limits but within EST limits
LCS = Laboratory Control Sample

ANALYST: Art Perez

REVIEWED BY: Ragi Abraham RA

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST

GC/MS # 2 2031-2-101002

Sample ID	LK039	LK040	LK129	LK045	LK046	LK027	LK049	NA
Date Analyzed	10/10/02	10/10/02	10/10/02	10/10/02	10/10/02	10/10/02	10/10/02	NA
Time Analyzed	16:02	16:29	16:56	17:22	17:50	18:36	19:04	NA
Sample Amount (ml)	10	10	10	10	10	10	10	NA
Purge Volume (ml)	NA	NA	NA	NA	NA	NA	NA	NA
Vacuum (in. H_2O)	NA	NA	NA	NA	NA	NA	NA	NA
Dilution Factor	1	1	1	1	1	1	1	NA
COMMENTS						Re-analysis	Duplicate	
tert-Butanol (TBA)	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	NA
Dichlorodifluoromethane (Freon®-12)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,2-Dichlorotetrafluoroethane (Freon®-114)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Chloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Vinyl Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Bromomethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Chloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Trichlorofluoromethane (Freon®-11)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1,2-Trichlorotrifluoroethane (Freon®-113)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Acetone	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	NA
Carbon Disulfide	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Methylene Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Methyl tert-butyl ether (MtBE)	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	NA
trans-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
cis-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
2-Butanone (MEK)	ND<5, P, QC	ND<5, P, QC	ND<5, P, QC	ND<5, P, QC	ND<5, P, QC	ND<5, P, QC	ND<5, P, QC	NA
Diisopropyl Ether (DIPE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Chloroform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
2-ethoxy-2-methyl propane (ETBE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1,1-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
tert-Amyl methyl ether (TAME)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Carbon tetrachloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Benzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,2-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Trichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,2-Dichloropropane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Bromodichloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
cis-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
4-Methyl-2-Pentanone (MIBK)	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	NA
Toluene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
trans-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1,2-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Tetrachloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA

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TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST
(CONTINUED)

GC/MS # 2 — 2091-2-101DC2

Sample ID	LK039	LK040	LK129	LK045	LK046	LK027	LK049	NA
Sample Amount (ml)	10	10	10	10	10	10	10	NA
Dilution Factor	1	1	1	1	1	1	1	NA
2-Hexanone	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	NA
Dibromochloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Chlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1,1,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Ethylbenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
meta- and para-Xylenes	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
ortho-Xylene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Styrene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Bromoform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1,2,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,3-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,4-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,2-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,2,4-Trichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Hexachlorobutadiene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
SURROGATES								
Dibromofluoromethane (Surrogate 1)	115%	120%	124%	118%	122%	120%	114%	NA
Toluene-d8 (Surrogate 2)	101%	102%	104%	102%	104%	106%	100%	NA
4-Bromofluorobenzene (Surrogate 3)	112%	112%	113%	115%	108%	108%	111%	NA

ml = milliliter
µg/L = microgram per liter
Concentrations reported in micrograms per liter (µg/L)
ND< = Not detected above the reported limit of quantitation
NA = Not Applicable

* = Exceeds quantitation range
B = Compound detected in blank
P = Precision out of Earth Tech Limits but within EST limits
QC = LCS out of Earth Tech limits but within EST limits
LCS = Laboratory Control Sample

ANALYST: Art Perez

REVIEWED BY: Ragi Abraham RA

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST

GC/MS # 2 — 2091-2-101102

Sample ID	Ambient Air	LK048	LK042	LK043	LK054	LK055	LK120	LK057
Date Analyzed	10/11/02	10/11/02	10/11/02	10/11/02	10/11/02	10/11/02	10/11/02	10/11/02
Time Analyzed	8:21	8:47	9:14	9:40	10:07	10:33	10:59	11:26
Sample Amount (ml)	10	10	10	10	10	10	10	10
Purge Volume (ml)	NA	NA	NA	NA	NA	NA	NA	NA
Vacuum (in. H_2O)	NA	NA	NA	NA	NA	NA	NA	NA
Dilution Factor	1	1	1	1	1	1	1	1
COMMENTS								
tert-Butanol (TBA)	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10
Dichlorodifluoromethane (Freon®-12)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichlorotetrafluoroethane (Freon®-114)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Vinyl Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromomethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloroethane	ND<1, P	ND<1, P	ND<1, P	ND<1, P	ND<1, P	ND<1, P	ND<1, P	ND<1, P
Trichlorofluoromethane (Freon®-11)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2-Trichlorotrifluoroethane (Freon®-113)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Acetone	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Carbon Disulfide	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Methylene Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Methyl tert-butyl ether (MtBE)	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2
trans-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
cis-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
2-Butanone (MEK)	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Diisopropyl Ether (DIPE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloroform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
2-ethoxy-2-methyl propane (ETBE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,1-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
tert-Amyl methyl ether (TAME)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Carbon tetrachloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Benzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Trichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichloropropane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromodichloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
cis-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
4-Methyl-2-Pentanone (MIBK)	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Toluene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
trans-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Tetrachloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1

Continued on next page

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST
(CONTINUED)

GC/MS # 2

2091-2-101102

Sample ID	Ambient Air	LK048	LK042	LK043	LK054	LK055	LK120	LK057
Sample Amount (ml)	10	10	10	10	10	10	10	10
Dilution Factor	1	1	1	1	1	1	1	1
2-Hexanone	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Dibromochloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,1,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Ethylbenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
meta- and para-Xylenes	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
ortho-Xylene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Styrene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromoform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,3-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,4-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2,4-Trichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Hexachlorobutadiene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
SURROGATES								
Dibromofluoromethane (Surrogate 1)	106%	101%	108%	114%	109%	113%	115%	114%
Toluene-d8 (Surrogate 2)	100%	102%	102%	101%	101%	101%	103%	104%
4-Bromofluorobenzene (Surrogate 3)	105%	107%	107%	108%	108%	107%	107%	110%

ml = milliliter
µg/L = microgram per liter
Concentrations reported in micrograms per liter (µg/L)
ND< = Not detected above the reported limit of quantitation
NA = Not Applicable

* = Exceeds quantitation range
B = Compound detected in blank
P = Precision out of Earth Tech Limits but within EST limits
QC = LCS out of Earth Tech limits but within EST limits
LCS = Laboratory Control Sample

ANALYST: Art Perez

REVIEWED BY: Ragi Abraham RA

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST

GC/MS # 2 | 2091-2-101102

Sample ID	LK058	LK060	LK061	LK051	LK052	LK121	LK072	LK073
Date Analyzed	10/11/02	10/11/02	10/11/02	10/11/02	10/11/02	10/11/02	10/11/02	10/11/02
Time Analyzed	11:53	12:20	12:47	13:14	13:40	14:07	14:34	15:01
Sample Amount (ml)	10	10	10	10	10	10	10	10
Purge Volume (ml)	NA	NA	NA	NA	NA	NA	NA	NA
Vacuum (in. H_2O)	NA	NA	NA	NA	NA	NA	NA	NA
Dilution Factor	1	1	1	1	1	1	1	1
COMMENTS								
tert-Butanol (TBA)	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10
Dichlorodifluoromethane (Freon®-12)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichlorotetrafluoroethane (Freon®-114)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Vinyl Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromomethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloroethane	ND<1, P	ND<1, P	ND<1, P	ND<1, P	ND<1, P	ND<1, P	ND<1, P	ND<1, P
Trichlorofluoromethane (Freon®-11)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2-Trichlorotrifluoroethane (Freon®-113)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Acetone	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Carbon Disulfide	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Methylene Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Methyl tert-butyl ether (MtBE)	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2
trans-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
cis-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
2-Butanone (MEK)	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Diisopropyl Ether (DIPE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloroform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
2-ethoxy-2-methyl propane (ETBE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,1-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
tert-Amyl methyl ether (TAME)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Carbon tetrachloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Benzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Trichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichloropropane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromodichloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
cis-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
4-Methyl-2-Pentanone (MIBK)	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Toluene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
trans-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Tetrachloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1

Continued on next page

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST
(CONTINUED)

GC/MS # 2 — 2091-2-101102

Sample ID	LK058	LK060	LK061	LK051	LK052	LK121	LK072	LK073
Sample Amount (ml)	10	10	10	10	10	10	10	10
Dilution Factor	1	1	1	1	1	1	1	1
2-Hexanone	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Dibromochloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,1,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Ethylbenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
meta- and para-Xylenes	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
ortho-Xylene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Styrene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromoform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,3-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,4-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2,4-Trichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Hexachlorobutadiene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
SURROGATES								
Dibromofluoromethane (Surrogate 1)	118%	117%	119%	121%	119%	114%	121%	119%
Toluene-d8 (Surrogate 2)	103%	103%	102%	104%	101%	100%	103%	100%
4-Bromofluorobenzene (Surrogate 3)	109%	113%	115%	114%	113%	112%	114%	114%

ml = milliliter
µg/L = microgram per liter
Concentrations reported in micrograms per liter (µg/L)
ND< = Not detected above the reported limit of quantitation
NA = Not Applicable

* = Exceeds quantitation range
B = Compound detected in blank
P = Precision out of Earth Tech Limits but within EST limits
QC = LCS out of Earth Tech limits but within EST limits
LCS = Laboratory Control Sample

ANALYST: Art Perez

REVIEWED BY: Ragi Abraham RA

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST

GC/MS # 2 — 2091-2-101102

Sample ID	LK069	LK070	LK122	LK066	LK067	LK063	LK067	NA
Date Analyzed	10/11/02	10/11/02	10/11/02	10/11/02	10/11/02	10/11/02	10/11/02	NA
Time Analyzed	15:27	15:54	16:55	17:21	17:48	18:43	19:10	NA
Sample Amount (ml)	10	10	10	10	10	10	10	NA
Purge Volume (ml)	NA	NA	NA	NA	NA	NA	NA	NA
Vacuum (in. H_2O)	NA	NA	NA	NA	NA	NA	NA	NA
Dilution Factor	1	1	1	1	1	1	1	NA
COMMENTS							Duplicate	
tert-Butanol (TBA)	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	NA
Dichlorodifluoromethane (Freon®-12)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,2-Dichlorotetrafluoroethane (Freon®-114)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Chloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Vinyl Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Bromomethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Chloroethane	ND<1, P	ND<1, P	ND<1, P	ND<1, P	ND<1, P	ND<1, P	ND<1, P	NA
Trichlorofluoromethane (Freon®-11)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1,2-Trichlorotrifluoroethane (Freon®-113)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Acetone	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	NA
Carbon Disulfide	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Methylene Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Methyl tert-butyl ether (MtBE)	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	NA
trans-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
cis-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
2-Butanone (MEK)	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	NA
Diisopropyl Ether (DIPE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Chloroform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
2-ethoxy-2-methyl propane (ETBE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1,1-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
tert-Amyl methyl ether (TAME)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Carbon tetrachloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Benzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,2-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Trichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,2-Dichloropropane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Bromodichloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
cis-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
4-Methyl-2-Pentanone (MIBK)	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	NA
Toluene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
trans-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1,2-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Tetrachloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA

Continued on next page

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST
(CONTINUED)

GC/MS # 2

2091-2-101102

Sample ID	LK069	LK070	LK122	LK066	LK067	LK063	LK067	NA
Sample Amount (ml)	10	10	10	10	10	10	10	NA
Dilution Factor	1	1	1	1	1	1	1	NA
2-Hexanone	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	NA
Dibromochloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Chlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1,1,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Ethylbenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
meta- and para-Xylenes	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
ortho-Xylene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Styrene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Bromoform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1,2,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,3-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,4-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,2-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,2,4-Trichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Hexachlorobutadiene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
SURROGATES								
Dibromofluoromethane (Surrogate 1)	120%	124%	111%	112%	125%	118%	118%	NA
Toluene-d8 (Surrogate 2)	103%	106%	103%	104%	103%	104%	104%	NA
4-Bromofluorobenzene (Surrogate 3)	120%	107%	112%	102%	117%	110%	122%	NA

ml = milliliter
µg/L = microgram per liter
Concentrations reported in micrograms per liter (µg/L)
ND< = Not detected above the reported limit of quantitation
NA = Not Applicable

* = Exceeds quantitation range
B = Compound detected in blank
P = Precision out of Earth Tech Limits but within EST limits
QC = LCS out of Earth Tech limits but within EST limits
LCS = Laboratory Control Sample

ANALYST: Art Perez

REVIEWED BY: Ragi Abraham RA

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST

GC/MS # 2 — 2391-2-101402

Sample ID	Ambient Air	LK064	LK075	LK076	LK078	LK079	LK082	LK081
Date Analyzed	10/14/02	10/14/02	10/14/02	10/14/02	10/14/02	10/14/02	10/14/02	10/14/02
Time Analyzed	8:52	11:28	11:54	12:21	12:48	13:15	13:41	14:06
Sample Amount (ml)	10	10	10	10	10	10	10	10
Purge Volume (ml)	NA	NA	NA	NA	NA	NA	NA	NA
Vacuum (in. H_2O)	NA	NA	NA	NA	NA	NA	NA	NA
Dilution Factor	1	1	1	1	1	1	1	1
COMMENTS								
tert-Butanol (TBA)	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10
Dichlorodifluoromethane (Freon®-12)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichlorotetrafluoroethane (Freon®-114)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Vinyl Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromomethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Trichlorofluoromethane (Freon®-11)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2-Trichlorotrifluoroethane (Freon®-113)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Acetone	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Carbon Disulfide	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Methylene Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Methyl tert-butyl ether (MtBE)	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2
trans-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
cis-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
2-Butanone (MEK)	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Diisopropyl Ether (DIPE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloroform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
2-ethoxy-2-methyl propane (ETBE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,1-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
tert-Amyl methyl ether (TAME)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Carbon tetrachloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Benzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Trichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichloropropane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromodichloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
cis-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
4-Methyl-2-Pentanone (MIBK)	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Toluene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
trans-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Tetrachloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1

Continued on next page

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST
(CONTINUED)

GC/MS # 2 2091-2-101402

Sample ID	Ambient Air	LK064	LK075	LK076	LK078	LK079	LK082	LK081
Sample Amount (ml)	10	10	10	10	10	10	10	10
Dilution Factor	1	1	1	1	1	1	1	1
2-Hexanone	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P
Dibromochloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,1,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Ethylbenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
meta- and para-Xylenes	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
ortho-Xylene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Styrene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromoform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,3-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,4-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2,4-Trichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Hexachlorobutadiene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
SURROGATES								
Dibromofluoromethane (Surrogate 1)	103%	111%	112%	105%	117%	117%	110%	113%
Toluene-d8 (Surrogate 2)	102%	102%	105%	102%	103%	105%	103%	102%
4-Bromofluorobenzene (Surrogate 3)	101%	102%	101%	103%	106%	109%	103%	106%

ml = milliliter
µg/L = microgram per liter
Concentrations reported in micrograms per liter (µg/L)
ND< = Not detected above the reported limit of quantitation
NA = Not Applicable

* = Exceeds quantitation range
B = Compound detected in blank
P = Precision out of Earth Tech Limits but within EST limits
QC = LCS out of Earth Tech limits but within EST limits
LCS = Laboratory Control Sample

ANALYST: Art Perez

REVIEWED BY: Ragi Abraham RA

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST

GC/MS # 2 | 2091-2-121422

Sample ID	LK084	LK085	LK096	LK097	LK093	LK094	LK123	LK124
Date Analyzed	10/14/02	10/14/02	10/14/02	10/14/02	10/14/02	10/14/02	10/14/02	10/14.02
Time Analyzed	14:32	15:03	15:30	15:57	16:23	16:49	17:14	17:41
Sample Amount (ml)	10	10	10	10	10	10	10	10
Purge Volume (ml)	NA	NA	NA	NA	NA	NA	NA	NA
Vacuum (in. H_2O)	NA	NA	NA	NA	NA	NA	NA	NA
Dilution Factor	1	1	1	1	1	1	1	1
COMMENTS								
tert-Butanol (TBA)	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10
Dichlorodifluoromethane (Freon®-12)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichlorotetrafluoroethane (Freon®-114)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Vinyl Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromomethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Trichlorofluoromethane (Freon®-11)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2-Trichlorotrifluoroethane (Freon®-113)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Acetone	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Carbon Disulfide	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Methylene Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Methyl tert-butyl ether (MtBE)	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2
trans-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
cis-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
2-Butanone (MEK)	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Diisopropyl Ether (DIPE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloroform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
2-ethoxy-2-methyl propane (ETBE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,1-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
tert-Amyl methyl ether (TAME)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Carbon tetrachloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Benzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Trichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichloropropane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromodichloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
cis-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
4-Methyl-2-Pentanone (MIBK)	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Toluene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
trans-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Tetrachloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1

Continued on next page

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST
(CONTINUED)

GC/MS # 2 | 2091-2-101402

Sample ID	LK084	LK085	LK096	LK097	LK093	LK094	LK123	LK124
Sample Amount (ml)	10	10	10	10	10	10	10	10
Dilution Factor	1	1	1	1	1	1	1	1
2-Hexanone	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5. P	ND<5, P	ND<5. P	ND<5, P
Dibromochloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,1,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Ethylbenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
meta- and para-Xylenes	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
ortho-Xylene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Styrene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromoform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,3-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,4-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2,4-Trichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Hexachlorobutadiene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
SURROGATES								
Dibromofluoromethane (Surrogate 1)	119%	115%	117%	121%	119%	125%	118%	119%
Toluene-d8 (Surrogate 2)	104%	104%	106%	105%	105%	109%	101%	105%
4-Bromofluorobenzene (Surrogate 3)	110%	107%	106%	105%	106%	109%	112%	116%

ml = milliliter
µg/L = microgram per liter
Concentrations reported in micrograms per liter (ug/L)
ND< = Not detected above the reported limit of quantitation
NA = Not Applicable

* = Exceeds quantitation range
B = Compound detected in blank
P = Precision out of Earth Tech Limits but within EST limits
QC = LCS out of Earth Tech limits but within EST limits
LCS = Laboratory Control Sample

ANALYST: Art Perez

REVIEWED BY: Ragi Abraham RA

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST

GC/MS # 2 | 2091-2-101402

Sample ID	LK094	LK090	LK091	LK125	LK087	LK088	LK088	NA
Date Analyzed	10/14/02	10/14/02	10/14/02	10/14/02	10/14/02	10/14/02	10/14/02	NA
Time Analyzed	18:26	18:53	19:20	19:46	20:13	20:40	21:06	NA
Sample Amount (ml)	10	10	10	10	10	10	10	NA
Purge Volume (ml)	NA	NA	NA	NA	NA	NA	NA	NA
Vacuum (in. H_2O)	NA	NA	NA	NA	NA	NA	NA	NA
Dilution Factor	1	1	1	1	1	1	1	NA
COMMENTS	Duplicate						Duplicate	
tert-Butanol (TBA)	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	NA
Dichlorodifluoromethane (Freon®-12)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,2-Dichlorotetrafluoroethane (Freon®-114)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Chloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Vinyl Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Bromomethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Chloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Trichlorofluoromethane (Freon®-11)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1,2-Trichlorotrifluoroethane (Freon®-113)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Acetone	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	NA
Carbon Disulfide	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Methylene Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Methyl tert-butyl ether (MtBE)	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	NA
trans-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
cis-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
2-Butanone (MEK)	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	NA
Diisopropyl Ether (DIPE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Chloroform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
2-ethoxy-2-methyl propane (ETBE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1,1-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
tert-Amyl methyl ether (TAME)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Carbon tetrachloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Benzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,2-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Trichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,2-Dichloropropane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Bromodichloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
cis-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
4-Methyl-2-Pentanone (MIBK)	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	NA
Toluene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
trans-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1,2-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Tetrachloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA

Continued on next page

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST
(CONTINUED)

GC/MS # 2 — 2091-2-101402

Sample ID	LK094	LK090	LK091	LK125	LK087	LK088	LK088	NA
Sample Amount (ml)	10	10	10	10	10	10	10	NA
Dilution Factor	1	1	1	1	1	1	1	NA
2-Hexanone	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	NA
Dibromochloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Chlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1,1,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Ethylbenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
meta- and para-Xylenes	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
ortho-Xylene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Styrene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Bromoform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,1,2,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,3-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,4-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,2-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
1,2,4-Trichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
Hexachlorobutadiene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	NA
SURROGATES								
Dibromofluoromethane (Surrogate 1)	113%	114%	117%	116%	120%	119%	115%	NA
Toluene-d8 (Surrogate 2)	104%	103%	107%	100%	105%	105%	105%	NA
4-Bromofluorobenzene (Surrogate 3)	107%	106%	110%	104%	111%	110%	105%	NA

ml = milliliter
µg/L = microgram per liter
Concentrations reported in micrograms per liter (µg/L)
ND< = Not detected above the reported limit of quantitation
NA = Not Applicable

* = Exceeds quantitation range
B = Compound detected in blank
P = Precision out of Earth Tech Limits but within EST limits
QC = LCS out of Earth Tech limits but within EST limits
LCS = Laboratory Control Sample

ANALYST: Art Perez

REVIEWED BY: Ragi Abraham RA

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST

GC/MS # 2 — 2091-2-101502

Sample ID	Ambient Air	LK099	LK100	LK102	LK103	LK105	LK106	LK108
Date Analyzed	10/15/02	10/15/02	10/15/02	10/15/02	10/15/02	10/15/02	10/15/02	10/15/02
Time Analyzed	7:48	10:46	11:11	11:35	11:58	12:22	12:45	13:09
Sample Amount (ml)	10	10	10	10	10	10	10	10
Purge Volume (ml)	NA	NA	NA	NA	NA	NA	NA	NA
Vacuum (in. H_2O)	NA	NA	NA	NA	NA	NA	NA	NA
Dilution Factor	1	1	1	1	1	1	1	1
COMMENTS								
tert-Butanol (TBA)	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10
Dichlorodifluoromethane (Freon®-12)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichlorotetrafluoroethane (Freon®-114)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Vinyl Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromomethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Trichlorofluoromethane (Freon®-11)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2-Trichlorotrifluoroethane (Freon®-113)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Acetone	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Carbon Disulfide	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Methylene Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Methyl tert-butyl ether (MtBE)	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2
trans-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
cis-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
2-Butanone (MEK)	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Diisopropyl Ether (DIPE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloroform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
2-ethoxy-2-methyl propane (ETBE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,1-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
tert-Amyl methyl ether (TAME)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Carbon tetrachloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Benzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Trichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichloropropane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromodichloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
cis-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
4-Methyl-2-Pentanone (MIBK)	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Toluene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
trans-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Tetrachloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1

Continued on next page

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST
(CONTINUED)

GC/MS # 2 | 2091-2-101502

Sample ID	Ambient Air	LK099	LK100	LK102	LK103	LK105	LK106	LK108
Sample Amount (ml)	10	10	10	10	10	10	10	10
Dilution Factor	1	1	1	1	1	1	1	1
2-Hexanone	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P
Dibromochloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,1,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Ethylbenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
meta- and para-Xylenes	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
ortho-Xylene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Styrene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromoform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,3-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,4-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2,4-Trichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Hexachlorobutadiene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
SURROGATES								
Dibromofluoromethane (Surrogate 1)	106%	110%	112%	106%	112%	115%	108%	113%
Toluene-d8 (Surrogate 2)	101%	101%	108%	106%	104%	105%	102%	104%
4-Bromofluorobenzene (Surrogate 3)	105%	107%	107%	106%	107%	106%	108%	104%

ml = milliliter
µg/L = microgram per liter
Concentrations reported in micrograms per liter (µg/L)
ND< = Not detected above the reported limit of quantitation
NA = Not Applicable

* = Exceeds quantitation range
B = Compound detected in blank
P = Precision out of Earth Tech Limits but within EST limits
QC = LCS out of Earth Tech limits but within EST limits
LCS = Laboratory Control Sample

ANALYST: Art Perez

REVIEWED BY: Ragi Abraham RA

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST

GC/MS # 2 — 2091-2-101502

Sample ID	LK109	LK126	LK114	LK115	LK127	LK111	LK112	LK112
Date Analyzed	10/15/02	10/15/02	10/15/02	10/15/02	10/15/02	10/15/02	10/15/02	10/15/02
Time Analyzed	13:33	13:57	14:21	14:46	15:11	15:35	16:01	16:25
Sample Amount (ml)	10	10	10	10	10	10	10	10
Purge Volume (ml)	NA	NA	NA	NA	NA	NA	NA	NA
Vacuum (in. H_2O)	NA	NA	NA	NA	NA	NA	NA	NA
Dilution Factor	1	1	1	1	1	1	1	1
COMMENTS								Duplicate
tert-Butanol (TBA)	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10	ND<10
Dichlorodifluoromethane (Freon®-12)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichlorotetrafluoroethane (Freon®-114)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Vinyl Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromomethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Trichlorofluoromethane (Freon®-11)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2-Trichlorotrifluoroethane (Freon®-113)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Acetone	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Carbon Disulfide	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Methylene Chloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Methyl tert-butyl ether (MtBE)	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2	ND<2
trans-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
cis-1,2-Dichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
2-Butanone (MEK)	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Diisopropyl Ether (DIPE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chloroform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
2-ethoxy-2-methyl propane (ETBE)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,1-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
tert-Amyl methyl ether (TAME)	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Carbon tetrachloride	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Benzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Trichloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichloropropane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromodichloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
cis-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
4-Methyl-2-Pentanone (MIBK)	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5	ND<5
Toluene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
trans-1,3-Dichloropropene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2-Trichloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Tetrachloroethene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1

Continued on next page

TABLE C-1

VOLATILE ORGANIC COMPOUNDS
FIELD ANALYTICAL RESULTS FOR SOIL GAS SAMPLES
CTO 78 - ANOMALY AREA 3, FORMER MCAS EL TORO, ORANGE COUNTY, CALIFORNIA
51-TARGET COMPOUND LIST
(CONTINUED)

GC/MS # 2 — 2091-2-101502

Sample ID	LK109	LK126	LK114	LK115	LK127	LK111	LK112	LK112
Sample Amount (ml)	10	10	10	10	10	10	10	10
Dilution Factor	1	1	1	1	1	1	1	1
2-Hexanone	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P	ND<5, P
Dibromochloromethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Chlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,1,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Ethylbenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
meta- and para-Xylenes	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
ortho-Xylene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Styrene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Bromoform	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,1,2,2-Tetrachloroethane	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,3-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,4-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2-Dichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
1,2,4-Trichlorobenzene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
Hexachlorobutadiene	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
SURROGATES								
Dibromofluoromethane (Surrogate 1)	123%	118%	119%	119%	121%	116%	120%	118%
Toluene-d8 (Surrogate 2)	107%	104%	102%	104%	106%	104%	104%	102%
4-Bromofluorobenzene (Surrogate 3)	110%	107%	111%	110%	111%	110%	114%	110%

ml = milliliter
µg/L = microgram per liter
Concentrations reported in micrograms per liter (µg/L)
ND< = Not detected above the reported limit of quantitation
NA = Not Applicable

* = Exceeds quantitation range
B = Compound detected in blank
P = Precision out of Earth Tech Limits but within EST limits
QC = LCS out of Earth Tech limits but within EST limits
LCS = Laboratory Control Sample

ANALYST: Art Perez

REVIEWED BY: Ragi Abraham RA

EARTH TECH

Chain of Custody Record

Lab Job no.: _____
Date _____
Page 1 of _____

Laboratory ~~AIR TOXICS~~ EST
Address ~~180 BLUE RAVINE ROAD SUITE B FOLSOM, CA 95630~~
Client EARTH TECH
Address 100 WEST BROADWAY STE 240, LONG BEACH, CA 90802
Project Name EL TORO ANOMALY AREA 3
Project Number 37380.01.30.02

Method of Shipment _____
Shipment No. _____
Airbill No. _____
Cooler No. 1
Project Manager CRISPIN WANYOIKE
Telephone No. (562) 951-2057
Fax. No. (562) 951-2086
Samplers: (Signature) Christopher Wong

Analysis Required: VOCs (8260)

Field Sample ID	Matrix	Sample Depth Interval	Sampling Date	Sampling Time	Type/Size of Container	Preservation Temp	Preservation Chemical	Filtered	No. of Containers	VOCs (8260)	Remarks
LK027	SG	5'	10/09/02	0825	1L TEDLAR				1	X	
LK028		15'		0955					1	X	
LK024		5'		1030					1	X	
LK025		15'		1100					1	X	
LK021		5'		1230					1	X	
LK022		15'		1325					1	X	
LK018		5'		1400					1	X	
LK019		15'		1425					1	X	
LK030		5'		1500					1	X	
LK031		15'		1525					1	X	
LK033		5'		1600					1	X	
LK034		15'		1700					1	X	

Relinquished by:	Date	Received by:	Date	Relinquished by:	Date	Received by:	Date
Signature: Christopher Wong	10/10	Signature: Art Perez	10/10	Signature:		Signature:	
Printed: CHRISTOPHER WONG	Time 0800	Printed: Art Perez	Time 0855	Printed:	Time	Printed:	Time
Company: EARTH TECH		Company: EST		Company:		Company:	
Reason:				Reason:			

Comments: SG = SOIL GAS

Relinquished by:	Date	Received by:	Date
Signature:		Signature:	
Printed:	Time	Printed:	Time
Company:		Company:	
Reason:			

DISTRIBUTION: White to Laboratory, Canary to Earth Technology Project File, Pink to Courier, Golden to Field File

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3/25/96

Chain of Custody Record

Lab Job no.: _____
Date _____
Page _____ of _____

Laboratory EST
Address _____
Method of Shipment _____
Shipment No. _____
Airbill No. _____
Cooler No. _____

Client EARTH TECH
Address 100 WEST BROADWAY STE 240
LONG BEACH, CA 90802
Project Manager CRISPIN WANYOIKE
Telephone No. (562) 951-2057
Fax. No. (562) 951-2086
Project Name MCAS EL TORO ANOMALY AREA 3
Project Number 37380 01.30.02
Samplers: (Signature) Christopher Wong

Analysis Required: VOCs (8260)

Field Sample ID	Matrix	Sample Depth Interval	Sampling Date	Sampling Time	Type/Size of Container	Preservation Temp	Preservation Chemical	Filtered	No. of Containers	VOCs (8260)	Remarks
LK036	SG	5'	10/10/02	0815	1L TEDLAR				1	X	
LK037		15'		0925					1	X	
LK039		5'		0958					1	X	
LK040		15'		1057					1	X	
LK048		5'		1140					1	X	
LK049		15'		1205					1	X	
LK129		25'		1415					1	X	
LK045		5'		1510					1	X	
LK046		15'		1520					1	X	
LK042		5'		1600					1	X	
LK043		15'		1612					1	X	
LK054		5'		1720					1	X	

Relinquished by:	Date	Received by:	Date	Relinquished by:	Date	Received by:	Date
Signature Christopher Wong	10/10	Signature Art Perez	10/10	Signature		Signature	
Printed CHRISTOPHER WONG	Time	Printed Art Perez	Time	Printed	Time	Printed	Time
Company EARTH TECH		Company EST		Company		Company	
Reason				Reason			

Relinquished by:	Date	Received by:	Date
Signature		Signature	
Printed	Time	Printed	Time
Company		Company	
Reason			

Comments: _____

DISTRIBUTION: White to Laboratory, Canary to Earth Technology Project File, Pink to Courier, Golden to Field File

F-1000
3/25/98

EARTH TECH

Chain of Custody Record

Lab Job no.: _____
Date _____
Page _____ of _____

Laboratory: EST
Address: _____

Client: EARTH TECH
Address: 100 WEST BROADWAY STE 240
LONG BEACH, CA 90802
Project Name: MCAS EL TORO, ANOMALY AREA 3
Project Number: 37380.01.30.02

Method of Shipment: _____
Shipment No.: _____
Airbill No.: _____
Cooler No.: _____
Project Manager: CRISPIN WANYOIKE
Telephone No.: (562) 951-2057
Fax. No.: (562) 951-2086
Samplers: (Signature) Christopher Wong

Analysis Required

Field Sample ID	Matrix	Sample Depth Interval	Sampling Date	Sampling Time	Type/Size of Container	Preservation Temp	Preservation Chemical	Filtered Y	No. of Containers	VOC (8260)	Remarks
LK055	SG	15'	10/10/02	1707	1L TEDLAR				1	X	
LK120	SG	15'	↓	1710					1	X	
LK057		5'	10/11/02	0815					1	X	
LK058		15'		0825					1	X	
LK060		5'		0945					1	X	
LK061		15'		1000					1	X	
LK051		5'		1045					1	X	
LK052		15'		1050					1	X	
LK121		15'		1052					1	X	
LK072		5'		1130					1	X	
LK073		15'		1137					1	X	
LK069		5'		1320					1	X	

Relinquished by:	Date	Received by:	Date	Relinquished by:	Date	Received by:	Date
Signature: Christopher Wong	10/11/02	Signature: Art Perez	10-11	Signature:		Signature:	
Printed: CHRISTOPHER WONG	Time	Printed: Art Perez	Time	Printed:	Time	Printed:	Time
Company: EARTH TECH	1355	Company: EST		Company:		Company:	
Reason:				Reason:			

Comments: SG=SOIL GAS

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Date _____
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Laboratory EST
Address _____

Method of Shipment _____
Shipment No. _____
Airbill No. _____
Cooler No. _____

Client EARTH TECH
Address 100 WEST BROADWAY STE 240
LONG BEACH, CA 90802
Project Name MCAS EL TORO, ANOMALY AREA 3
Project Number 37340.01.30.02

Project Manager CRISPIN WANYOIKE
Telephone No. (562) 951-2057
Fax. No. (562) 951-2086
Samplers: (Signature) Christopher Wong

Analysis Required

Field Sample ID	Matrix	Sample Depth Interval	Sampling Date	Sampling Time	Type/Size of Container	Preservation Temp	Preservation Chemical	Filtered Y	No. of Containers	VOCs (8260B)											Remarks
LK070	SG	15'	10/11/02	1340	1L TEDLAR				1	X											
LK122		15'		1345					1	X											
LK066		5'		1420					1	X											
LK067		15'		1430					1	X											
LK063		5'		1505					1	X											
LK064		15'		1512					1	X											
		'																			
		'																			
		'																			
		'																			
		'																			
		'																			

Relinquished by:	Date	Received by:	Date
Signature Christopher Wong	10/11/02	Signature Art Perez	10-11
Printed CHRISTOPHER WONG	Time	Printed Art Perez	Time
Company EARTH TECH	1550	Company EST	
Reason			

Relinquished by:	Date	Received by:	Date
Signature		Signature	
Printed	Time	Printed	Time
Company		Company	
Reason			

Relinquished by:	Date	Received by:	Date
Signature		Signature	
Printed	Time	Printed	Time
Company		Company	
Reason			

Comments: SG = SOIL GAS

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Lab Job no.: _____
Date _____
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Laboratory EST
Address _____

Method of Shipment _____
Shipment No. _____
Airbill No. _____
Cooler No. _____
Project Manager CRISPIN WANYOIKE
Telephone No. (562) 951-2057
Fax. No. (562) 951-2066
Samplers: (Signature) Christopher Wong

Client EARTH TECH
Address 100 WEST BROADWAY SUITE 240
LONG BEACH, CA 90802
Project Name EL TORO ANOMALY AREA 3
Project Number 37380 01.30.02

Field Sample ID	Matrix	Sample Depth Interval	Sampling Date	Sampling Time	Type/Size of Container	Preservation Temp	Preservation Chemical	Filtered	No. of Containers	VOCs (E260B)	Remarks
LK075	SG	5'	10/14/02	0810	1L TEDLAR				1	X	
LK076		15'		0819					1	X	
LK078		5'		0922					1	X	
LK079		15'		0955					1	X	
LK081		5'		635					1	X	
LK082		15'		1105					1	X	
LK084		5'		1130					1	X	
LK085		15'		1145					1	X	
LK123		15'		1147					1	X	
LK096		5'		1305					1	X	
LK097		15'		1310					1	X	
LK124		15'		1312					1	X	

Analysis Required

Relinquished by:	Date	Received by:	Date	Relinquished by:	Date	Received by:	Date
Signature Christopher Wong	10/14/02	Signature Art Perez	10-14-02	Signature		Signature	
Printed CHRISTOPHER WONG	Time 1330	Printed Art Perez	Time	Printed	Time	Printed	Time
Company EARTH TECH		Company EST		Company		Company	
Reason				Reason			

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Printed	Time	Printed	Time
Company		Company	
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Laboratory EST
Address _____

Client EARTH TECH
Address 100 WEST BROADWAY SUITE 240
LONG BEACH, CA 90802
Project Name MCAS EL TORO ANOMALY AREA 3
Project Number _____

Method of Shipment _____
Shipment No. _____
Airbill No. _____
Cooler No. _____
Project Manager CRISPIN WANYAIKE
Telephone No. (562) 951-2057
Fax. No. (562) 951-2080
Samplers: (Signature) Christopher Wong

Field Sample ID	Matrix	Sample Depth Interval	Sampling Date	Sampling Time	Type/Size of Container	Preservation Temp	Preservation Chemical	Filtered Y	No. of Containers	VOCs (8260B)	Remarks
LK093	SG	5'	10/14/02	1345	1L TEDLAR				1	X	
LK094		15'		1355					1	X	
LK090		5'		1450					1	X	
LK091		15'		1615					1	X	
LK125		15'		1617					1	X	
LK087		5'		1655					1	X	
LK088		15'		1700					1	X	
LK099		5'	10/15/02	0812					1	X	
LK100		15'		0820					1	X	
LK102		5'		0850					1	X	
LK103		15'		0900					1	X	
LK105		5'		0930					1	X	

Analysis Required

Relinquished by:	Date	Received by:	Date	Relinquished by:	Date	Received by:	Date
Signature Christopher Wong	10/15/02	Signature Art Perez	11/15	Signature		Signature	
Printed CHRISTOPHER WONG	Time	Printed Art Perez	Time	Printed	Time	Printed	Time
Company EARTH TECH	1045	Company EST		Company		Company	
Reason				Reason			

Comments: SG = SOIL GAS

Relinquished by:	Date	Received by:	Date
Signature		Signature	
Printed	Time	Printed	Time
Company		Company	
Reason			

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EARTH TECH

Chain of Custody Record

Lab job no.: _____
Date _____
Page _____ of _____

Laboratory: EST
Address: _____

Method of Shipment: _____
Shipment No.: _____
Airbill No.: _____
Cooler No.: _____

Client: EARTH TECH
Address: 100 WEST BROADWAY, SUITE 240, LONG BEACH, CA 90802
Project Manager: CRISPIN WANYOIKE
Telephone No.: (562) 951-2057
Fax. No.: (562) 951-2066
Project Name: MCAS EL TORO, ANOMALY AREA 3
Project Number: 37380.02.30.02
Samplers: (Signature) Christopher Wong

Analysis Required

Field Sample ID	Matrix	Sample Depth Interval	Sampling Date	Sampling Time	Type/Size of Container	Preservation Temp	Preservation Chemical	Filtered	No. of Containers	VOCs (8260B)	Remarks
LK 106	SG	15'	10/15/02	0938	1L TEDLAR				1	X	
LK 108	↓	5'	↓	1012	↓				1	X	
LK 109		12'		1045					1	X	
LK 126		12'		1097					1	X	
LK 114		5'		1133					1	X	
LK 115		15'		1140					1	X	
LK 127		15'		1142					1	X	
LK 111		5'		1315					1	X	
LK 112	↓	15'	↓	1330	↓				1	X	

Relinquished by:	Date	Received by:	Date	Relinquished by:	Date	Received by:	Date
Signature: Christopher Wong	10/15/02	Signature: Art Perez	11/15	Signature:		Signature:	
Printed: CHRISTOPHER WONG	Time	Printed: Art Perez	Time	Printed:	Time	Printed:	Time
Company: EARTH TECH	1355	Company: EST		Company:		Company:	
Reason:				Reason:			

Comments: SG = SOIL GAS

Relinquished by:	Date	Received by:	Date
Signature:		Signature:	
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Appendix D

METHODS AND PROCEDURES FOR THE ANALYSIS OF SOIL GAS SAMPLES FOR VOLATILE ORGANIC COMPOUNDS

METHODS AND PROCEDURES FOR THE ANALYSIS OF SOIL GAS SAMPLES FOR VOLATILE ORGANIC COMPOUNDS

ENVIRONMENTAL SUPPORT TECHNOLOGIES, INC.
360 Goddard
Irvine, California 92618-4601
(949) 679-9500
Fax (949) 679-9501

2002

METHODS AND PROCEDURES FOR THE ANALYSIS OF SOIL GAS SAMPLES FOR VOLATILE ORGANIC COMPOUNDS

Soil gas samples were collected from Tedlar™ bags using a glass syringe fitted with a disposable needle and a gas-tight valve. Immediately following collection, the samples were introduced into a purge and trap autosampler and then automatically transferred into a gas chromatograph/mass spectrometer (GCMS) for analysis. Soil gas samples were analyzed for fifty-one (51) volatile organic compounds (VOCs).

Reporting limits for the target compounds are listed in Earth Tech's Project Quality Control Criteria for Soil Vapor/Ambient Air Samples (Table 1). A series of quality assurance/quality control (QA/QC) analyses were performed prior to, during, and following the analysis of the soil gas samples.

SURROGATE COMPOUNDS

Three (3) surrogate compounds were added to all analyzed samples. Surrogate compound concentrations were within the calibration range. The percent recovery of the surrogate compounds was calculated and reported with soil gas sample results. The acceptance goal for surrogate recovery is ±25 percent difference from the true concentration of the surrogate compounds. Surrogate compounds added to each sample analysis run included dibromofluoromethane, toluene-d8, and 4-bromofluorobenaene, each at a concentration of 25 μg/L.

INITIAL MULTI-POINT EQUIPMENT CALIBRATION

The GC/MS used for soil gas analysis was calibrated using high-purity solvent-based standards obtained from certified vendors. Standards were typically prepared in high-purity methanol or dodecane solvent. Calibration was performed using solvent-based standards at varying concentration levels. When necessary. stock solvent-based standards were diluted to an appropriate concentration. Diluted standards were prepared by introducing a known volume of stock solvent-based standard into a known volume of high-purity solvent.

Initial GC/MS calibration was performed for the target compounds. The GC/MS was calibrated using a minimum of five standard injections to establish a multi-point calibration curve. The lowest standard was not higher than five times the method detection limit. The percent relative standard deviation (%RSD) of the response factor (RF) for each target compound did not exceed the criteria specified in the EPA Method 8260B and the LARWQCB guidelines. Identification and quantitation of compounds in the field was conducted under the same analytical conditions as for the initial calibration.

LABORATORY CONTROL SAMPLE

A laboratory control sample (LCS) from a source or a lot number other than the initial calibration standard was analyzed to verify the true concentration of the initial calibration standard. The percent difference for each compound is listed in EST's Project Quality Control Criteria for Soil Vapor/Ambient Air Samples (Table D-2). Items listed in bold type were modified from the proposed original listed in Table D-1. The Earth Tech Project Manager approved these changes prior to the

TABLE D-1

Earth Tech's Project Quality Control Criteria for Soil Vapor/Ambient Air Samples

Analyte	Project Decision Threshold[a]	Reporting Limit Required	Precision (RPD)	Accuracy (%R)[b]	
				MS/MSD	LCS
Volatile Organic Compounds (modified SW8260 or TO-14) (µg/L)					
1,1,1,2-Tetrachloroethane	1	1	20	n.a	75–125
1,1,1-Trichloroethane	1	1	40	n.a	60–140
1,1,2,2-Tetrachloroethane	1	1	20	n.a	75–125
1,1,2-Trichloroethane	1	1	20	n.a	75–125
1,1,2-trichlorofluoroethane (F113)	1	1	20	n.a	75–125
1,1-Dichloroethane	1	1	20	n.a	75–125
1,1-Dichloroethene	1	1	20	n.a	75–125
1,2-dichlorotetrafluoroethane (F114)	1	1	20	n.a	75–125
1,2-Dichloroethane	1	1	40	n.a	60–140
1,2-Dichloropropane	1	1	20	n.a	75–125
2-Butanone (MEK)	1	1	20	n.a	75–125
2-Hexanone	1	1	20	n.a	75–125
4-Methyl-2-Pentanone (MIBK)	1	1	20	n.a	75–125
Acetone	1	1	20	n.a	75–125
Benzene	1	1	20	n.a	75–125
Bromodichloromethane	1	1	20	n.a	75–125
Bromoform	1	1	20	n.a	75–125
Bromomethane	1	1	20	n.a	75–125
Carbon disulfide	1	1	20	n.a	75–125
Carbon Tetrachloride	1	1	20	n.a	75–125
Chlorobenzene	1	1	20	n.a	75–125
Chloroethane	1	1	20	n.a	75–125
Chloroform	1	1	20	n.a	75–125
Chloromethane	1	1	20	n.a	75–125
cis-1,2-Dichloroethene	1	1	40	n.a	60–140
cis-1,3-Dichloropropene	1	1	20	n.a	75–125
Dibromochloromethane	1	1	20	n.a	75–125
Dichlorodifluoromethane (F12)	1	1	20	n.a	75-125
di-Isopropyl ether	1	1	20	n.a	75-125
Ethyl tert-butyl ether	1	1	20	n.a	75-125
Ethylbenzene	1	1	20	n.a	75–125
Methyl tertiary butyl ether	1	1	20	n.a	75–125
Methylene chloride	1	1	20	n.a	75–125
Styrene	1	1	20	n.a	75–125
Tertiary amyl ether	1	1	20	n.a	75–125
Tertiary butyl alcohol	1	1	20	n.a	75–125

TABLE D-1

Earth Tech's Project Quality Control Criteria for Soil Vapor/Ambient Air Samples

Analyte	Project Decision Threshold[a]	Reporting Limit Required	Precision (RPD)	Accuracy (%R)[b]	
				MS/MSD	LCS
Tetrachloroethene	1	1	20	n.a	75–125
Toluene	1	1	20	n.a	75–125
trans-1,2-Dichloroethene	1	1	40	n.a	60–140
trans-1,3-Dichloropropene	1	1	20	n.a	75–125
Trichlorofluoromethane (F11)	1	1	20	n.a	75–125
Trichloroethene	1	1	20	n.a	75–125
Vinyl chloride	1	1	20	n.a	75–125
m-xylene	1	1	20	n.a	75–125
o-xylene	1	1	20	n.a	75–125
p-xylene	1	1	20	n.a	75–125
1,2,4-Trichlorobenzene	1	1	20	n.a	75–125
1,2-Dichlorobenzene	1	1	20	n.a	75–125
1,3-Dichlorobenzene	1	1	20	n.a	75–125
1,4-Dichlorobenzene	1	1	20	n.a	75–125
Hexachlorobutadiene	1	1	20	n.a	75–125
Atmospheric Gases (ASTM-1946) (ppmv)					
Oxygen	1000	1000	20	n.a	75–125
Nitrogen	1000	1000	20	n.a	75–125
Carbon dioxide	10	10	20	n.a	75–125
Carbon monoxide	10	10	20	n.a	75–125
Methane	1	1	20	n.a	75–125

Notes:

µg/L = micrograms per liter
LCS = laboratory control sample
EPA = U.S. Environmental Protection Agency
MS = matrix spike
ppmv = parts per million, volume
n.a. = not applicable
RPD = relative percentage of difference
% R = percent recovery
MSD = matrix spike duplicate

[a] Project Decision Threshold is equal to the Reporting Limit. Decision Threshold for the hot spot determination is 300 µg/L total VOC concentration.

[b] Laboratory-specific performance criteria.

[c] Target analytes for TO-14 only.

TABLE D-2

EST's Project Quality Control Criteria for Soil Vapor/Ambient Air Samples

Analyte	Project Decision Threshold[a]	Reporting Limit Required	Precision (RPD)	Accuracy (%R)[b]	
				MS/MSD	LCS
Volatile Organic Compounds (modified SW8260 or TO-14) (µg/L)					
1,1,1,2-Tetrachloroethane	1	1	20	n.a	75–125
1,1,1-Trichloroethane	1	1	40	n.a	60–140
1,1,2,2-Tetrachloroethane	1	1	20	n.a	75–125
1,1,2-Trichloroethane	1	1	20	n.a	75–125
1,1,2-trichlorofluoroethane (F113)	1	1	20	n.a	75–125
1,1-Dichloroethane	1	1	20	n.a	75–125
1,1-Dichloroethene	1	1	20	n.a	75–125
1,2-dichlorotetrafluoroethane (F114)	1	1	20	n.a	75–125
1,2-Dichloroethane	1	1	40	n.a	60–140
1,2-Dichloropropane	1	1	20	n.a	75–125
2-Butanone (MEK)	**1**	**5**	**40**	**n.a**	**60–140**
2-Hexanone	**1**	**5**	**40**	**n.a**	**60–140**
4-Methyl-2-Pentanone (MIBK)	**1**	**5**	**40**	**n.a**	**60–140**
Acetone	**1**	**5**	**40**	**n.a**	**60–140**
Benzene	1	1	20	n.a	75–125
Bromodichloromethane	1	1	20	n.a	75–125
Bromoform	1	1	20	n.a	75–125
Bromomethane	1	1	20	n.a	75–125
Carbon disulfide	**1**	**1**	**30**	**n.a**	**70–130**
Carbon Tetrachloride	1	1	20	n.a	75–125
Chlorobenzene	1	1	20	n.a	75–125
Chloroethane	1	1	20	n.a	75–125
Chloroform	1	1	20	n.a	75–125
Chloromethane	1	1	20	n.a	75–125
cis-1,2-Dichloroethene	1	1	40	n.a	60–140
cis-1,3-Dichloropropene	1	1	20	n.a	75–125
Dibromochloromethane	1	1	20	n.a	75–125
Dichlorodifluoromethane (F12)	1	1	20	n.a	75-125
di-Isopropyl ether	1	1	20	n.a	75-125
Ethyl tert-butyl ether	1	1	20	n.a	75-125
Ethylbenzene	1	1	20	n.a	75–125
Methyl tertiary butyl ether	**1**	**2**	**30**	**n.a**	**70–130**
Methylene chloride	1	1	20	n.a	75–125
Styrene	1	1	20	n.a	75–125
Tertiary amyl ether	**1**	**1**	**30**	**n.a**	**70–130**
Tertiary butyl alcohol	**1**	**10**	**40**	**n.a**	**60–140**

TABLE D-2

EST's Project Quality Control Criteria for Soil Vapor/Ambient Air Samples

Analyte	Project Decision Threshold[a]	Reporting Limit Required	Precision (RPD)	Accuracy (%R)[b]	
				MS/MSD	LCS
Tetrachloroethene	1	1	20	n.a	75–125
Toluene	1	1	20	n.a	75–125
trans-1,2-Dichloroethene	1	1	40	n.a	60–140
trans-1,3-Dichloropropene	1	1	20	n.a	75–125
Trichlorofluoromethane (F11)	1	1	20	n.a	75–125
Trichloroethene	1	1	20	n.a	75–125
Vinyl chloride	1	1	20	n.a	75–125
m-xylene	1	1	20	n.a	75–125
o-xylene	1	1	20	n.a	75–125
p-xylene	1	1	20	n.a	75–125
1,2,4-Trichlorobenzene	1	1	20	n.a	75–125
1,2-Dichlorobenzene	1	1	20	n.a	75–125
1,3-Dichlorobenzene	1	1	20	n.a	75–125
1,4-Dichlorobenzene	1	1	20	n.a	75–125
Hexachlorobutadiene	1	1	20	n.a	75–125
Atmospheric Gases (ASTM-1946) (ppmv)					
Oxygen	1000	1000	20	n.a	75–125
Nitrogen	1000	1000	20	n.a	75–125
Carbon dioxide	10	10	20	n.a	75–125
Carbon monoxide	10	10	20	n.a	75–125
Methane	1	1	20	n.a	75–125

Notes:

µg/L = micrograms per liter
LCS = laboratory control sample
EPA = U.S. Environmental Protection Agency
MS = matrix spike
ppmv = parts per million, volume
n.a. = not applicable
RPD = relative percentage of difference
% R = percent recovery
MSD = matrix spike duplicate

[a] Project Decision Threshold is equal to the Reporting Limit. Decision Threshold for the hot spot determination is 300 µg/L total VOC concentration.

[b] Laboratory-specific performance criteria.

[c] Target analytes for TO-14 only.

Analytes that are in bold type have modified LCS Percent Recovery values that were approved by the Earth Tech, Inc. Project Manager prior to the beginning of the project.

beginning of the project. Values that were outside of Earth Tech's Project Quality Control Criteria (Table D-1) but were within EST's Project Quality Control Criteria (Table D-2) were noted with the appropriate qualifier.

INITIAL CALIBRATION VERIFICATION

A daily Initial Calibration Verification (ICV) analysis was performed, which consisted of a sample at the mid-point concentration of the initial calibration using the calibration standard solution. The Relative Percent Difference (RPD) for each compound is listed in the Project Quality Control Criteria for Soil Vapor/Ambient Air Samples provided in Appendix A. Daily ICV was performed prior to the first sample analysis of the day.

END OF DAY GC TEST RUN

A LCS was analyzed at the detection limit concentration when the soil gas samples showed no detectable concentrations of volatile organic compounds. The recovery for each compound was at least 50 percent of the true concentration of that LCS. If these criteria were not met, an additional LCS was analyzed to satisfy these criteria.

BLANK INJECTIONS

The syringes used for soil gas sample collection were filled with ambient air or high-purity carrier-grade gas from a compressed gas cylinder. The ambient air or high-purity gas was analyzed daily before running samples. The blank injection served to detect contamination of the syringe to be used for sampling and verified the effectiveness of equipment decontamination procedures.

DECONTAMINATION PROCEDURES

Syringes used for sampling were decontaminated prior to initiation of sampling. Decontamination of the syringes was conducted by baking in the gas chromatograph oven. Baked syringes were allowed cool down to ambient temperature before further sampling.

Table F-1: Details of Perimeter Soil Gas Sampling – RSE Investigation

Well ID	Round	EPA ID	Earth Tech ID	Date of Sample collection	Sample Type	Laboratory Type	Analysis Type	
							EPA Method TO-14 (VOCs)	ASTM D1946 (Fixed Gases)
PZ1	1	LK266	AA 3-PZ1SG-S01-D000	12/3/2002	Regular	Fixed	√	√
	1	LK267	AA 3-PZ1SG-D02-D000	12/3/2002	Duplicate of LK266	Fixed	√	√
	2	LK314	AA3-PZ01SG-S01-D0321	03/21/2003	Regular	Fixed	√	√
PZ2	2	LK265	AA 3-PZ2SG-S01-D000	12/3/2002	Regular	Fixed	√	√
	2	LK315	AA3-PZ02SG-S01-D0321	03/21/2003	Regular	Fixed	√	√
PZ3	1	LK268	AA 3-PZ3SG-S01-D000	12/3/2002	Regular	Fixed	√	√
	2	LK316	AA3-PZ03SG-S01-D0321	03/21/2003	Regular	Fixed	√	√
PG1S	1	LK269	AA 3-PG1SSG-S01-D000	12/3/2002	Regular	Fixed	√	√
	2	LK304	AA3-PG01SSG-S01-D0320	03/20/2003	Regular	Fixed	√	√
PG1M	1	LK270	AA 3-PG1MSG-S01-D000	12/3/2002	Regular	Fixed	√	√
	2	LK305	AA3-PG01MSG-S01-D0320	03/20/2003	Regular	Fixed	√	√
PG1D	1	LK271	AA 3-PG1DSG-S01-D000	12/3/2002	Regular	Fixed	√	√
	2	LK303	AA3-PG01DSG-S01-D0320	03/20/2003	Regular	Fixed	√	√
PG2S	1	LK272	AA 3-PG2SSG-S01-D000	12/3/2002	Regular	Fixed	√	√
	2	LK306	AA3-PG02SSG-S01-D0320	03/20/2003	Regular	Fixed	√	√
PG2M	1	LK273	AA 3-PG2MSG-S01-D000	12/3/2002	Regular	Fixed	√	√
	2	LK307	AA3-PG02MSG-S01-D0320	03/20/2003	Regular	Fixed	√	√
PG2D	1	LK274	AA 3-PG2DSG-S01-D000	12/3/2002	Regular	Fixed	√	√
	2	LK308	AA3-PG02DSG-S01-D0320	03/20/2003	Regular	Fixed	√	√
PG3S	1	LK275	AA 3-PG3SSG-S01-D000	12/3/2002	Regular	Fixed	√	√
	2	LK309	AA3-PG03SSG-S01-D0320	03/20/2003	Regular	Fixed	√	√
	2	LK310	AA3-PG03SSG-D02-D0320	03/20/2003	Duplicate of LK309	Fixed	√	√
PG3M	1	LK276	AA 3-PG3MSG-S01-D000	12/3/2002	Regular	Fixed	√	√
	1	LK277	AA 3-PG3MSG-D02-D000	12/3/2002	Duplicate of LK276	Fixed	√	√
	2	LK311	AA3-PG03MSG-S01-D0320	03/20/2003	Regular	Fixed	√	√
	2	LK312	AA3-PG03MSG-D02-D0320	03/20/2003	Duplicate of LK311	Fixed	√	√

Table F-1: Details of Perimeter Soil Gas Sampling – RSE Investigation

Well ID	Round	EPA ID	Earth Tech ID	Date of Sample collection	Sample Type	Laboratory Type	Analysis Type	
							EPA Method TO-14 (VOCs)	ASTM D1946 (Fixed Gases)
PG3D	1	LK278	AA 3-PG3DSG-S01-D000	12/3/2002	Regular	Fixed	√	√
	2	LK317	AA3-PG03DSG-S01-D0325	03/20/2003	Regular	Fixed	√	√

Appendix B3
Perimeter Soil Gas Sampling Information

Table F-2: Round 1 Perimeter Soil Gas Sample Analytical Results - RSE Investigation

	Sample ID:	LK265	LK266	LK267	LK268	LK269	LK270	LK271	LK272	LK273	LK274	LK275	LK276	LK277	LK278
	Location ID:	AA3-PZ02	AA3-PZ01	AA3-PZ01	AA3-PZ03	AA3-PG01S	AA3-PG01M	AA3-PG01D	AA3-PG02S	AA3-PG02M	AA3-PG02D	AA3-PG03S	AA3-PG03M	AA3-PG03M	AA3-PG03D
	Sampling Date:	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002
	Sample Type:	Regular	Regular	Duplicate	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular
VOCs (EPA Method TO-14)	Units														
1,1,1-Trichloroethane	µg/L	0.0028 U	0.0028 U	0.0037 U	0.0028 U	0.0028 U	0.0055 U	0.0028 U	0.006 U	0.022 U	0.092 U	0.18 U	0.55 U	0.43 U	0.0028 U
1,1,2,2-Tetrachloroethane	µg/L	0.0035 U	0.0035 U	0.0046 U	0.0035 U	0.0035 U	0.0070 U	0.0035 U	0.007 U	0.028 U	0.12 U	0.23 U	0.70 U	0.54 U	0.0035 U
1,1,2-Trichloroethane	µg/L	0.0028 U	0.0028 U	0.0037 U	0.0028 U	0.0028 U	0.0055 U	0.0028 U	0.006 U	0.022 U	0.092 U	0.18 U	0.55 U	0.43 U	0.0028 U
1,1-Dichloroethane	µg/L	0.0020 U	0.0020 U	0.0027 U	0.0020 U	0.0020 U	0.0041 U	0.0020 U	0.004 U	0.016 U	0.068 U	0.14 U	0.41 U	0.32 U	0.0021 U
1,1-Dichloroethene	µg/L	0.0020 U	0.0020 U	0.0027 U	0.0020 U	0.0020 U	0.0040 U	0.0020 U	0.004 U	0.016 U	0.067 U	0.13 U	0.40 U	0.31 U	0.0020 U
1,2,4-Trichlorobenzene	µg/L	0.015 UJ	0.015 U	0.020 UJ	0.015 UJ	0.015 UJ	0.030 UJ	0.015 UJ	0.030 UJ	0.12 U	0.5 U	1.0 U	3.0 U	2.3 U	0.0151 U
1,2,4-Trimethylbenzene	µg/L	0.0049	0.0025 J	0.0087	0.0099	0.0045	0.0066	0.0054	0.005 U	0.02 U	0.083 U	0.17 U	0.50 U	0.38 U	0.0027
1,2-Dibromoethane (EDB)	µg/L	0.0039 U	0.0039 U	0.0052 U	0.0039 U	0.0039 U	0.0078 U	0.0039 U	0.008 U	0.031 U	0.13 U	0.26 U	0.78 U	0.60 U	0.0039 U
1,2-Dichlorobenzene	µg/L	0.0030 U	0.0030 U	0.0041 U	0.0030 U	0.0030 U	0.0061 U	0.0030 U	0.006 U	0.024 U	0.10 U	0.20 U	0.61 U	0.47 U	0.0031 U
1,2-Dichloroethane	µg/L	0.0020 U	0.0020 U	0.0027 U	0.0020 U	0.0020 U	0.0041 U	0.0020 U	0.004 U	0.016 U	0.068 U	0.14 U	0.41 U	0.32 U	0.0021 U
1,2-Dichloropropane	µg/L	0.0023 U	0.0023 U	0.0031 U	0.0023 U	0.0023 U	0.0047 U	0.0023 U	0.005 U	0.019 U	0.078 U	0.16 U	0.47 U	0.36 U	0.0023 U
1,3,5-Trimethylbenzene	µg/L	0.0025 U	0.0025 U	0.0033 U	0.0033	0.0025 U	0.0050 U	0.0025 U	0.005 U	0.020 U	0.083 U	0.17 U	0.50 U	0.38 U	0.0025 U
1,3-Butadiene	µg/L	0.0045 U	0.0045 U	0.0060 U	0.0045 U	0.0045 U	0.0090 U	0.0045 U	0.009 U	0.036 U	0.15 U	0.30 U	0.90 U	0.69 U	0.0045 U
1,3-Dichlorobenzene	µg/L	0.0030 U	0.0030 U	0.0041 U	0.0030 U	0.0030 U	0.0061 U	0.0030 U	0.006 U	0.024 U	0.10 U	0.20 U	0.61 U	0.47 U	0.0031 U
1,4-Dichlorobenzene	µg/L	0.0030 U	0.0030 U	0.0041 U	0.0030 U	0.0030 U	0.0061 U	0.0030 U	0.006 U	0.024 U	0.10 U	0.20 U	0.61 U	0.47 U	0.0031 U
1,4-Dioxane	µg/L	0.0073 U	0.0073 U	0.0097 U	0.0073 U	0.0073 U	0.015 U	0.0073 U	0.015 U	0.059 U	0.24 U	0.49 U	1.5 U	1.1 U	0.0073 U
2-Butanone (Methyl Ethyl Ketone)	µg/L	0.052	0.0599	0.041	0.070	0.0079	0.034	0.026	0.084	0.10	0.20 U	0.58	19	18	0.0060 U
2-Hexanone	µg/L	0.0083 U	0.0083 U	0.011 U	0.0083 U	0.0083 U	0.017 U	0.0083 U	0.017 U	0.067 U	0.28 U	0.56 U	1.7 U	1.3 U	0.0083 U
2-Propanol	µg/L	0.033	0.033	0.028	0.021	0.043	0.032	0.031	0.040	0.040	0.17 U	0.33 U	1.00 U	0.77 U	0.047
4-Ethyltoluene	µg/L	0.010 U	0.010 U	0.013 U	0.010 U	0.010 U	0.020 U	0.010 U	0.020 U	0.080 U	0.33 U	0.67 U	2.00 U	1.5 U	0.0100 U
4-Methyl-2-pentanone	µg/L	0.0083 U	0.0083 U	0.011 U	0.0083 U	0.0083 U	0.017 U	0.0083 U	0.017 U	0.067 U	0.28 U	0.56 U	1.7 U	1.3 U	0.0083 U
Acetone	µg/L	0.014	0.016	0.012	0.0210	0.0089	0.037	0.021	0.022	0.062	0.16 U	0.32 U	5.5	5.1	0.012
alpha-Chlorotoluene	µg/L	0.0026 U	0.0026 U	0.0035 U	0.0026 U	0.0026 U	0.0053 U	0.0026 U	0.005 U	0.021 U	0.088 U	0.18 U	0.53 U	0.40 U	0.0026 U
Benzene	µg/L	0.0035	0.0037	0.0032	0.0067	0.0016 U	0.0032 J	0.0016 U	0.003 U	0.013 U	0.054 U	0.11 U	0.32 U	0.25 U	0.0043
Bromodichloromethane	µg/L	0.014 U	0.014 U	0.018 U	0.014 U	0.014 U	0.027 U	0.0136 U	0.027 U	0.11 U	0.45 U	0.91 U	2.7 U	2.1 U	0.0136 U
Bromoform	µg/L	0.0210 U	0.0210 UJ	0.028 U	0.0210 U	0.0210 U	0.042 U	0.0210 U	0.042 U	0.17 UJ	0.70 U	1.40 U	4.2 U	3.2 U	0.0210 U
Bromomethane	µg/L	0.0020 U	0.0020 U	0.0026 U	0.0020 U	0.0020 U	0.0039 U	0.0020 U	0.004 U	0.016 U	0.066 U	0.13 U	0.39 U	0.30 U	0.0020 U
Carbon Disulfide	µg/L	0.0071	0.0095	0.0084 U	0.0063 U	0.0063 U	0.013 U	0.0066	0.013 U	0.051 U	0.21 U	0.42 U	1.3 U	0.97 U	0.0200
Carbon Tetrachloride	µg/L	0.0032 U	0.0032 U	0.0042 U	0.0032 U	0.0032 U	0.0064 U	0.0032 U	0.006 U	0.026 U	0.11 U	0.21 U	0.64 U	0.49 U	0.0032 U
Chlorobenzene	µg/L	0.0023 U	0.0023 U	0.0031 U	0.0023 U	0.0023 U	0.0047 U	0.0023 U	0.005 U	0.019 U	0.078 U	0.16 U	0.47 U	0.36 U	0.0023 U
Chloroethane	µg/L	0.0013 U	0.0013 U	0.0018 U	0.0013 U	0.0013 U	0.0027 U	0.0013 U	0.003 U	0.011 U	0.045 U	0.089 U	0.27 U	0.21 U	0.0013 U
Chloroform	µg/L	0.0025 U	0.0025 U	0.0033 U	0.0025 U	0.0025 U	0.0050 U	0.0025 U	0.005 U	0.020 U	0.083 U	0.16 U	0.50 U	0.38 U	0.0025 U
Chloromethane	µg/L	0.0010 U	0.0010 U	0.0014 U	0.0028	0.0010 U	0.0057	0.0023	0.002 U	0.008 U	0.035 U	0.07 U	0.21 U	0.16 U	0.0010 U
cis-1,2-Dichloroethene	µg/L	0.0020 U	0.0020 U	0.0027 U	0.0020 U	0.0020 U	0.0040 U	0.0020 U	0.004 U	0.016 U	0.067 U	0.13 U	0.40 U	0.31 U	0.0020 U
cis-1,3-Dichloropropene	µg/L	0.0023 U	0.0023 U	0.0031 U	0.0023 U	0.0023 U	0.0046 U	0.0023 U	0.005 U	0.018 U	0.077 U	0.15 U	0.46 U	0.36 U	0.0023 U
Cyclohexane	µg/L	0.0070 U	0.0070 U	0.0093 U	0.0070 U	0.0070 U	0.0140 U	0.0070 U	0.014 U	0.056 U	0.23 U	0.47 U	1.40 U	1.1 U	0.0070 U
Dibromochloromethane	µg/L	0.017 U	0.017 UJ	0.023 U	0.017 U	0.017 U	0.035 U	0.0173 U	0.035 U	0.14 UJ	0.58 U	1.2 U	3.5 U	2.7 U	0.0173 U
Ethanol	µg/L	0.0038 U	0.0042	0.0051 U	0.0080	0.0057	0.024	0.0047	0.008 U	0.031 U	0.13 U	0.26 U	0.77 U	0.59 U	0.0065
Ethyl Benzene	µg/L	0.0022 U	0.0022 U	0.0029 U	0.0046	0.0022 U	0.0044 U	0.0023	0.004 U	0.018 U	0.073 U	0.15 U	0.44 U	0.34 U	0.0022 U
Freon 11	µg/L	0.0028 U	0.0028 U	0.0038 U	0.0028 U	0.0028 U	0.0057 U	0.0029 U	0.006 U	0.023 U	0.095 U	0.19 U	0.57 U	0.44 U	0.0029 U
Freon 113	µg/L	0.0039 U	0.0039 U	0.0052 U	0.0039 U	0.0039 U	0.0078 U	0.0039 U	0.008 U	0.031 U	0.130 U	0.26 U	0.78 U	0.60 U	0.0039 U

Table F-2: Round 1 Perimeter Soil Gas Sample Analytical Results - RSE Investigation

	Sample ID:	LK265	LK266	LK267	LK268	LK269	LK270	LK271	LK272	LK273	LK274	LK275	LK276	LK277	LK278
	Location ID:	AA3-PZ02	AA3-PZ01	AA3-PZ01	AA3-PZ03	AA3-PG01S	AA3-PG01M	AA3-PG01D	AA3-PG02S	AA3-PG02M	AA3-PG02D	AA3-PG03S	AA3-PG03M	AA3-PG03M	AA3-PG03D
	Sampling Date:	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002	12/3/2002
	Sample Type:	Regular	Regular	Duplicate	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular
VOCs (EPA Method TO-14)	Units														
Freon 114	µg/L	0.0036 U	0.0036 U	0.0047 U	0.0036 U	0.0036 U	0.0071 U	0.0036 U	0.007 U	0.028 U	0.120 U	0.24 U	0.71 U	0.55 U	0.0036 U
Freon 12	µg/L	0.13	0.016	0.014	0.0037	0.0032	0.0050 U	0.0031	0.0050 U	0.020 U	0.084 U	0.17 U	0.50 U	0.39 U	0.0030
Heptane	µg/L	0.0083 U	0.0083 U	0.011 U	0.018	0.0083 U	0.017 U	0.0083 U	0.017 U	0.067 U	0.28 U	0.56 U	1.7 U	1.3 U	0.0083 U
Hexachlorobutadiene	µg/L	0.022 U	0.0217 U	0.029 U	0.0217 U	0.0217 U	0.043 U	0.0217 U	0.043 U	0.17 U	0.72 U	1.4 U	4.3 U	3.3 U	0.0217 U
Hexane	µg/L	0.0072 U	0.0072 U	0.0095 U	0.0072 U	0.0072 U	0.014 U	0.0072 U	0.014 U	0.057 U	0.24 U	0.48 U	1.4 U	1.1 U	0.012
m,p-Xylene	µg/L	0.0056	0.0033	0.0047	0.018	0.0066	0.010	0.0096	0.006	0.018 U	0.073 U	0.15 U	0.44 U	0.34 U	0.0055
Methyl tert-Butyl Ether	µg/L	0.0073 U	0.0073 U	0.0097 U	0.0073 U	0.0073 U	0.015 U	0.0073 U	0.015 U	0.059 U	0.24 U	0.49 U	1.5 U	1.1 U	0.0073 U
Methylene Chloride	µg/L	0.0088	0.0086	0.0096	0.098	0.010	0.0080	0.011	0.010	0.014 U	0.059 U	0.12 U	0.35 U	0.27 U	0.010
o-Xylene	µg/L	0.0024	0.0022 U	0.0029 U	0.0066	0.0022 U	0.0044 U	0.0033	0.0044 U	0.018 U	0.073 U	0.15 U	0.44 U	0.34 U	0.0022 U
Propylene	µg/L	0.0035 U	0.0035 U	0.0046 U	0.0035 U	0.0035 U	0.0070 U	0.0035 U	0.0070 U	0.028 U	0.12 U	0.23 U	0.70 U	0.54 U	0.0035 U
Styrene	µg/L	0.0022 U	0.0022 U	0.0029 U	0.0022 U	0.0022 U	0.0043 U	0.0022 U	0.0043 U	0.017 U	0.072 U	0.14 U	0.43 U	0.33 U	0.0022 U
Tetrachloroethene	µg/L	0.0058	0.0034 U	0.0046 U	0.0034 U	0.0034 U	0.0069 U	0.0034 U	0.0069 U	0.028 U	0.11 U	0.23 U	0.69 U	0.53 U	0.0034 U
Tetrahydrofuran	µg/L	0.21	0.22	0.14	0.24	0.092	0.58	0.31	0.99	4.0	13	27	74	65	0.0066
Toluene	µg/L	0.0083	0.0069	0.0067	0.17	0.0078	0.011	0.012	0.0070	0.015 U	0.064 U	0.13 U	0.38 U	0.29 U	0.0096
trans-1,2-Dichloroethene	µg/L	0.0080 U	0.0081 U	0.011 U	0.0081 U	0.0081 U	0.016 U	0.0081 U	0.016 U	0.064 U	0.27 U	0.54 U	1.6 U	1.2 U	0.0081 U
trans-1,3-Dichloropropene	µg/L	0.0023 U	0.0023 U	0.0031 U	0.0023 U	0.0023 U	0.0046 U	0.0023 U	0.0046 U	0.018 U	0.077 U	0.15 U	0.46 U	0.36 U	0.0023 U
Trichloroethene	µg/L	0.0027 U	0.0027 U	0.0036 U	0.0027 U	0.0027 U	0.0055 U	0.0027 U	0.0055 U	0.022 U	0.091 U	0.18 U	0.55 U	0.42 U	0.0027 U
Vinyl Acetate	µg/L	0.0072 U	0.0072 U	0.0095 U	0.0072 U	0.0072 U	0.014 U	0.0072 U	0.014 U	0.057 U	0.24 U	0.48 U	1.4 U	1.1 U	0.0072 U
Vinyl Chloride	µg/L	0.0013 U	0.0013 U	0.0017 U	0.0013 U	0.0013 U	0.0026 U	0.0013 U	0.003 U	0.010 U	0.043 U	0.087 U	0.26 U	0.20 U	0.0013 U
Fixed Gases (ASTM D-1946)															
Carbon Dioxide	%	4	0.31	3.9	4.6	1.8	2.3	0.44	1.3	1.9	2.8	1.1	2.2	2.2	3
Carbon Monoxide	%	0.002 U	0.0021 U	0.0022 U	0.0022 U	0.0029 U	0.0022 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0022 U	0.0021 U
Methane	%	0.000 U	0.00021 U	0.00022 U	0.00022 U	0.00029 U	0.00022 U	0.00021 U	0.00021 U	0.00021 U	0.00021 U	0.00021 U	0.00021 U	0.00022 U	0.00021 U
Nitrogen	%	77	77	76	77	77	77	79	78	79	78	78	80	78	78
Oxygen	%	18	17	17	16	19	18	20	19	19	17	19	19	18	18

NOTES:

µg/L = micrograms per liter

% = percent

VOCs = volatile organic compounds

AA3 = Anomaly Area 3

RSE = Removal Site Evaluation

U = indicates the analyte was not detected at or above the stated limit.

UJ = indicates the analyte was not detected at or above the stated limit. The sample detection limit is an estimated value.

J = indicates an estimated value.

Table F-3: Round 2 Perimeter Soil Gas Sample Analytical Results - RSE Investigation

PARAMETER		Sample ID:	LK304	LK305	LK306	LK307	LK303	LK308	LK309	LK310	LK311	LK312	LK314	LK315	LK316	LK317
		Location ID:	AA3-PG01S	AA3-PG01M	AA3-PG02S	AA3-PG02M	AA3-PG01D	AA3-PG02D	AA3-PG03S	AA3-PG03S	AA3-PG03M	AA3-PG03M	AA3-PZ01	AA3-PZ02	AA3-PZ03	AA3-PG03D
		Sampling Date:	3/20/2003	3/20/2003	3/20/2003	3/20/2003	3/20/2003	3/20/2003	3/20/2003	3/20/2003	3/20/2003	3/20/2003	3/21/2003	3/21/2003	3/21/2003	3/20/2003
		Sample Type:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular	Duplicate	Regular	Regular	Regular	Duplicate
VOCs	Units	Method														
1,1,1-Trichloroethane	µg/L	TO-14A	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.028 U	0.022 U	0.003 U	0.003 U	0.003 U	0.003 U
1,1,2,2-Tetrachloroethane	µg/L	TO-14A	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.035 U	0.028 U	0.003 U	0.003 U	0.003 U	0.003 U
1,1,2-Trichloroethane	µg/L	TO-14A	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.028 U	0.022 U	0.003 U	0.003 U	0.003 U	0.003 U
1,1-Dichloroethane	µg/L	TO-14A	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.021 U	0.016 U	0.002 U	0.002 U	0.002 U	0.002 U
1,1-Dichloroethene	µg/L	TO-14A	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.020 U	0.016 U	0.002 U	0.002 U	0.002 U	0.002 U
1,2,4-Trichlorobenzene	µg/L	TO-14A	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.151 U	0.121 U	0.015 U	0.015 U	0.015 U	0.015 U
1,2,4-Trimethylbenzene	µg/L	TO-14A	0.002 U	0.004	0.003	0.003	0.003	0.002 U	0.004	0.002 U	0.025 U	0.020 U	0.003	0.002 U	0.005	0.005
1,2-Dibromoethane (EDB)	µg/L	TO-14A	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.039 U	0.031 U	0.004 U	0.004 U	0.004 U	0.004 U
1,2-Dichlorobenzene	µg/L	TO-14A	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.031 U	0.024 U	0.003 U	0.003 U	0.003 U	0.003 U
1,2-Dichloroethane	µg/L	TO-14A	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.021 U	0.016 U	0.002 U	0.002 U	0.002 U	0.002 U
1,2-Dichloropropane	µg/L	TO-14A	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.023 U	0.019 U	0.002 U	0.002 U	0.002 U	0.002 U
1,3,5-Trimethylbenzene	µg/L	TO-14A	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.025 U	0.020 U	0.002 U	0.002 U	0.002 U	0.002 U
1,3-Butadiene	µg/L	TO-14A	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.045 U	0.036 U	0.004 U	0.004 U	0.004 U	0.004 U
1,3-Dichlorobenzene	µg/L	TO-14A	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.031 U	0.024 U	0.003 U	0.003 U	0.003 U	0.003 U
1,4-Dichlorobenzene	µg/L	TO-14A	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.031 U	0.024 U	0.003 U	0.003 U	0.003 U	0.003 U
1,4-Dioxane	µg/L	TO-14A	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.073 U	0.059 U	0.007 U	0.007 U	0.007 U	0.007 U
2-Butanone (Methyl Ethyl Ketone)	µg/L	TO-14A	0.006 U	0.006 U	0.006 U	0.006 U	0.054	0.006 U	0.016	0.006 U	1.529	1.798	0.006 U	0.006 U	0.006 U	0.006 U
2-Hexanone	µg/L	TO-14A	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.083 U	0.067 U	0.008 U	0.008 U	0.008 U	0.008 U
2-Propanol	µg/L	TO-14A	0.087	0.057	0.072	0.090	0.055	0.097	0.080	0.075	0.095	0.097	0.097	0.117	0.062	0.027
4-Ethyltoluene	µg/L	TO-14A	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.100 U	0.080 U	0.010 U	0.010 U	0.010 U	0.010 U
4-Methyl-2-pentanone	µg/L	TO-14A	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.083 U	0.067 U	0.008 U	0.008 U	0.008 U	0.008 U
Acetone	µg/L	TO-14A	0.020	0.016	0.017	0.015	0.021	0.015	0.019	0.012	0.290	0.290	0.017	0.017	0.019	0.015
alpha-Chlorotoluene	µg/L	TO-14A	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.026 U	0.021 U	0.003 U	0.003 U	0.003 U	0.003 U
Benzene	µg/L	TO-14A	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.003	0.002 U	0.016 U	0.013 U	0.002	0.002	0.009	0.012
Bromodichloromethane	µg/L	TO-14A	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U	0.136 U	0.109 U	0.014 U	0.014 U	0.014 U	0.014 U
Bromoform	µg/L	TO-14A	0.021 U	0.021 U	0.021 U	0.021 U	0.021 U	0.021 U	0.021 U	0.021 U	0.210 U	0.168 U	0.021 U	0.021 U	0.021 U	0.021 U
Bromomethane	µg/L	TO-14A	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.020 U	0.016 U	0.002 U	0.002 U	0.002 U	0.002 U
Carbon Disulfide	µg/L	TO-14A	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	0.063 U	0.051 U	0.006 U	0.006 U	0.006 U	0.006 U
Carbon Tetrachloride	µg/L	TO-14A	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.032 U	0.026 U	0.003 U	0.003 U	0.003 U	0.003 U
Chlorobenzene	µg/L	TO-14A	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.023 U	0.019 U	0.002 U	0.002 U	0.002 U	0.002 U
Chloroethane	µg/L	TO-14A	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.013 U	0.011 U	0.001 U	0.001 U	0.001 U	0.001 U
Chloroform	µg/L	TO-14A	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.025 U	0.020 U	0.002 U	0.002 U	0.002 U	0.002 U
Chloromethane	µg/L	TO-14A	0.002	0.001 U	0.001 U	0.002	0.002	0.002	0.003	0.003	0.010 U	0.008 U	0.001 U	0.001 U	0.001 U	0.001 U
cis-1,2-Dichloroethene	µg/L	TO-14A	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.020 U	0.016 U	0.002 U	0.002 U	0.002 U	0.002 U
cis-1,3-Dichloropropene	µg/L	TO-14A	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.023 U	0.018 U	0.002 U	0.002 U	0.002 U	0.002 U
Cyclohexane	µg/L	TO-14A	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.070 U	0.056 U	0.007 U	0.007 U	0.007 U	0.007 U
Dibromochloromethane	µg/L	TO-14A	0.017 U	0.017 U	0.017 U	0.017 U	0.017 U	0.017 U	0.017 U	0.017 U	0.173 U	0.139 U	0.017 U	0.017 U	0.017 U	0.017 U
Ethanol	µg/L	TO-14A	0.004	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.038 U	0.031 U	0.005	0.004	0.009	0.015
Ethyl Benzene	µg/L	TO-14A	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.022 U	0.018 U	0.002 U	0.002 U	0.003	0.003
Freon 11	µg/L	TO-14A	0.003 U	0.003	0.003 U	0.003 U	0.004	0.003 U	0.003 U	0.003 U	0.029 U	0.023 U	0.003 U	0.003 U	0.003 U	0.003 U
Freon 113	µg/L	TO-14A	0.009	0.027	0.004 U	0.004 U	0.028	0.004 U	0.004 U	0.004 U	0.039 U	0.031 U	0.004 U	0.004 U	0.004 U	0.004 U
Freon 114	µg/L	TO-14A	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.036 U	0.028 U	0.004 U	0.004 U	0.004 U	0.004 U
Freon 12	µg/L	TO-14A	0.003	0.005	0.004	0.004	0.006	0.004	0.003	0.003	0.025 U	0.020 U	0.014	0.111	0.003	0.003
Heptane	µg/L	TO-14A	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.083 U	0.067 U	0.008 U	0.008 U	0.008 U	0.008 U
Hexachlorobutadiene	µg/L	TO-14A	0.022 U	0.022 U	0.022 U	0.022 U	0.022 U	0.022 U	0.022 U	0.022 U	0.217 U	0.173 U	0.022 U	0.022 U	0.022 U	0.022 U
Hexane	µg/L	TO-14A	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.072 U	0.057 U	0.007 U	0.007 U	0.007 U	0.007 U
m,p-Xylene	µg/L	TO-14A	0.003	0.004	0.003	0.004	0.003	0.003	0.005	0.003	0.022 U	0.018 U	0.006	0.005	0.013	0.011
Methyl tert-butyl ether	µg/L	TO-14A	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.073 U	0.059 U	0.007 U	0.007 U	0.007 U	0.007 U
Methylene Chloride	µg/L	TO-14A	0.014	0.011	0.011	0.011	0.007	0.011	0.011	0.007	0.019	0.014 U	0.011	0.012	0.011	0.002
o-Xylene	µg/L	TO-14A	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.022 U	0.018 U	0.002 U	0.002 U	0.004	0.003

Table F-3: Round 2 Perimeter Soil Gas Sample Analytical Results - RSE Investigation

		Sample ID:	LK304	LK305	LK306	LK307	LK303	LK308	LK309	LK310	LK311	LK312	LK314	LK315	LK316	LK317
		Location ID:	AA3-PG01S	AA3-PG01M	AA3-PG02S	AA3-PG02M	AA3-PG01D	AA3-PG02D	AA3-PG03S	AA3-PG03S	AA3-PG03M	AA3-PG03M	AA3-PZ01	AA3-PZ02	AA3-PZ03	AA3-PG03D
		Sampling Date:	3/20/2003	3/20/2003	3/20/2003	3/20/2003	3/20/2003	3/20/2003	3/20/2003	3/20/2003	3/20/2003	3/20/2003	3/21/2003	3/21/2003	3/21/2003	3/20/2003
PARAMETER		Sample Type:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular	Duplicate	Regular	Regular	Regular	Duplicate
Propylene	µg/L	TO-14A	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.035 U	0.028 U	0.003 U	0.003 U	0.003 U	0.003 U
Styrene	µg/L	TO-14A	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.022 U	0.017 U	0.002 U	0.002 U	0.002 U	0.002 U
Tetrachloroethene	µg/L	TO-14A	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.004	0.003 U	0.003 U	0.034 U	0.028 U	0.003 U	0.006	0.003 U	0.003 U
Tetrahydrofuran	µg/L	TO-14A	0.012	0.022	0.017	0.084	0.123	0.057	0.063	0.011	3.896	4.796	0.006 U	0.006 U	0.007	0.006 U
Toluene	µg/L	TO-14A	0.005	0.005	0.005	0.005	0.004	0.004	0.006	0.005	0.019 U	0.015 U	0.009	0.009	0.025	0.019
trans-1,2-Dichloroethene	µg/L	TO-14A	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.008 U	0.081 U	0.064 U	0.008 U	0.008 U	0.008 U	0.008 U
trans-1,3-Dichloropropene	µg/L	TO-14A	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.023 U	0.018 U	0.002 U	0.002 U	0.002 U	0.002 U
Trichloroethene	µg/L	TO-14A	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.027 U	0.022 U	0.003 U	0.003 U	0.003 U	0.006
Vinyl Acetate	µg/L	TO-14A	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U	0.072 U	0.057 U	0.007 U	0.007 U	0.007 U	0.007 U
Vinyl Chloride	µg/L	TO-14A	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.013 U	0.010 U	0.001 U	0.001 U	0.001 U	0.001
Fixed Gases																
Carbon Dioxide	%	ASTM D-1946	2	10	2	2.1	12	2.6	1.9	1.9	2.1	2	3	3.1	3.2	2.4
Carbon Monoxide	%	ASTM D-1946	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Methane	%	ASTM D-1946	0.00019	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U
Nitrogen	%	ASTM D-1946	77	77	75	76	77	75	76	74	75	75	74	74	75	75
Oxygen	%	ASTM D-1946	18	8	18	18	6.2	18	19	19	18	18	18	18	18	19

NOTES:

µg/L = micrograms per liter

% = percent

VOCs = volatile organic compounds

AA3 = Anomaly Area 3

RSE = Removal Site Evaluation

U = indicates the analyte was not detected at or above the stated limit.

UJ = indicates the analyte was not detected at or above the stated limit. The sample detection limit is an estimated value.

J = indicates an estimated value.

Appendix B4
Surface Soil Sampling Information

Table G-1: Details of Surface Soil Sampling – RSE Investigation

Location ID	EPA ID	Earth Tech ID	Sampling Date	Sampling Depths (feet bgs)	Sample Type	Ph	Petroleum Hydrocarbons	VOCs	SVOCs	PAHs	Metals	Dioxins and Furans
HA4	LK026	AA 3-HA4SS-S01-D001'	10/9/2002	0–1	Regular	√	√	√	√	√	√	—
HA3	LK023	AA 3-HA3SS-S01-D001'	10/9/2002	0–1	Regular	√	√	√	√	√	√	—
HA2	LK020	AA 3-HA2SS-S01-D001'	10/9/2002	0–1	Regular	√	√	√	√	√	√	—
HA1	LK017	AA 3-HA1SS-S01-D001'	10/9/2002	0–1	Regular	√	√	√	√	√	√	—
HA5	LK029	AA 3-HA5SS-S01-D001'	10/9/2002	0–1	Regular	√	√	√	√	√	√	—
HA6	LK032	AA 3-HA6SS-S01-D001'	10/9/2002	0–1	Regular	√	√	√	√	√	√	—
HA7	LK035	AA 3-HA7SS-S01-D001'	10/10/2002	0–1	Regular	√	√	√	√	√	√	—
HA8	LK038	AA 3-HA8SS-S01-D001'	10/10/2002	0–1	Regular	√	√	√	√	√	√	—
HA11	LK047	AA 3-HA11SS-S01-D001'	10/10/2002	0–1	Regular	√	√	√	√	√	√	√
HA10	LK044	AA 3-HA10SS-S01-D001'	10/10/2002	0–1	Regular	√	√	√	√	√	√	—
HA9	LK041	AA 3-HA9SS-S01-D001'	10/10/2002	0–1	Regular	√	√	√	√	√	√	—
HA13	LK053	AA 3-HA13SS-S01-D001'	10/10/2002	0–1	Regular	√	√	√	√	√	√	—
	LK116	AA 3-HA13SS-D02-D001'	10/10/2002	0–1	Duplicate of LK053	√	√	√	√	√	√	—
HA14	LK056	AA 3-HA14SS-S01-D001'	10/11/2002	0–1	Regular	√	√	√	√	√	√	√
HA15	LK059	AA 3-HA15SS-S01-D001'	10/11/2002	0–1	Regular	√	√	√	√	√	√	—
HA12	LK050	AA 3-HA12SS-S01-D001'	10/11/2002	0–1	Regular	√	√	√	√	√	√	—
	LK117	AA 3-HA12SS-D02-D001'	10/11/2002	0–1	Duplicate of LK050	√	√	√	√	√	√	—
HA19	LK071	AA 3-HA19SS-S01-D001'	10/11/2002	0–1	Regular	√	√	√	√	√	√	—
HA18	LK068	AA 3-HA18SS-S01-D001'	10/11/2002	0–1	Regular	√	√	√	√	√	√	√
HA17	LK065	AA 3-HA17SS-S01-D001'	10/11/2002	0–1	Regular	√	√	√	√	√	√	—
HA16	LK062	AA 3-HA16SS-S01-D001'	10/11/2002	0–1	Regular	√	√	√	√	√	√	—
HA20	LK074	AA 3-HA20SS-S01-D001'	10/14/2002	0–1	Regular	√	√	√	√	√	√	—
HA21	LK077	AA 3-HA21SS-S01-D001'	10/14/2002	0–1	Regular	√	√	√	√	√	√	√
HA22	LK080	AA 3-HA22SS-S01-D001'	10/14/2002	0–1	Regular	√	√	√	√	√	√	—
HA23	LK083	AA 3-HA23SS-S01-D001'	10/14/2002	0–1	Regular	√	√	√	√	√	√	—
HA27	LK095	AA 3-HA27SS-S01-D001'	10/14/2002	0–1	Regular	√	√	√	√	√	√	√
HA26	LK092	AA 3-HA26SS-S01-D001'	10/14/2002	0–1	Regular	√	√	√	√	√	√	√
	LK118	AA 3-HA26SS-D02-D001'	10/14/2002	0–1	Soil Dup	√	√	√	√	√	√	√
HA25	LK089	AA 3-HA25SS-S01-D001'	10/14/2002	0–1	Regular	√	√	√	√	√	√	√
HA24	LK086	AA 3-HA24SS-S01-D001'	10/14/2002	0–1	Regular	√	√	√	√	√	√	—
HA28	LK098	AA 3-HA28SS-S01-D001'	10/15/2002	0–1	Regular	√	√	√	√	√	√	—
HA29	LK101	AA 3-HA29SS-S01-D001'	10/15/2002	0–1	Regular	√	√	√	√	√	√	√
HA30	LK104	AA 3-HA30SS-S01-D001'	10/15/2002	0–1	Regular	√	√	√	√	√	√	—

Table G-1: Details of Surface Soil Sampling – RSE Investigation

Location ID	EPA ID	Earth Tech ID	Sampling Date	Sampling Depths (feet bgs)	Sample Type	Ph	Petroleum Hydrocarbons	VOCs	SVOCs	PAHs	Metals	Dioxins and Furans
HA31	LK107	AA 3-HA31SS-S01-D001'	10/15/2002	0–1	Regular	√	√	√	√	√	√	√
HA32	LK110	AA 3-HA32SS-S01-D001'	10/15/2002	0–1	Regular	√	√	√	√	√	√	—
HA33	LK113	AA 3-HA33SS-S01-D001'	10/15/2002	0–1	Regular	√	√	√	√	√	√	—
	LK119	AA 3-HA33SS-D02-D001'	10/15/2002	0–1	Duplicate of LK113	√	√	√	√	√	√	—

Table G-2: Surface Soil Sample Analytical Results - RSE Investigation

	Sample ID:	LK017	LK020	LK023	LK026	LK029	LK032	LK035	LK038	LK041	LK044	LK047	LK050	LK117	LK053	LK116
	Location ID:	HA01	HA02	HA03	HA04	HA05	HA06	HA07	HA08	HA09	HA10	HA11	HA12	HA12	HA13	HA13
	SampleType:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular	Duplicate
	Sample Date:	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/10/2002	10/10/2002	10/10/2002	10/10/2002	10/10/2002	10/11/2002	10/11/2002	10/10/2002	10/10/2002
Parameter	Sample Depth:	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
TPH (EPA Method 8015B DRO)	Units															
Motor Oils	mg/kg	10J	12U	86	160	11U	10U	3J	43	8J	13U	11U	14	7J	11U	8J
PHC as Diesel Fuel	mg/kg	12U	12U	15	100U	11U	10U	10U	2J	0.8J	13U	11U	3J	11U	11U	0.9J
PHC as Gasoline	mg/kg	0.04J	0.03J	0.03J	0.1J	0.03J	0.02J	0.03J	10U	0.04J	0.04J	0.03J	0.03J	0.03J	0.03J	0.03J
VOCs (EPA Method 8260B)																
1,1,1,2-Tetrachloroethane	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
1,1,1-Trichloroethane	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
1,1,2,2-Tetrachloroethane	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
1,1,2-Trichloroethane	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
1,1,2-Trichlorotrifluoroethane	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
1,1-Dichloroethane	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
1,1-Dichloroethene	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
1,2,3-Trichloropropane	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
1,2-Dichloroethane	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
1,2-Dichloropropane	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
1,2-Dichlorotetrafluoroethane	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
2-Hexanone	ug/kg	59U	59U	64U	55U	59U	58U	50U	52U	53U	60U	54U	54U	54U	57U	57U
4-Methyl-2-pentanone (MIBK)	ug/kg	59U	59U	64U	55U	59U	58U	50U	52U	53U	60U	54U	54U	54U	57U	57U
Acetone	ug/kg	120UJ	120UJ	130UJ	110UJ	120UJ	120UJ	100UJ	100UJ	110UJ	120UJ	110UJ	110UJ	110UJ	110UJ	110UJ
Benzene	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Bromodichloromethane	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Bromoform	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Bromomethane	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3UJ	6UJ	5.4UJ	5.4UJ	5.4UJ	5.7UJ	5.7UJ
Carbon Disulfide	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Carbon Tetrachloride	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Chlorobenzene	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Chloroethane	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Chloroform	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Chloromethane	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
cis-1,2-Dichloroethene	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
cis-1,3-Dichloropropene	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Dibromochloromethane	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Dichlorodifluoromethane (F12)	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Di-Isopropyl Ether (DIPE)	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Ethyl Tertiary Butyl Ether	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Ethylbenzene	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Methyl Ethyl Ketone	ug/kg	120U	120U	130U	110U	120U	120U	100U	100U	110UJ	120UJ	110UJ	110UJ	110UJ	110UJ	110UJ
Methylene Chloride	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Methyl-Tert-Butyl Ether (MTBE)	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Styrene	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Tertiary Amyl Methyl Ether	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Tertiary Butyl Alcohol (TBA)	ug/kg	23UJ	23UJ	26UJ	22UJ	24UJ	23UJ	20UJ	21UJ	21UJ	24UJ	22UJ	22UJ	22UJ	23UJ	23UJ
Tetrachloroethene (PCE)	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Toluene	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
trans-1,2-Dichloroethene	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
trans-1,3-Dichloropropene	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Trichloroethene (TCE)	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Trichlorofluoromethane	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Vinyl Chloride	ug/kg	5.9U	5.9U	6.4U	5.5U	5.9U	5.8U	5U	5.2U	5.3U	6U	5.4U	5.4U	5.4U	5.7U	5.7U
Xylenes, Total	ug/kg	18U	18U	19U	17U	18U	17U	15U	16U	16U	18U	16U	16U	16U	17U	17U
SVOCs (EPA Method 8270C)																
1,2,4-Trichlorobenzene	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
1,2-Dichlorobenzene	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U

Table G-2: Surface Soil Sample Analytical Results - RSE Investigation

	Sample ID:	LK017	LK020	LK023	LK026	LK029	LK032	LK035	LK038	LK041	LK044	LK047	LK050	LK117	LK053	LK116
	Location ID:	HA01	HA02	HA03	HA04	HA05	HA06	HA07	HA08	HA09	HA10	HA11	HA12	HA12	HA13	HA13
	SampleType:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular	Duplicate
	Sample Date:	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/10/2002	10/10/2002	10/10/2002	10/10/2002	10/10/2002	10/11/2002	10/11/2002	10/10/2002	10/10/2002
Parameter	Sample Depth:	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
1,3-Dichlorobenzene	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
1,4-Dichlorobenzene	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
2,2'-Oxybis(1-chloropropane)	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
2,4,5-Trichlorophenol	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
2,4,6-Trichlorophenol	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
2,4-Dichlorophenol	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
2,4-Dimethylphenol	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
2,4-Dinitrophenol	ug/kg	3000U	2900U	5900U	5000U	2800U	2600U	2600U	5100U	2600U	3200U	2700U	2600U	2700U	2700U	3000U
2,4-Dinitrotoluene	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
2,6-Dinitrotoluene	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
2-Chloronaphthalene	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
2-Chlorophenol	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
2-Methylphenol (o-cresol)	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
2-Nitroaniline	ug/kg	3000U	2900U	5900U	5000U	2800U	2600U	2600U	5100U	2600U	3200U	2700U	2600U	2700U	2700U	3000U
2-Nitrophenol	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
3,3'-Dichlorobenzidine	ug/kg	1200U	1200U	2400U	2000U	1100U	1000U	1000U	2000U	1000U	1300U	1100U	1100U	1100U	1100U	1200U
3/4-Methylphenol (m/p-cresol)	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
3-Nitroaniline	ug/kg	3000U	2900U	5900U	5000U	2800U	2600U	2600U	5100U	2600U	3200U	2700U	2600U	2700U	2700U	3000U
4,6-Dinitro-2-Methylphenol	ug/kg	3000U	2900U	5900U	5000U	2800U	2600U	2600U	5100U	2600U	3200U	2700U	2600U	2700U	2700U	3000U
4-Bromophenyl-Phenylether	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
4-Chloro-3-Methylphenol	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
4-Chloroaniline	ug/kg	1200U	1200U	2400U	2000U	1100U	1000U	1000U	2000U	1000U	1300U	1100U	1100U	1100U	1100U	1200U
4-Chlorophenyl-Phenyl-Ether	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
4-Nitroaniline	ug/kg	3000U	2900U	5900U	5000U	2800U	2600U	2600U	5100U	2600U	3200U	2700U	2600U	2700U	2700U	3000U
4-Nitrophenol	ug/kg	3000U	2900U	5900U	5000U	2800U	2600U	2600U	5100U	2600U	3200U	2700U	2600U	2700U	2700U	3000U
Bis(2-Chloroethoxy) Methane	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
Bis(2-Chloroethyl) Ether	ug/kg	200U	190U	380U	330U	180U	170U	170U	330U	170U	210U	180U	170U	180U	180U	200U
Bis(2-Ethylhexyl)Phthalate	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	65J	520U	630U	540U	530U	540U	550U	600U
Butylbenzylphthalate	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
Carbazole	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
Dibenzofuran	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
Diethylphthalate	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
Dimethylphthalate	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
Di-N-butylphthalate	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
Di-N-Octylphthalate	ug/kg	610U	580U	1200U	1000UJ	560U	520U	520U	1000UJ	520U	630U	540U	530U	540U	550U	600U
Hexachlorobenzene	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
Hexachlorobutadiene	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
Hexachlorocyclopentadiene	ug/kg	3000U	2900U	5900U	5000U	2800U	2600U	2600U	5100U	2600U	3200U	2700U	2600U	2700U	2700U	3000U
Hexachloroethane	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
Isophorone	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
Nitrobenzene	ug/kg	610U	580U	1200U	1000U	560U	520U	520U	1000U	520U	630U	540U	530U	540U	550U	600U
N-Nitroso-Di-N-Propylamine	ug/kg	35U	34U	68U	58U	33U	30U	30U	59U	30U	37U	31U	31U	31U	32U	35U
N-Nitroso-Diphenylamine	ug/kg	3000U	2900U	5900U	5000U	2800U	2600U	2600U	5100U	2600U	3200U	2700U	2600U	2700U	2700U	3000U
Pentachlorophenol	ug/kg	2100U	2000U	4000U	3400U	1900U	1800U	1800U	3500U	1800U	2200U	1800U	1800U	1800U	1900U	2100U
Phenol	ug/kg	610U	110J	410J	1000U	560U	520U	520U	1000U	210J	150J	220J	530U	540U	550U	110J
PAHs (Method PAH-SIM)																
2-Methylnaphthalene	ug/kg	30U	29U	29U	25U	28U	26U	26U	25U	26U	32U	27U	26U	27U	27U	30U
Acenaphthene	ug/kg	30U	29U	29U	25U	28U	26U	26U	25U	26U	32U	27U	26U	27U	27U	30U
Acenaphthylene	ug/kg	30U	29U	29U	25U	28U	26U	26U	25U	26U	32U	27U	26U	27U	27U	30U
Anthracene	ug/kg	30UJ	29UJ	29UJ	25UJ	28UJ	26UJ	26UJ	25UJ	26UJ	32UJ	27UJ	26UJ	27UJ	27UJ	30UJ
Benzo(a)anthracene	ug/kg	16J	29UJ	19J	18J	28UJ	26UJ	7J	25UJ	26UJ	32UJ	27UJ	26UJ	27UJ	27UJ	30UJ
Benzo(a)pyrene	ug/kg	30U	29U	11J	10J	28U	26U	26U	25U	26U	32U	27U	26U	27U	27U	30U
Benzo(b)fluoranthene	ug/kg	8J	29UJ	17J	15J	28UJ	26UJ	26UJ	25UJ	26UJ	32UJ	27UJ	26UJ	27UJ	27UJ	30UJ

Table G-2: Surface Soil Sample Analytical Results - RSE Investigation

	Sample ID:	LK017	LK020	LK023	LK026	LK029	LK032	LK035	LK038	LK041	LK044	LK047	LK050	LK117	LK053	LK116
	Location ID:	HA01	HA02	HA03	HA04	HA05	HA06	HA07	HA08	HA09	HA10	HA11	HA12	HA12	HA13	HA13
	SampleType:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular	Duplicate
	Sample Date:	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/10/2002	10/10/2002	10/10/2002	10/10/2002	10/10/2002	10/11/2002	10/11/2002	10/10/2002	10/10/2002
Parameter	Sample Depth:	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
Benzo(g,h,i)perylene	ug/kg	30U	29U	11J	7J	28U	26U	26U	25U	26U	32U	27U	26U	27U	27U	30U
Benzo(k)fluoranthene	ug/kg	30UJ	29UJ	13J	7J	28UJ	26UJ	26UJ	25UJ	26UJ	32UJ	27UJ	26UJ	27UJ	27UJ	30UJ
Chrysene	ug/kg	10J	29U	29U	8J	28U	26U	26U	25U	26U	32U	27U	26U	27U	27U	30U
Dibenz(a,h)anthracene	ug/kg	30U	29U	29UJ	25U	28U	26U	26U	25U	26U	32U	27U	26U	27U	27U	30U
Fluoranthene	ug/kg	16J	29U	8J	11J	28U	26U	26U	25U	26U	32U	27U	26U	27U	27U	30U
Fluorene	ug/kg	30U	29U	29U	25U	28U	26U	26U	25U	26U	32U	27U	26U	27U	27U	30U
Indeno(1,2,3-c,d)pyrene	ug/kg	30UJ	29UJ	29UJ	25UJ	28UJ	26UJ	26UJ	25UJ	26UJ	32UJ	27UJ	26UJ	27UJ	27UJ	30UJ
Naphthalene	ug/kg	30U	29U	29U	25U	28U	26U	26U	25U	26U	32U	27U	26U	27U	27U	30U
Phenanthrene	ug/kg	9J	29U	29U	25U	28U	26U	26U	25U	26U	32U	27U	26U	27U	27U	30U
Pyrene	ug/kg	16J	29UJ	11J	14J	28UJ	26UJ	26UJ	25U	26U	32U	27U	26U	27U	27U	30U
Dioxins/Furans (EPA Method 8290)																
1,2,3,4,6,7,8-HpCDD	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.947	NA	NA	NA	NA
1,2,3,4,6,7,8-HpCDF	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.417	NA	NA	NA	NA
1,2,3,4,7,8,9-HpCDF	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.116	NA	NA	NA	NA
1,2,3,4,7,8-HxCDD	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0835	NA	NA	NA	NA
1,2,3,4,7,8-HxCDF	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0944	NA	NA	NA	NA
1,2,3,6,7,8-HxCDD	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.171	NA	NA	NA	NA
1,2,3,6,7,8-HxCDF	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.101	NA	NA	NA	NA
1,2,3,7,8,9-HxCDD	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.184	NA	NA	NA	NA
1,2,3,7,8,9-HxCDF	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.193	NA	NA	NA	NA
1,2,3,7,8-PeCDD	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0791	NA	NA	NA	NA
1,2,3,7,8-PeCDF	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.114	NA	NA	NA	NA
2,3,4,6,7,8-HxCDF	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.134	NA	NA	NA	NA
2,3,4,7,8-PeCDF	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.141	NA	NA	NA	NA
2,3,7,8-TCDD	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.103	NA	NA	NA	NA
2,3,7,8-TCDF	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.119	NA	NA	NA	NA
OCDD	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.93	NA	NA	NA	NA
OCDF	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.97	NA	NA	NA	NA
Total HpCDDs	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.9	NA	NA	NA	NA
Total HpCDFs	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.417	NA	NA	NA	NA
Total HxCDDs	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.604	NA	NA	NA	NA
Total HxCDFs	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.916	NA	NA	NA	NA
Total PeCDDs	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.294U	NA	NA	NA	NA
Total PeCDFs	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.681	NA	NA	NA	NA
Total TCDDs	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.226U	NA	NA	NA	NA
Total TCDFs	pg/g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.514	NA	NA	NA	NA
Metals (EPA Method 6010B)																
Aluminum	mg/kg	6550	4330	8190	8960	9680	6650	5320	7120	3570	7700	12400	14300	12100	11100	12100
Antimony	mg/kg	2.1	7U	7.1U	6U	6.8U	6.2U	6.3U	6.1U	6.2U	0.29UJ	6.5U	6.3U	6.5U	6.5U	7.2U
Arsenic	mg/kg	2.6	1.7	3.1	3.3	3.1	2.2	1.9	2.7	1.6	4.1	3.5	3.7	3.8	3.3	4.7
Barium	mg/kg	98.5	50.9	67.8	110	98.8	77.8	59.6	111	105	95.4	119	118	115	120	142
Beryllium	mg/kg	0.48U	0.46U	0.099UJ	0.029UJ	0.091UJ	0.1UJ	0.059UJ	0.41U	0.41U	0.056UJ	0.15UJ	0.33	0.13UJ	0.44U	0.13UJ
Cadmium	mg/kg	0.28	0.44	0.35	0.49	0.67	0.48	0.46	0.56	0.093J	0.39	0.98	0.88	0.78	0.6	1.1
Calcium	mg/kg	5120	1590	4960	7110	4110	2390	2000	4090	2980J	4480J	3940J	4090J	4290J	5920J	5060J
Chromium	mg/kg	7.8	5.2	10.9	11.9	12.4	6.2	6.3	8.8	8.9	9	12.2	12.1	11.3	11.5	13.6
Cobalt	mg/kg	4.4	2.5	4.6	5.4	5.2	3.4	3	4.4	2.8	5.3	5.8	5.8	6	5.6	6.7
Copper	mg/kg	3.9	2.9	7	8.2	8.2	3.5	3.3	4.6	2.4	8	7.2	7.4	8.7	6	12.8
Iron	mg/kg	9540	5880	10200	12400	12500	8440	6990	10400	6820J	12000J	13700J	15100J	13800J	13200J	15700J
Lead	mg/kg	4.7	1.6	15.5	20.7	9.5	2.6	4.2	7.2	2.5	20.6	4.7	5	10	4.7	17
Magnesium	mg/kg	3320	1780	3110	4490	4960	2790	2260	3620	2030J	3860J	5000J	5540J	5150J	4840J	5620J
Manganese	mg/kg	177J	104J	151J	201J	193J	145J	128J	173J	119	180	242	234	228	217	252
Mercury (EPA Method 7471A)	mg/kg	0.038	0.034	0.069	0.051	0.039	0.028	0.041	0.028	0.02	0.037	0.027	0.027	0.023	0.028	0.029
Nickel	mg/kg	4.7	4.4	7.4	7.8	8.2	5.2	4.9	6.2	5.1	6.4	10.1	9.5	8.5	7.9	10.6

Table G-2: Surface Soil Sample Analytical Results - RSE Investigation

	Sample ID:	LK017	LK020	LK023	LK026	LK029	LK032	LK035	LK038	LK041	LK044	LK047	LK050	LK117	LK053	LK116
	Location ID:	HA01	HA02	HA03	HA04	HA05	HA06	HA07	HA08	HA09	HA10	HA11	HA12	HA12	HA13	HA13
	SampleType:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular	Duplicate
	Sample Date:	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/9/2002	10/10/2002	10/10/2002	10/10/2002	10/10/2002	10/10/2002	10/11/2002	10/11/2002	10/10/2002	10/10/2002
Parameter	Sample Depth:	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
Potassium	mg/kg	2290J	1210J	1800J	2760J	3310J	1850J	1560J	2490J	1100J	2500J	3010J	3280J	3070J	2920J	3540J
Selenium	mg/kg	0.48	0.47	0.57	0.73	0.5	0.49	0.41	0.76	0.27	0.68	0.53	0.87	0.82	0.72	0.63
Silver	mg/kg	1.2U	1.2U	1.2U	1U	1.1U	1U	1U	1U	1U	1.3UJ	1.1UJ	1.1UJ	1.1UJ	1.1UJ	1.2UJ
Sodium	mg/kg	240U	230U	121UJ	200U	230U	210U	210U	200U	210U	250U	220U	210U	220U	220U	240U
Thallium	mg/kg	0.97UJ	0.93UJ	0.94UJ	0.81UJ	0.9UJ	0.83UJ	0.84UJ	0.81UJ	0.82UJ	1UJ	0.86UJ	0.84UJ	0.87UJ	0.87UJ	0.97UJ
Vanadium	mg/kg	21.6	13.5	22.7	28.2	26.8	18	15.4	24.3	16.4	26.1	31.5	33.5	32.4	31.7	35.4
Zinc	mg/kg	28	16.4	37.1	50.3	41.6	23.3	21.6	45	15.8	37.2	38.1	41.2	43.5	40.1	57.8
General Chemistry																
Moisture (ASTM D 2216)	%	17.4	14	15	0.76	11.4	3.7	4.3	1.6	3	21	7.4	5.3	7.7	8.4	17.2
pH (EPA Method 9045)	pH	7.78	8.26	10.5	7.82	8.26	8.18	8.3	8.01	8.68	9.21	7.94	7.99	8.3	8	8.12

Table G-2: Surface Soil Sample Analytical Results - RSE Investigation

	Sample ID:	LK056	LK059	LK062	LK065	LK068	LK071	LK074	LK077	LK080	LK083	LK086	LK089	LK092	LK118	LK095
	Location ID:	HA14	HA15	HA16	HA17	HA18	HA19	HA20	HA21	HA22	HA23	HA24	HA25	HA26	HA26	HA27
	SampleType:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular
	Sample Date:	10/11/2002	10/11/2002	10/11/2002	10/11/2002	10/11/2002	10/11/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002
Parameter	Sample Depth:	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
TPH (EPA Method 8015B DRO)	Units															
Motor Oils	mg/kg	5J	49	12U	11U	18	14	11U	40	11U	12U	10U	12U	20	10U	11U
PHC as Diesel Fuel	mg/kg	11U	3J	12U	11U	1J	11U	1J	4J	11U	12U	10U	12U	2J	10U	11U
PHC as Gasoline	mg/kg	0.03J	0.04J	0.03J	0.03J	0.03J	0.03J	0.02J	0.02J	0.03J	12U	11U	12U	0.05J	11U	0.02J
VOCs (EPA Method 8260B)																
1,1,1,2-Tetrachloroethane	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
1,1,1-Trichloroethane	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
1,1,2,2-Tetrachloroethane	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
1,1,2-Trichloroethane	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
1,1,2-Trichlorotrifluoroethane	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
1,1-Dichloroethane	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
1,1-Dichloroethene	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
1,2,3-Trichloropropane	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
1,2-Dichloroethane	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
1,2-Dichloropropane	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
1,2-Dichlorotetrafluoroethane	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
2-Hexanone	ug/kg	57U	48U	58U	60U	57U	57U	52U	49U	55U	59U	52U	58U	54U	46U	51U
4-Methyl-2-pentanone (MIBK)	ug/kg	57U	48U	58U	60U	57U	57U	52U	49U	55U	59U	52U	58U	54U	46U	51U
Acetone	ug/kg	110UJ	96UJ	120UJ	120UJ	110UJ	110UJ	100UJ	99UJ	110UJ	120UJ	100UJ	120UJ	110UJ	92UJ	100UJ
Benzene	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Bromodichloromethane	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Bromoform	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Bromomethane	ug/kg	5.7UJ	4.8UJ	5.8UJ	6UJ	5.7UJ	5.7UJ	5.2UJ	4.9UJ	5.5UJ	5.9UJ	5.2UJ	5.8UJ	5.4UJ	4.6UJ	5.1UJ
Carbon Disulfide	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Carbon Tetrachloride	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Chlorobenzene	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Chloroethane	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Chloroform	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Chloromethane	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
cis-1,2-Dichloroethene	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
cis-1,3-Dichloropropene	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Dibromochloromethane	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Dichlorodifluoromethane (F12)	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Di-Isopropyl Ether (DIPE)	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Ethyl Tertiary Butyl Ether	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Ethylbenzene	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Methyl Ethyl Ketone	ug/kg	110UJ	96UJ	120UJ	120UJ	110UJ	110UJ	100U	99U	110U	120U	100U	120U	110U	92U	100U
Methylene Chloride	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Methyl-Tert-Butyl Ether (MTBE)	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Styrene	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Tertiary Amyl Methyl Ether	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Tertiary Butyl Alcohol (TBA)	ug/kg	23UJ	19UJ	23UJ	24UJ	23UJ	23UJ	21UJ	20UJ	22UJ	24UJ	21UJ	23UJ	22UJ	18UJ	21UJ
Tetrachloroethene (PCE)	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Toluene	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
trans-1,2-Dichloroethene	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
trans-1,3-Dichloropropene	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Trichloroethene (TCE)	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Trichlorofluoromethane	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Vinyl Chloride	ug/kg	5.7U	4.8U	5.8U	6U	5.7U	5.7U	5.2U	4.9U	5.5U	5.9U	5.2U	5.8U	5.4U	4.6U	5.1U
Xylenes, Total	ug/kg	17U	14U	18U	18U	17U	17U	16U	15U	17U	18U	16U	17U	16U	14U	15U
SVOCs (EPA Method 8270C)																
1,2,4-Trichlorobenzene	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
1,2-Dichlorobenzene	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U

Table G-2: Surface Soil Sample Analytical Results - RSE Investigation

	Sample ID:	LK056	LK059	LK062	LK065	LK068	LK071	LK074	LK077	LK080	LK083	LK086	LK089	LK092	LK118	LK095
	Location ID:	HA14	HA15	HA16	HA17	HA18	HA19	HA20	HA21	HA22	HA23	HA24	HA25	HA26	HA26	HA27
	SampleType:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular
	Sample Date:	10/11/2002	10/11/2002	10/11/2002	10/11/2002	10/11/2002	10/11/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002
Parameter	Sample Depth:	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
1,3-Dichlorobenzene	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
1,4-Dichlorobenzene	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
2,2'-Oxybis(1-chloropropane)	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
2,4,5-Trichlorophenol	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
2,4,6-Trichlorophenol	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
2,4-Dichlorophenol	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
2,4-Dimethylphenol	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
2,4-Dinitrophenol	ug/kg	2900U	5100U	2900U	2800U	2600U	2800U	2700UJ	2700UJ	2800U	3100U	2600U	2900U	3000UJ	2500UJ	2700U
2,4-Dinitrotoluene	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
2,6-Dinitrotoluene	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
2-Chloronaphthalene	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
2-Chlorophenol	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
2-Methylphenol (o-cresol)	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
2-Nitroaniline	ug/kg	2900U	5100U	2900U	2800U	2600U	2800U	2700U	2700U	2800U	3100U	2600U	2900U	3000U	2500U	2700U
2-Nitrophenol	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
3,3'-Dichlorobenzidine	ug/kg	1100U	2100U	1200U	1100U	1100U	1100U	1100U	1100U	1100U	1200U	1000U	1200U	1200U	1000U	1100U
3/4-Methylphenol (m/p-cresol)	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
3-Nitroaniline	ug/kg	2900U	5100U	2900U	2800U	2600U	2800U	2700U	2700U	2800U	3100U	2600U	2900U	3000U	2500U	2700U
4,6-Dinitro-2-Methylphenol	ug/kg	2900U	5100U	2900U	2800U	2600U	2800U	2700U	2700U	2800U	3100U	2600U	2900U	3000U	2500U	2700U
4-Bromophenyl-Phenylether	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
4-Chloro-3-Methylphenol	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
4-Chloroaniline	ug/kg	1100U	2100U	1200U	1100U	1100U	1100U	1100U	1100U	1100U	1200U	1000U	1200U	1200U	1000U	1100U
4-Chlorophenyl-Phenyl-Ether	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
4-Nitroaniline	ug/kg	2900U	5100U	2900U	2800U	2600U	2800U	2700U	2700U	2800U	3100U	2600U	2900U	3000U	2500U	2700U
4-Nitrophenol	ug/kg	2900U	5100U	2900U	2800U	2600U	2800U	2700U	2700U	2800U	3100U	2600U	2900U	3000U	2500U	2700U
Bis(2-Chloroethoxy) Methane	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
Bis(2-Chloroethyl) Ether	ug/kg	190U	340U	190U	180U	170U	180U	180U	180U	180U	200U	170U	190U	190U	170U	180U
Bis(2-Ethylhexyl)Phthalate	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
Butylbenzylphthalate	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
Carbazole	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
Dibenzofuran	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
Diethylphthalate	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
Dimethylphthalate	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
Di-N-butylphthalate	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
Di-N-Octylphthalate	ug/kg	570U	1000UJ	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
Hexachlorobenzene	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
Hexachlorobutadiene	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
Hexachlorocyclopentadiene	ug/kg	2900U	5100U	2900U	2800U	2600U	2800U	2700U	2700U	2800U	3100U	2600U	2900U	3000U	2500U	2700U
Hexachloroethane	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
Isophorone	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
Nitrobenzene	ug/kg	570U	1000U	590U	560U	530U	560U	540U	540U	560U	620U	520U	580U	590U	510U	540U
N-Nitroso-Di-N-Propylamine	ug/kg	33U	60U	34U	32U	31U	32U	32U	31U	33U	36U	30U	34U	34U	29U	31U
N-Nitroso-Diphenylamine	ug/kg	2900U	5100U	2900U	2800U	2600U	2800U	2700U	2700U	2800U	3100U	2600U	2900U	3000U	2500U	2700U
Pentachlorophenol	ug/kg	1900U	3500U	2000U	1900U	1800U	1900U	1900U	1800U	1900U	2100U	1800U	2000U	2000U	1700U	1800U
Phenol	ug/kg	570U	1000U	590U	560U	530U	695	540U	540U	936	450J	520U	250J	590U	510U	902
PAHs (Method PAH-SIM)																
2-Methylnaphthalene	ug/kg	29U	51U	29U	28U	26U	28U	27U	27U	28U	31U	26U	29U	30U	25U	27U
Acenaphthene	ug/kg	29U	51U	29U	28U	26U	28U	27U	27U	28U	31U	26U	29U	30U	25U	27U
Acenaphthylene	ug/kg	29U	51U	29U	28U	26U	28U	27U	27U	28U	31U	26U	29U	30U	25U	27U
Anthracene	ug/kg	29UJ	44J	29UJ	28UJ	26UJ	28UJ	27UJ	27UJ	28UJ	31UJ	26UJ	29UJ	30UJ	25UJ	27UJ
Benzo(a)anthracene	ug/kg	29UJ	730J	29UJ	28UJ	26UJ	28UJ	27UJ	27UJ	28UJ	31UJ	26UJ	29UJ	13J	25UJ	27UJ
Benzo(a)pyrene	ug/kg	29U	1030J	29U	28U	26U	28U	27U	27U	28U	31U	26U	29U	30U	25U	27U
Benzo(b)fluoranthene	ug/kg	29UJ	1790J	29UJ	28UJ	26UJ	28UJ	27UJ	27UJ	28UJ	31UJ	26UJ	29UJ	30UJ	25UJ	27UJ

Table G-2: Surface Soil Sample Analytical Results - RSE Investigation

	Sample ID:	LK056	LK059	LK062	LK065	LK068	LK071	LK074	LK077	LK080	LK083	LK086	LK089	LK092	LK118	LK095
	Location ID:	HA14	HA15	HA16	HA17	HA18	HA19	HA20	HA21	HA22	HA23	HA24	HA25	HA26	HA26	HA27
	SampleType:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular
	Sample Date:	10/11/2002	10/11/2002	10/11/2002	10/11/2002	10/11/2002	10/11/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002
Parameter	Sample Depth:	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
Benzo(g,h,i)perylene	ug/kg	29U	440J	29U	28U	26U	28U	27U	27U	28U	31U	26U	29U	30U	25U	27U
Benzo(k)fluoranthene	ug/kg	29UJ	510J	29UJ	28UJ	26UJ	28UJ	27UJ	27UJ	28UJ	31UJ	26UJ	29UJ	30UJ	25UJ	27UJ
Chrysene	ug/kg	29U	870	29U	28U	26U	28U	27U	27U	28U	31U	26U	29U	30U	25U	27U
Dibenz(a,h)anthracene	ug/kg	29U	97J	29U	28U	26U	28U	27U	27U	28U	31U	26U	29U	30U	25U	27U
Fluoranthene	ug/kg	29U	1000	29U	28U	26U	28U	27U	27U	28U	31U	26U	29U	30U	25U	27U
Fluorene	ug/kg	29U	51U	29U	28U	26U	28U	27U	27U	28U	31U	26U	29U	30U	25U	27U
Indeno(1,2,3-c,d)pyrene	ug/kg	29UJ	460J	29UJ	28UJ	26UJ	28UJ	27UJ	27UJ	28UJ	31UJ	26UJ	29UJ	30UJ	25UJ	27UJ
Naphthalene	ug/kg	29U	51U	29U	28U	26U	28U	27U	27U	28U	31U	26U	29U	30U	25U	27U
Phenanthrene	ug/kg	29U	290	29U	28U	26U	28U	27U	27U	28U	31U	26U	29U	30U	25U	27U
Pyrene	ug/kg	29U	960	29U	28U	26U	28U	27U	27UJ	28U	31U	26U	29U	30U	25U	27U
Dioxins/Furans (EPA Method 8290)																
1,2,3,4,6,7,8-HpCDD	pg/g	1.88	NA	NA	NA	2.41	NA	NA	3.12	NA	NA	NA	2.04	9.92	10.3	1.55
1,2,3,4,6,7,8-HpCDF	pg/g	0.637	NA	NA	NA	1.36	NA	NA	0.893	NA	NA	NA	0.579	7.92	6.59	0.436
1,2,3,4,7,8,9-HpCDF	pg/g	0.241U	NA	NA	NA	0.239U	NA	NA	0.252U	NA	NA	NA	0.295U	0.329	0.394U	0.261U
1,2,3,4,7,8-HxCDD	pg/g	0.241U	NA	NA	NA	0.391	NA	NA	0.252U	NA	NA	NA	0.364	0.362	0.475	0.444U
1,2,3,4,7,8-HxCDF	pg/g	0.0617	NA	NA	NA	0.084	NA	NA	0.0967	NA	NA	NA	0.0851	1.58	1.34	0.261U
1,2,3,6,7,8-HxCDD	pg/g	0.135	NA	NA	NA	0.353	NA	NA	0.345	NA	NA	NA	0.328	1.87	1.6	0.345U
1,2,3,6,7,8-HxCDF	pg/g	0.083	NA	NA	NA	0.122	NA	NA	0.125	NA	NA	NA	0.0874	7.68	6.09	0.261U
1,2,3,7,8,9-HxCDD	pg/g	0.125	NA	NA	NA	0.469	NA	NA	0.401	NA	NA	NA	0.475	0.785	0.923	0.385U
1,2,3,7,8,9-HxCDF	pg/g	0.241U	NA	NA	NA	0.33	NA	NA	0.31	NA	NA	NA	0.371	0.903	1.05	0.261U
1,2,3,7,8-PeCDD	pg/g	0.241U	NA	NA	NA	0.193	NA	NA	0.169	NA	NA	NA	0.0803	0.515	0.497	0.261U
1,2,3,7,8-PeCDF	pg/g	0.241U	NA	NA	NA	0.0744	NA	NA	0.101	NA	NA	NA	0.113	1.06	0.775	0.261U
2,3,4,6,7,8-HxCDF	pg/g	0.162	NA	NA	NA	0.177	NA	NA	0.204	NA	NA	NA	0.149	14.7	11.2	0.261U
2,3,4,7,8-PeCDF	pg/g	0.081	NA	NA	NA	0.239	NA	NA	0.181	NA	NA	NA	0.156	32.4	26.5	0.152
2,3,7,8-TCDD	pg/g	0.0965U	NA	NA	NA	0.107	NA	NA	0.105	NA	NA	NA	0.118U	0.17	0.229	0.111U
2,3,7,8-TCDF	pg/g	0.0617	NA	NA	NA	0.137	NA	NA	0.147	NA	NA	NA	0.156	3.05	2.12	0.133
OCDD	pg/g	17	NA	NA	NA	30	NA	NA	40.3	NA	NA	NA	19.8	61.7	79.8	17
OCDF	pg/g	1.35	NA	NA	NA	6.87	NA	NA	6.59	NA	NA	NA	4.13	6.92	7.46	1.1
Total HpCDDs	pg/g	3.8	NA	NA	NA	5.71	NA	NA	6.32	NA	NA	NA	3.93	22	22.3	3.19
Total HpCDFs	pg/g	1.39	NA	NA	NA	3.05	NA	NA	2.32	NA	NA	NA	1.45	15	12.8	0.436
Total HxCDDs	pg/g	0.413	NA	NA	NA	1.2	NA	NA	1.23	NA	NA	NA	1.11	20.2	17.4	0.484U
Total HxCDFs	pg/g	1.92	NA	NA	NA	2.55	NA	NA	2.03	NA	NA	NA	1.8	201	156	0.442
Total PeCDDs	pg/g	0.0444	NA	NA	NA	0.282	NA	NA	0.183	NA	NA	NA	0.461	5.99	3.72	0.419U
Total PeCDFs	pg/g	1.63	NA	NA	NA	2.66	NA	NA	2.18	NA	NA	NA	1.76	752	563	1.56
Total TCDDs	pg/g	0.178U	NA	NA	NA	0.139	NA	NA	0.216	NA	NA	NA	0.123	0.313	1.53	0.346U
Total TCDFs	pg/g	0.324	NA	NA	NA	1.19	NA	NA	1.34	NA	NA	NA	1.35	346	294	0.586
Metals (EPA Method 6010B)																
Aluminum	mg/kg	8030	9350	7860	7980	9340	9690	10900	5590	15000	13200	9320	6920	14300	7860	8830
Antimony	mg/kg	6.8U	6.2U	7.1U	0.32UJ	6.3U	0.28UJ	6.5U	6.5U	6.8U	7.4U	6.3U	7U	7.1U	6.1U	6.5U
Arsenic	mg/kg	2.9	2.9	2.2	3	2.9	2.8	2.7	2.2	4.6	3.6	3	2.5	4.7	2.2	2.3
Barium	mg/kg	73.6	89	87.9	94.5	101	93.3	105	60.3	187	122	104	79.3	163	71.6	88.6
Beryllium	mg/kg	0.053UJ	0.1UJ	0.47U	0.14UJ	0.16UJ	0.098UJ	0.14	0.052UJ	0.29	0.31	0.22	0.12	0.27	0.089UJ	0.12
Cadmium	mg/kg	0.46	0.59	0.62	0.69	0.78	0.83	0.65	0.55	1	0.92	0.86	0.62	0.98	0.6	0.76
Calcium	mg/kg	5250J	25200J	2510J	3800J	3300J	3260J	5340	2720	6050	4720	3600	3540	5540	3160	16400
Chromium	mg/kg	8.3	8.7	14.6	8.8	8.9	9.7	12.3	5.8	15.8	13	10.6	7.1	18.2	8.6	8.6
Cobalt	mg/kg	3.8	4	4.2	4.7	4.5	5	4.7	3	7.6	5.5	4.8	3.8	7.3	3.9	4.2
Copper	mg/kg	3.6	4.3	5.1	5.2	5.6	6.8	7	3.3	10.8	7.6	6.8	4.4	12.8	4.9	4.9
Iron	mg/kg	9310J	10100J	9650J	11000J	11100J	11800J	13000	8070	19400	15300	12600	9990	19100	10000	10600
Lead	mg/kg	2.5	2.9	7.5	6.3	4.3	8.3	4.7	2	12.4	5.8	9.2	2.9	15	2.7	3.5
Magnesium	mg/kg	3350J	3820J	3060J	3910J	3750J	4090J	4230	2530	6770	5190	4140	3340	6790	3390	3700
Manganese	mg/kg	161	167	178	207	197	216	221J	126J	289J	227J	197J	164J	277J	146J	168J
Mercury (EPA Method 7471A)	mg/kg	0.021	0.022	0.029	0.027	0.019	0.041	0.018	0.012	0.021	0.026	0.02	0.021	0.02	0.015	0.012
Nickel	mg/kg	6	6.4	9	7.4	7	7.7	7.8	4.7	12.1	9	8.3	5.7	11.8	7.5	6.2

Table G-2: Surface Soil Sample Analytical Results - RSE Investigation

	Sample ID:	LK056	LK059	LK062	LK065	LK068	LK071	LK074	LK077	LK080	LK083	LK086	LK089	LK092	LK118	LK095
	Location ID:	HA14	HA15	HA16	HA17	HA18	HA19	HA20	HA21	HA22	HA23	HA24	HA25	HA26	HA26	HA27
	SampleType:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular
	Sample Date:	10/11/2002	10/11/2002	10/11/2002	10/11/2002	10/11/2002	10/11/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002	10/14/2002
Parameter	Sample Depth:	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
Potassium	mg/kg	1880J	2150J	2190J	2470J	2450J	2530J	2670J	1440J	3970J	3300J	2670J	1980J	4170J	1940J	2170J
Selenium	mg/kg	0.45	0.42	0.54	0.65	0.72	1.1	0.65U	0.29	0.68U	0.74U	0.63U	0.7U	0.71U	0.61U	0.65U
Silver	mg/kg	1.1UJ	1UJ	1.2UJ	1.1UJ	1.1UJ	1.1UJ	1.1U	1.1U	1.1U	1.2U	1U	1.2U	1.2U	1UJ	1.1U
Sodium	mg/kg	11.9UJ	11.2UJ	240U	22.1UJ	210U	220U	220U	33UJ	230U	30.2UJ	28.7UJ	230U	240U	200U	220U
Thallium	mg/kg	0.91UJ	0.82UJ	0.94UJ	0.9UJ	0.85UJ	0.89UJ	0.87U	0.87U	0.9U	0.98U	0.84U	0.93U	0.94U	0.81U	0.87U
Vanadium	mg/kg	22.1	25.1	22.2	23.1	24.2	27.3	29.2	17.4	44.1	33.3	27.5	21.6	41.7	24	24.6
Zinc	mg/kg	23.7	26.8	30.8	30.8	30.9	34.1	33.5	20.9	57.1	49.6	36.6	26.7	60.8	26.2	27.8
General Chemistry																
Moisture (ASTM D 2216)	%	12.3	2.8	15.2	10.6	5.4	10.4	8.1	7.8	11.1	18.7	4.3	13.8	15.3	1.7	7.8
pH (EPA Method 9045)	pH	9.1	8.33	7.48	7.93	8.66	6.41	8.32	8.93	8.31	8.15	8.29	8.45	8.86	8.47	9.2

Table G-2: Surface Soil Sample Analytical Results - RSE Investigation

	Sample ID:	LK098	LK101	LK104	LK107	LK110	LK113	LK119
	Location ID:	HA28	HA29	HA30	HA31	HA32	HA33	HA33
	SampleType:	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate
	Sample Date:	10/15/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002
Parameter	Sample Depth:	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
TPH (EPA Method 8015B DRO)	Units							
Motor Oils	mg/kg	7J	26	27	3J	19	7J	12U
PHC as Diesel Fuel	mg/kg	2J	5J	2J	10U	0.9J	12U	12U
PHC as Gasoline	mg/kg	10U	9.9U	0.02J	9.5U	0.05J	0.03J	0.03J
VOCs (EPA Method 8260B)								
1,1,1,2-Tetrachloroethane	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
1,1,1-Trichloroethane	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
1,1,2,2-Tetrachloroethane	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
1,1,2-Trichloroethane	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
1,1,2-Trichlorotrifluoroethane	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
1,1-Dichloroethane	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
1,1-Dichloroethene	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
1,2,3-Trichloropropane	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
1,2-Dichloroethane	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
1,2-Dichloropropane	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
1,2-Dichlorotetrafluoroethane	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
2-Hexanone	ug/kg	56U	52U	50U	49U	59U	57U	58U
4-Methyl-2-pentanone (MIBK)	ug/kg	56U	52U	50U	49U	59U	57U	58U
Acetone	ug/kg	110UJ	100UJ	100UJ	99UJ	120UJ	110UJ	120UJ
Benzene	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Bromodichloromethane	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Bromoform	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Bromomethane	ug/kg	5.6UJ	5.2UJ	5UJ	4.9UJ	5.9UJ	5.7UJ	5.8UJ
Carbon Disulfide	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Carbon Tetrachloride	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Chlorobenzene	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Chloroethane	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Chloroform	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Chloromethane	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
cis-1,2-Dichloroethene	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
cis-1,3-Dichloropropene	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Dibromochloromethane	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Dichlorodifluoromethane (F12)	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Di-Isopropyl Ether (DIPE)	ug/kg	5.6U	5.2U	5U	4.9U	5.9UJ	5.7UJ	5.8UJ
Ethyl Tertiary Butyl Ether	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Ethylbenzene	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Methyl Ethyl Ketone	ug/kg	110U	100U	100U	99U	120U	110U	120U
Methylene Chloride	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Methyl-Tert-Butyl Ether (MTBE)	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Styrene	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Tertiary Amyl Methyl Ether	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Tertiary Butyl Alcohol (TBA)	ug/kg	22UJ	21UJ	20UJ	20UJ	24UJ	23UJ	23UJ
Tetrachloroethene (PCE)	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Toluene	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
trans-1,2-Dichloroethene	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
trans-1,3-Dichloropropene	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Trichloroethene (TCE)	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Trichlorofluoromethane	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Vinyl Chloride	ug/kg	5.6U	5.2U	5U	4.9U	5.9U	5.7U	5.8U
Xylenes, Total	ug/kg	17U	16U	15U	15U	18U	17U	17U
SVOCs (EPA Method 8270C)								
1,2,4-Trichlorobenzene	ug/kg	530U	540U	520U	520U	610U	620U	620U
1,2-Dichlorobenzene	ug/kg	530U	540U	520U	520U	610U	620U	620U

Table G-2: Surface Soil Sample Analytical Results - RSE Investigation

	Sample ID:	LK098	LK101	LK104	LK107	LK110	LK113	LK119
	Location ID:	HA28	HA29	HA30	HA31	HA32	HA33	HA33
	SampleType:	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate
	Sample Date:	10/15/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002
Parameter	Sample Depth:	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
1,3-Dichlorobenzene	ug/kg	530U	540U	520U	520U	610U	620U	620U
1,4-Dichlorobenzene	ug/kg	530U	540U	520U	520U	610U	620U	620U
2,2'-Oxybis(1-chloropropane)	ug/kg	530U	540U	520U	520U	610U	620U	620U
2,4,5-Trichlorophenol	ug/kg	530U	540U	520U	520U	610U	620U	620U
2,4,6-Trichlorophenol	ug/kg	530U	540U	520U	520U	610U	620U	620U
2,4-Dichlorophenol	ug/kg	530U	540U	520U	520U	610U	620U	620U
2,4-Dimethylphenol	ug/kg	530U	540U	520U	520U	610U	620U	620U
2,4-Dinitrophenol	ug/kg	2600UJ	2700UJ	2600UJ	2600UJ	3100U	3100U	3100U
2,4-Dinitrotoluene	ug/kg	530U	540U	520U	520U	610U	620U	620U
2,6-Dinitrotoluene	ug/kg	530U	540U	520U	520U	610U	620U	620U
2-Chloronaphthalene	ug/kg	530U	540U	520U	520U	610U	620U	620U
2-Chlorophenol	ug/kg	530U	540U	520U	520U	610U	620U	620U
2-Methylphenol (o-cresol)	ug/kg	530U	540U	520U	520U	610U	620U	620U
2-Nitroaniline	ug/kg	2600U	2700U	2600U	2600U	3100U	3100U	3100U
2-Nitrophenol	ug/kg	530U	540U	520U	520U	610U	620U	620U
3,3'-Dichlorobenzidine	ug/kg	1100U	1100U	1000U	1000U	1200U	1200U	1200U
3/4-Methylphenol (m/p-cresol)	ug/kg	530U	540U	520U	520U	610U	620U	620U
3-Nitroaniline	ug/kg	2600U	2700U	2600U	2600U	3100U	3100U	3100U
4,6-Dinitro-2-Methylphenol	ug/kg	2600U	2700U	2600U	2600U	3100U	3100U	3100U
4-Bromophenyl-Phenylether	ug/kg	530U	540U	520U	520U	610U	620U	620U
4-Chloro-3-Methylphenol	ug/kg	530U	540U	520U	520U	610U	620U	620U
4-Chloroaniline	ug/kg	1100U	1100U	1000U	1000U	1200U	1200U	1200U
4-Chlorophenyl-Phenyl-Ether	ug/kg	530U	540U	520U	520U	610U	620U	620U
4-Nitroaniline	ug/kg	2600U	2700U	2600U	2600U	3100U	3100U	3100U
4-Nitrophenol	ug/kg	2600U	2700U	2600U	2600U	3100U	3100U	3100U
Bis(2-Chloroethoxy) Methane	ug/kg	530U	540U	520U	520U	610U	620U	620U
Bis(2-Chloroethyl) Ether	ug/kg	170U	180U	170U	170U	200U	200U	200U
Bis(2-Ethylhexyl)Phthalate	ug/kg	530U	70J	520U	520U	51J	620U	620U
Butylbenzylphthalate	ug/kg	530U	540U	520U	520U	610U	620U	620U
Carbazole	ug/kg	530U	540U	520U	520U	610U	620U	620U
Dibenzofuran	ug/kg	530U	540U	520U	520U	610U	620U	620U
Diethylphthalate	ug/kg	530U	540U	520U	520U	610U	620U	140J
Dimethylphthalate	ug/kg	530U	540U	520U	520U	610U	620U	620U
Di-N-butylphthalate	ug/kg	530U	540U	520U	520U	610U	620U	620U
Di-N-Octylphthalate	ug/kg	530U	540U	520U	520U	610U	620U	620U
Hexachlorobenzene	ug/kg	530U	540U	520U	520U	610U	620U	620U
Hexachlorobutadiene	ug/kg	530U	540U	520U	520U	610U	620U	620U
Hexachlorocyclopentadiene	ug/kg	2600U	2700U	2600U	2600U	3100U	3100U	3100U
Hexachloroethane	ug/kg	530U	540U	520U	520U	610U	620U	620U
Isophorone	ug/kg	530U	540U	520U	520U	610U	620U	620U
Nitrobenzene	ug/kg	530U	540U	520U	520U	610U	620U	620U
N-Nitroso-Di-N-Propylamine	ug/kg	31U	31U	30U	30U	36U	36U	36U
N-Nitroso-Diphenylamine	ug/kg	2600U	2700U	2600U	2600U	3100U	3100U	3100U
Pentachlorophenol	ug/kg	1800U	1800U	1800U	1800U	2100U	2100U	2100U
Phenol	ug/kg	530U	540U	520U	520U	610U	210J	250J
PAHs (Method PAH-SIM)								
2-Methylnaphthalene	ug/kg	26U	27U	26U	26U	31U	31U	31U
Acenaphthene	ug/kg	26U	27U	26U	26U	31U	31U	31U
Acenaphthylene	ug/kg	26U	27U	26U	26U	31U	31U	31U
Anthracene	ug/kg	26UJ	27UJ	26UJ	26UJ	31UJ	31UJ	31UJ
Benzo(a)anthracene	ug/kg	26UJ	12J	26UJ	26UJ	31UJ	31UJ	31UJ
Benzo(a)pyrene	ug/kg	26U	15J	26U	26U	31U	31U	31U
Benzo(b)fluoranthene	ug/kg	26UJ	34J	26UJ	26UJ	31UJ	31UJ	31UJ

Table G-2: Surface Soil Sample Analytical Results - RSE Investigation

	Sample ID:	LK098	LK101	LK104	LK107	LK110	LK113	LK119
	Location ID:	HA28	HA29	HA30	HA31	HA32	HA33	HA33
	SampleType:	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate
	Sample Date:	10/15/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002
Parameter	Sample Depth:	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
Benzo(g,h,i)perylene	ug/kg	26U	16J	26U	26U	31U	31U	31U
Benzo(k)fluoranthene	ug/kg	26UJ	11J	26UJ	26UJ	31UJ	31UJ	31UJ
Chrysene	ug/kg	26U	24J	26U	26U	31U	31U	31U
Dibenz(a,h)anthracene	ug/kg	26U	27U	26U	26U	31U	31U	31U
Fluoranthene	ug/kg	26U	14J	26U	26U	31U	31U	31U
Fluorene	ug/kg	26U	27U	26U	26U	31U	31U	31U
Indeno(1,2,3-c,d)pyrene	ug/kg	26UJ	15J	26UJ	26UJ	31UJ	31UJ	31UJ
Naphthalene	ug/kg	26U	27U	26U	26U	31U	31U	31U
Phenanthrene	ug/kg	26U	27U	26U	26U	31U	31U	31U
Pyrene	ug/kg	26U	17J	26U	26U	31U	31U	31U
Dioxins/Furans (EPA Method 8290)								
1,2,3,4,6,7,8-HpCDD	pg/g	NA	1.92	NA	6.96	NA	NA	NA
1,2,3,4,6,7,8-HpCDF	pg/g	NA	0.394	NA	1.35	NA	NA	NA
1,2,3,4,7,8,9-HpCDF	pg/g	NA	0.253U	NA	0.258U	NA	NA	NA
1,2,3,4,7,8-HxCDD	pg/g	NA	0.253U	NA	0.258U	NA	NA	NA
1,2,3,4,7,8-HxCDF	pg/g	NA	0.0647	NA	0.138	NA	NA	NA
1,2,3,6,7,8-HxCDD	pg/g	NA	0.117	NA	0.472	NA	NA	NA
1,2,3,6,7,8-HxCDF	pg/g	NA	0.0829	NA	0.153	NA	NA	NA
1,2,3,7,8,9-HxCDD	pg/g	NA	0.115	NA	0.377	NA	NA	NA
1,2,3,7,8,9-HxCDF	pg/g	NA	0.253U	NA	0.223	NA	NA	NA
1,2,3,7,8-PeCDD	pg/g	NA	0.253U	NA	0.115	NA	NA	NA
1,2,3,7,8-PeCDF	pg/g	NA	0.253U	NA	0.099	NA	NA	NA
2,3,4,6,7,8-HxCDF	pg/g	NA	0.135	NA	0.252	NA	NA	NA
2,3,4,7,8-PeCDF	pg/g	NA	0.154	NA	0.221	NA	NA	NA
2,3,7,8-TCDD	pg/g	NA	0.109	NA	0.161	NA	NA	NA
2,3,7,8-TCDF	pg/g	NA	0.0687	NA	0.144	NA	NA	NA
OCDD	pg/g	NA	16.5	NA	59	NA	NA	NA
OCDF	pg/g	NA	0.821	NA	4.11	NA	NA	NA
Total HpCDDs	pg/g	NA	4.35	NA	13.7	NA	NA	NA
Total HpCDFs	pg/g	NA	0.883	NA	3.34	NA	NA	NA
Total HxCDDs	pg/g	NA	0.521	NA	2.66	NA	NA	NA
Total HxCDFs	pg/g	NA	1.48	NA	2.92	NA	NA	NA
Total PeCDDs	pg/g	NA	0.141	NA	0.254	NA	NA	NA
Total PeCDFs	pg/g	NA	2.54	NA	2.49	NA	NA	NA
Total TCDDs	pg/g	NA	0.228U	NA	0.214	NA	NA	NA
Total TCDFs	pg/g	NA	1.08	NA	1.47	NA	NA	NA
Metals (EPA Method 6010B)								
Aluminum	mg/kg	15800	8760	6870	9010	12100	13500	7860
Antimony	mg/kg	6.3U	6.5U	6.2U	6.3U	7.4U	7.4U	7.5U
Arsenic	mg/kg	4.2	2.8	2.5	3.2	3.2	3.5	2.2
Barium	mg/kg	145	96.8	77.7	110	103	111	74.4
Beryllium	mg/kg	0.21	0.43U	0.085	0.088UJ	0.11UJ	0.49U	0.5U
Cadmium	mg/kg	0.5	0.31	0.58	0.55	0.76	0.42	0.39
Calcium	mg/kg	6000	4090	4690	7110	4430	6000	1990
Chromium	mg/kg	14.3	8.4	7.3	9.6	12.7	12.2	12.2
Cobalt	mg/kg	7.2	5.2	3.6	5.1	5.4	6.3	3.5
Copper	mg/kg	9.4	5.7	4	6.5	7.9	6.4	6.8
Iron	mg/kg	18400	12300	9270	12700	14100	15400	7670
Lead	mg/kg	6	6	2.5	4.9	12.7	3.5	4.3
Magnesium	mg/kg	6900	4310	3150	4530	5040	5920	2180
Manganese	mg/kg	227J	181J	156J	196J	175J	225J	88.1J
Mercury (EPA Method 7471A)	mg/kg	0.021	0.013	0.015	0.029	0.025	0.011	0.019
Nickel	mg/kg	9.5	5.1	5.4	6.9	7	7.6	7.4

Table G-2: Surface Soil Sample Analytical Results - RSE Investigation

	Sample ID:	LK098	LK101	LK104	LK107	LK110	LK113	LK119
	Location ID:	HA28	HA29	HA30	HA31	HA32	HA33	HA33
	SampleType:	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate
	Sample Date:	10/15/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002	10/15/2002
Parameter	Sample Depth:	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'	0 - 1'
Potassium	mg/kg	3600J	2740J	1900J	2440J	2730J	3270J	902J
Selenium	mg/kg	0.63U	0.65U	0.62U	0.63U	0.74U	0.74U	0.75U
Silver	mg/kg	1.1U	1.1U	1UJ	1UJ	2	1.2UJ	1.2UJ
Sodium	mg/kg	210U	220U	210U	210U	250U	250U	250U
Thallium	mg/kg	0.84U	0.86U	0.82U	0.83U	0.98U	0.99U	1U
Vanadium	mg/kg	40.4	27	20.5	27.7	31.6	35.1	21.5
Zinc	mg/kg	46.5	33	25.1	33.2	43.7	37.5	28.4
General Chemistry								
Moisture (ASTM D 2216)	%	5.1	7.2	3	4	18.4	19.1	19.8
pH (EPA Method 9045)	pH	8.44	9.31	9.42	9.03	8.43	9.35	8.63

NOTES:

mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
pg/g = picogram per per kilogram
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds
SVOCs = semivolatile organic compounds
PAHs = polynuclear aromatic hydrocarbons

pH = the negative log of the hydrogen ion concentration
AA3 = Anomaly Area 3
RSE = Removal Site Evaluation
U = indicates the analyte was not detected at or above the stated limit.
UJ = indicates the analyte was not detected at or above the stated limit. The sample detection limit is an estimated value.
J = indicates an estimated value.
NA = not analyzed; Only 10% of soil samples collected were analyzed for Dioxin/Furans.

Appendix B5
Groundwater Sampling Information

Table I-1: Groundwater Sampling Details – RSE Investigation

Location ID	Round	Sample ID	Earth Tech ID	Sampling Date	Sample Type	pH	Petroleum Hydrocarbons	VOCs	SVOCs	PAH	Metals	Perchlorate	Hexavalent Chromium
MW01	1	LK256	AA 3-MW01GW-S01-D000	12/3/2002	Regular	√	√	√	√	√	√	√	-
	2	LK332	AA 3-MW01GW-S02-D000	04/1/2003	Regular	√	√	√	√	√	√	√	-
	2	LK333	AA 3-MW01GW-D03-D000	04/1/2003	Duplicate of LK332	√	√	√	√	√	√	√	-
	3	LK362	AA3-MW01GW-S04-D000	11/18/2003	Regular	√	√	√	√	√	√	√	-
	3	LK363	AA3-MW01GW-D05-D000	11/18/2003	Duplicate of LK362	√	√	√	√	√	√	√	-
	4	LK391	AA3-MW01GW-S06-D000	04/06/2004	Regular	√	√	√	√	√	√	√	√
	4	LK392	AA3-MW01GW-S07-D000	04/06/2004	Regular	-	-	-	-	-	√ (D)	-	-
	4	LK393	AA3-MW01GW-D08-D000	04/06/2004	Duplicate of LK391	√	√	√	√	√	√	√	-
	4	LK394	AA3-MW01GW-D09-D000	04/06/2004	Duplicate of LK393	-	-	-	-	-	√ (D)	-	-
	5	LK419	AA3-MW01GW-S10-D000	07/06/2004	Regular	√	√	√	√	√	√	-	√
	5	LK420	AA3-MW01GW-S11-D000	07/06/2004	Regular	-	-	-	-	-	√ (D)	-	-
	5	LK421	AA3-MW01GW-D12-D000	07/06/2004	Duplicate of LK419	√	√	√	√	√	√	-	-
	6	LK454	AA3-MW01GW-S13-D000	10/07/2004	Regular	√	√	√	√	√	√	-	√
	6	LK455	AA3-MW01GW-D14-D000	10/07/2004	Duplicate of LK454	√	√	√	√	√	√	-	-
	6	LK456	AA3-MW01GW-S15-D000	10/07/2004	Regular	-	-	-	-	-	√ (D)	-	-
	7	LK484	AA3-MW01GW-S16-D000	02/23/2005	Regular	√	√	√	√	√	√	-	-
	7	LK485	AA3-MW01GW-S17-D000	02/23/2005	Regular	-	-	-	-	-	√ (D)	-	-
MW02	1	LK264	AA 3-MW02GW-S01-D000	12/4/2002	Regular	√	√	√	√	√	√	√	-
	2	LK340	AA 3-MW02GW-S02-D000	04/2/2003	Regular	√	√	√	√	√	√	√	-
	2	LK341	AA 3-MW02GW-D03-D000	04/2/2003	Duplicate of LK340	√	√	√	√	√	√	√	-
	3	LK368	AA3-MW02GW-S04-D000	11/19/2003	Regular	√	√	√	√	√	√	√	-
	3	LK369	AA3-MW02GW-D05-D000	11/19/2003	Duplicate of LK368	√	√	√	√	√	√	√	-
	4	LK395	AA3-MW02GW-S06-D000	04/06/2004	Regular	√	√	√	√	√	√	√	√
	4	LK396	AA3-MW02GW-S07-D000	04/06/2004	Regular	-	-	-	-	-	√ (D)	-	-
	4	LK397	AA3-MW02GW-D08-D000	04/06/2004	Duplicate of LK395	√	√	√	√	√	√	√	√
	4	LK398	AA3-MW02GW-D09-D000	04/06/2004	Duplicate of LK396	-	-	-	-	-	√ (D)	-	-
	5	LK425	AA3-MW02GW-S10-D000	07/07/2004	Regular	√	√	√	√	√	√	-	√
	5	LK426	AA3-MW02GW-D11-D000	07/07/2004	Duplicate of LK425	√	√	√	√	√	√	-	-
	5	LK427	AA3-MW02GW-S12-D000	07/07/2004	Regular	-	-	-	-	-	√ (D)	-	-
	5	LK428	AA3-MW02GW-D13-D000	07/07/2004	Duplicate of LK427	-	-	-	-	-	√ (D)	-	-
	6	LK460	AA3-MW02GW-S14-D000	10/08/2004	Regular	√	√	√	√	√	√	-	√
	6	LK461	AA3-MW02GW-D15-D000	10/08/2004	Duplicate of LK460	√	√	√	√	√	√	-	-
	6	LK462	AA3-MW02GW-S16-D000	10/08/2004	Regular	-	-	-	-	-	√ (D)	-	-
	7	LK488	AA3-MW02GW-S17-D000	02/24/2005	Regular	√	√	√	√	√	√	-	-
	7	LK489	AA3-MW02GW-S18-D000	02/24/2005	Regular	-	-	-	-	-	√ (D)	-	-
V03	1	LK261	AA 3-MW03GW-S01-D000	12/4/2002	Regular	√	√	√	√	√	√	√	-
	2	LK297	AA 3-MW03GW-S02-D000	03/19/2003	Regular	√	√	√	√	√	√	√	-

Table I-1: Groundwater Sampling Details – RSE Investigation

Location ID	Round	Sample ID	Earth Tech ID	Sampling Date	Sample Type	pH	Petroleum Hydrocarbons	VOCs	SVOCs	PAH	Metals	Perchlorate	Hexavalent Chromium
	3	LK346	AA 3-MW03GW-S03-D000	11/11/2003	Regular	√	√	√	√	√	√	√	-
MW04	1	LK258	AA 3-MW04GW-S01-D000	12/3/2002	Regular	√	√	√	√	√	√	√	-
	2	LK329	AA 3-MW04GW-S02-D000	03/28/2003	Regular	√	√	√	√	√	√	√	-
	3	LK359	AA 3-MW04GW-S03-D000	11/17/2003	Regular	√	√	√	√	√	√	-	-
	4	LK384	AA 3-MW04GW-S04-D000	04/05/2004	Regular	√	√	√	√	√	√	-	-
	5	LK418	AA 3-MW04GW-S05-D000	07/06/2004	Regular	√	√	√	√	√	√	-	-
	6	LK451	AA 3-MW04GW-S06-D000	10/07/2004	Regular	√	√	√	√	√	√	-	-
	7	LK482	AA3-MW04GW-S07-D000	02/18/2005	Regular	√	√	√	√	√	√	-	-
MW05	1	LK243	AA 3-MW05GW-S01-D000	11/27/2002	Regular	√	√	√	√	√	√	√	-
	2	LK324	AA 3-MW05GW-S02-D000	03/27/2003	Regular	√	√	√	√	√	√	√	-
	3	LK355	AA 3-MW05GW-S03-D000	11/13/2003	Regular	√	√	√	√	√	√	-	-
	4	LK378	AA 3-MW05GW-S04-D000	04/01/2004	Regular	√	√	√	√	√	√	-	-
	5	LK412	AA 3-MW05GW-S05-D000	07/01/2004	Regular	√	√	√	√	√	√	-	-
	6	LK446	AA 3-MW05GW-S06-D000	10/06/2004	Regular	√	√	√	√	√	√	-	-
	7	LK489	AA3-MW05GW-S07-D000	02/28/2005	Regular	√	√	√	√	√	√	-	-
MW06	1	LK240	AA 3-MW06GW-S01-D000	11/26/2002	Regular	√	√	√	√	√	√	√	-
	2	LK299	AA 3-MW06GW-S02-D000	03/20/2003	Regular	√	√	√	√	√	√	√	-
	3	LK347	AA 3-MW06GW-S03-D000	11/11/2003	Regular	√	√	√	√	√	√	√	-
	4	LK389	AA 3-MW06GW-S04-D000	04/06/2003	Regular	√	√	√	√	√	√	√	√
	4	LK390	AA 3-MW06GW-S05-D000	04/06/2003	Regular	-	-	-	-	-	√ (D)	-	-
	5	LK409	AA 3-MW06GW-S06-D000	07/01/2004	Regular	√	√	√	√	√	√	-	√
	5	LK410	AA 3-MW06GW-D07-D000	07/01/2004	Duplicate of LK409 (Cr+06 only)	-	-	-	-	-	-	-	√
	5	LK411	AA 3-MW06GW-S08-D000	07/01/2004	Regular	-	-	-	-	-	√ (D)	-	-
	6	LK441	AA 3-MW06GW-S09-D000	10/06/2004	Regular	√	√	√	√	√	√	-	√
	6	LK442	AA 3-MW06GW-D10-D000	10/06/2004	Duplicate of LK441 (Cr+06 only)	-	-	-	-	-	-	-	√
	6	LK443	AA 3-MW06GW-S11-D000	10/06/2004	Regular	-	-	-	-	-	√ (D)	-	-
	7	LK500	AA3-MW06GW-S12-D000	02/28/2005	Regular	√	√	√	√	√	√	-	√
	7	LK501	AA3-MW06GW-D13-D000	02/28/2005	Duplicate of LK500 (Cr+06 only)	-	-	-	-	-	-	-	√
	7	LK502	AA3-MW06GW-S14-D000	02/28/2005	Regular	-	-	-	-	-	√ (D)	-	-
	7	LK503	AA3-MW06GW-D15-D000	02/28/2005	Duplicate of LK502	-	-	-	-	-	√ (D)	-	-
MW07	1	LK237	AA 3-MW07GW-S01-D000	11/26/2002	Regular	√	√	√	√	√	√	√	-
	2	LK325	AA 3-MW07GW-S02-D000	03/27/2003	Regular	√	√	√	√	√	√	√	-
	3	LK358	AA 3-MW07GW-S03-D000	11/17/2003	Regular	√	√	√	√	√	√	√	-
	4	LK381	AA 3-MW07GW-S04-D000	04/02/2004	Regular	√	√	√	√	√	√	√	-
	5	LK415	AA 3-MW07GW-S05-D000	07/02/2004	Regular	√	√	√	√	√	√	-	-
	6	LK449	AA 3-MW07GW-S06-D000	10/07/2004	Regular	√	√	√	√	√	√	-	-

Table I-1: Groundwater Sampling Details – RSE Investigation

Location ID	Round	Sample ID	Earth Tech ID	Sampling Date	Sample Type	pH	Petroleum Hydrocarbons	VOCs	SVOCs	PAH	Metals	Perchlorate	Hexavalent Chromium
	7	LK480	AA3-MW07GW-S07-D000	02/16/2005	Regular	√	√	√	√	√	√	-	-
MW08	1	LK255	AA 3-MW08GW-S01-D000	12/3/2002	Regular	√	√	√	√	√	√	√	-
	2	LK337	AA 3-MW08GW-S02-D000	04/02/2003	Regular	√	√	√	√	√	√	√	-
	2	LK338	AA 3-MW08GW-D03-D000	04/02/2003	Duplicate of LK337	√	√	√	√	√	√	√	-
	3	LK364	AA 3-MW08GW-S04-D000	11/18/2003	Regular	√	√	√	√	√	√	√	-
	3	LK365	AA 3-MW08GW-D05-D000	11/18/2003	Duplicate of LK364	√	√	√	√	√	√	√	-
	4	LK385	AA 3-MW08GW-S06-D000	04/05/2004	Regular	√	√	√	√	√	√	-	-
	4	LK386	AA 3-MW08GW-D07-D000	04/05/2004	Duplicate of LK385	√	√	√	√	√	√	-	-
	5	LK424	AA 3-MW08GW-S08-D000	07/07/2004	Regular	√	√	√	√	√	√	-	-
	6	LK452	AA 3-MW08GW-S09-D000	10/07/2004	Regular	√	√	√	√	√	√	-	-
	7	LK495	AA3-MW08GW-S10-D000	02/25/2005	Regular	√	√	√	√	√	√	-	-
MW09A	1	LK246	AA 3-MW09AGW-S01-D000	11/27/2002	Regular	√	√	√	√	√	√	√	-
	2	LK319	AA 3-MW09AGW-S02-D000	03/26/2003	Regular	√	√	√	√	√	√	√	-
	3	LK351	AA 3-MW09AGW-S03-D000	11/12/2003	Regular	√	√	√	√	√	√	√	-
	4	LK374	AA 3-MW09AGW-S04-D000	03/31/2004	Regular	√	√	√	√	√	√	-	-
	5	LK405	AA 3-MW09AGW-S05-D000	06/30/2004	Regular	√	√	√	√	√	√	-	-
	6	LK437	AA 3-MW09AGW-S06-D000	10/05/2004	Regular	√	√	√	√	√	√	-	-
	7	LK491	AA3-MW09AGW-S07-D000	02/24/2005	Regular	√	√	√	√	√	√	-	-
MW09B	1	LK249	AA 3-MW09BGW-S01-D000	11/27/2002	Regular	√	√	√	√	√	√	√	-
	2	LK320	AA 3-MW09BGW-S02-D000	03/26/2003	Regular	√	√	√	√	√	√	√	-
	3	LK354	AA 3-MW09BGW-S03-D000	11/13/2003	Regular	√	√	√	√	√	√	√	-
	4	LK375	AA 3-MW09BGW-S04-D000	03/31/2004	Regular	√	√	√	√	√	√	-	-
	5	LK406	AA 3-MW09BGW-S05-D000	06/30/2004	Regular	√	√	√	√	√	√	-	-
	6	LK438	AA 3-MW09BGW-S06-D000	10/05/2004	Regular	√	√	√	√	√	√	-	-
	7	LK493	AA3-MW09BGW-S07-D000	02/25/2005	Regular	√	√	√	√	√	√	-	-
MW10	1	LK252	AA 3-MW10GW-S01-D000	12/2/2002	Regular	√	√	√	√	√	√	√	-
	1	LK253	AA 3-MW10GW-D02-D000	12/2/2002	Duplicate of LK252	√	√	√	√	√	√	√	-
	2	LK301	AA 3-MW10GW-S03-D000	03/20/2003	Regular	√	√	√	√	√	√	√	-
	3	LK350	AA 3-MW10GW-S04-D000	11/12/2003	Regular	√	√	√	√	√	√	√	-
	4	LK373	AA 3-MW10GW-S05-D000	03/30/2004	Regular	√	√	√	√	√	√	-	-
	5	LK402	AA 3-MW10GW-S06-D000	06/29/2004	Regular	√	√	√	√	√	√	-	-
	6	LK436	AA 3-MW10GW-S07-D000	10/05/2004	Regular	√	√	√	√	√	√	-	-
	7	LK478	AA3-MW10GW-S08-D000	02/17/2005	Regular	√	√	√	√	√	√	-	-
MW11	7	LK466	AA3-MW11GW-S01-D000	02/15/2005	Regular	√	√	√	√	√	√	-	-
	7	LK467	AA3-MW10GW-S08-D000	02/15/2005	Regular	-	-	-	-	-	√ (D)	-	-
/12	7	LK469	AA3-MW10GW-S08-D000	02/16/2005	Regular	√	√	√	√	√	√	-	-
	7	LK472	AA3-MW10GW-S08-D000	02/16/2005	Regular	-	-	-	-	-	√ (D)	-	-
MW13	7	LK471	AA3-MW10GW-S08-D000	02/16/2005	Regular	√	√	√	√	√	√	-	√

Table I-1: Groundwater Sampling Details – RSE Investigation

Location ID	Round	Sample ID	Earth Tech ID	Sampling Date	Sample Type	pH	Petroleum Hydrocarbons	VOCs	SVOCs	PAH	Metals	Perchlorate	Hexavalent Chromium
	7	LK473	AA3-MW10GW-S08-D000	02/16/2005	Regular	-	-	-	-	-	√ (D)	-	-
MW14	7	LK475	AA3-MW10GW-S08-D000	02/17/2005	Regular	√	√	√	√	√	√	-	-
	7	LK476	AA3-MW10GW-S08-D000	02/17/2005	Regular	-	-	-	-	-	√ (D)	-	-

Table I-2: Round 1 GroundwaterSample Analytical Results - RSE Investigation

	Sample ID:	LK256	LK264	LK261	LK258	LK243	LK240	LK237	LK255	LK246	LK249
	Location ID:	AA3-MW01	AA3-MW02	AA3-MW03	AA3-MW04	AA3-MW05	AA3-MW06	AA3-MW07	AA3-MW08	AA3-MW09A	AA3-MW09
	Sample Type:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular
Parameter	Sample Date:	12/3/2002	12/4/2002	12/4/2002	12/3/2002	11/27/2002	11/26/2002	11/26/2002	12/3/2002	11/27/2002	11/27/200
TPH (EPA Method 8015B DRO)	Units										
Motor Oils	mg/L	0.096 U	0.37	0.096 U	0.096 U	100 U	0.096 U	0.096 U	0.096 U	100 U	100 U
Diesel Fuel	mg/L	0.096 U	1.3	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.008 J	0.096 U	0.096 U
Gasoline	mg/L	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
VOCs (EPA Method 8260B)											
1,1,1,2-Tetrachloroethane	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,1-Trichloroethane	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/L	5 UJ	5 UJ	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ
1,1-Dichloroethane	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-Trichloropropane	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	ug/L	5 UJ	5 U	5 UJ	5 UJ	5 U	5 U	5 UJ	5 UJ	5 U	5 U
2-Hexanone	ug/L	50 U	50 UJ	50 U	50 U	50 UJ	50 UJ	50 U	50 U	50 UJ	50 UJ
4-Methyl-2-Pentanone	ug/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Acetone	ug/L	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ
Benzene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	ug/L	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Bromoform	ug/L	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U
Bromomethane	ug/L	1 UJ	1 U	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U
Carbon Disulfide	ug/L	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
Carbon Tetrachloride	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U
Chlorobenzene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	ug/L	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.61	0.1 U	0.1 U
Chloromethane	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,2-Dichloroethene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,3-Dichloropropene	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorodibromomethane	ug/L	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Dichlorodifluoromethane (F12)	ug/L	1 U	1 U	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U
Diisopropyl Ether	ug/L	5 U	5 UJ	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U
Ethyl-tert-butyl ether (ETBE)	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone (MEK)	ug/L	100 U	100 UJ	100 U	100 U	100 UJ	100 UJ	100 UJ	100 U	100 UJ	100 UJ
Methylene Chloride	ug/L	3 U	3 U	3 U	3 U	3 U	3 UJ	3 U	3 U	3 U	3 U
Methyl Tert-Butyl Ether	ug/L	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Styrene	ug/L	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
tertiary-Butyl alcohol (TBA)	ug/L	2 UJ	2 U	2 UJ	2 UJ	2 U	2 U	2 UJ	2 UJ	2 U	2 U
Tetrachloroethene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	ug/L	1 U	1 UJ	1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 UJ	1 UJ
Trans-1,3-Dichloropropene	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Total Xylenes	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Table I-2: Round 1 GroundwaterSample Analytical Results - RSE Investigation

Parameter	Sample ID:	LK256	LK264	LK261	LK258	LK243	LK240	LK237	LK255	LK246	LK249
	Location ID:	AA3-MW01	AA3-MW02	AA3-MW03	AA3-MW04	AA3-MW05	AA3-MW06	AA3-MW07	AA3-MW08	AA3-MW09A	AA3-MW0
	Sample Type:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular
	Sample Date:	12/3/2002	12/4/2002	12/4/2002	12/3/2002	11/27/2002	11/26/2002	11/26/2002	12/3/2002	11/27/2002	11/27/200
SVOCs (EPA Method 8270C)											
1,2,4-Trichlorobenzene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
1,2-Dichlorobenzene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
1,3-Dichlorobenzene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
1,4-Dichlorobenzene	ug/L	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U	5 U	4.8 U	4.8 U	4.8 U
Bis(2-Chloro-1-Methylethyl)Ether	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
2,4,5-Trichlorophenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
2,4,6-Trichlorophenol	ug/L	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U	5 U	4.8 U	4.8 U	4.8 U
2,4-Dichlorophenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
2,4-Dimethylphenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
2,4-Dinitrophenol	ug/L	48 U	48 U	48 U	48 U	48 U	48 U	50 U	48 U	48 U	48 U
2,4-Dinitrotoluene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
2,6-Dinitrotoluene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
2-Chloronaphthalene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
2-Chlorophenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
2-Methylphenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
2-Nitroaniline	ug/L	48 UJ	48 UJ	48 UJ	48 U	48 UJ	48 U	50 U	48 U	48 UJ	48 UJ
2-Nitrophenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
3,3'-Dichlorobenzidine	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
4-Methylphenol	ug/L	9.6 U	6 J	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
3-Nitroaniline	ug/L	48 U	48 U	48 U	48 U	48 U	48 U	50 U	48 U	48 U	48 U
4,6-Dinitro-2-Methylphenol	ug/L	48 U	48 U	48 U	48 U	48 UJ	48 UJ	50 UJ	48 U	48 UJ	48 UJ
4-Bromophenyl Phenyl Ether	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
4-Chloro-3-Methylphenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
4-Chloroaniline	ug/L	19 U	19 U	19 U	19 U	19 U	19 U	20 U	19 U	19 U	19 U
4-Chlorophenyl Phenyl Ether	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
4-Nitroaniline	ug/L	48 UJ	48 UJ	48 UJ	48 UJ	48 UJ	48 U	50 U	48 UJ	48 UJ	48 UJ
4-Nitrophenol	ug/L	48 U	48 U	48 U	48 U	48 U	48 U	50 U	48 U	48 U	48 U
Bis(2-Chloroethoxy)Methane	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
Bis(2-Chloroethyl)Ether	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
Bis(2-Ethylhexyl)Phthalate	ug/L	9.6 UJ	9.6 UJ	9.6 UJ	9.6 UJ	9.6 UJ	9.6 UJ	10 UJ	9.6 UJ	9.6 UJ	9.6 UJ
Butyl Benzyl Phthalate	ug/L	9.6 UJ	9.6 UJ	9.6 UJ	9.6 U	9.6 UJ	9.6 UJ	10 UJ	9.6 U	9.6 UJ	9.6 UJ
Carbazole	ug/L	48 U	48 U	48 U	48 U	48 U	48 U	50 U	48 U	48 U	48 U
Dibenzofuran	ug/L	9.6 UJ	9.6 UJ	9.6 UJ	9.6 U	9.6 UJ	9.6 U	10 U	9.6 U	9.6 UJ	9.6 UJ
Diethyl Phthalate	ug/L	2 J	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	2 J	9.6 U	9.6 U
Dimethyl Phthalate	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
Di-N-Butyl Phthalate	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
Di-N-Octyl Phthalate	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
Hexachlorobenzene	ug/L	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U
Hexachlorobutadiene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
Hexachlorocyclopentadiene	ug/L	48 U	48 U	48 U	48 U	48 U	48 U	50 U	48 U	48 U	48 U
Hexachloroethane	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
Isophorone	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
Nitrobenzene	ug/L	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U	5 U	4.8 U	4.8 U	4.8 U
N-Nitroso-Di-N-Propylamine	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
N-Nitrosodiphenylamine	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
Pentachlorophenol	ug/L	12 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U
Phenol	ug/L	9.6 U	12	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U
PAHs (Method PAH-SIM)											
2-Methylnaphthalene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Acenaphthene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Acenaphthylene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Anthracene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benz(A)Anthracene	ug/L	0.48 UJ	0.48 UJ	0.48 UJ	0.48 UJ	0.48 UJ	0.48 UJ	0.48 UJ	0.48 UJ	0.48 UJ	0.48 UJ
Benzo(A)Pyrene	ug/L	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U

Table I-2: Round 1 GroundwaterSample Analytical Results - RSE Investigation

	Sample ID:	LK256	LK264	LK261	LK258	LK243	LK240	LK237	LK255	LK246	LK249
	Location ID:	AA3-MW01	AA3-MW02	AA3-MW03	AA3-MW04	AA3-MW05	AA3-MW06	AA3-MW07	AA3-MW08	AA3-MW09A	AA3-MW0
	Sample Type:	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular
Parameter	Sample Date:	12/3/2002	12/4/2002	12/4/2002	12/3/2002	11/27/2002	11/26/2002	11/26/2002	12/3/2002	11/27/2002	11/27/200
Benzo(B)Fluoranthene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(G,H,I)Perylene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(K)Fluoranthene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Chrysene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Dibenz(A,H)Anthracene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Fluoranthene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Fluorene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Indeno(1,2,3-Cd)Pyrene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Naphthalene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Phenanthrene	ug/L	0.48 UJ	0.48 UJ	0.48 UJ	0.48 UJ	0.48 UJ	0.48 UJ	0.48 UJ	0.48 UJ	0.48 UJ	0.48 UJ
Pyrene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Metals (EPA Method 6010B)											
Aluminum	ug/L	13.1	315	18.4 J	31.4	120 J	101 J	302	287	195	204
Antimony	ug/L	4.4 UJ	4.2 UJ	60 U	3.2 UJ	60 U	60 U	60 U	2.8 UJ	60 U	60 U
Arsenic	ug/L	8.4 UJ	12 UJ	5.9 UJ	19.1	7.8 UJ	2.4	3.6	4.7 UJ	9.9 UJ	7.9 UJ
Barium	ug/L	45.6	48.4	23.9	30.3	23.2	24.1	52.7	39.5	50.1	36.4
Beryllium	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Cadmium	ug/L	0.15 UJ	0.25 UJ	0.22 UJ	0.49 UJ	0.45 UJ	0.47 UJ	0.98 UJ	0.28 UJ	0.33 UJ	0.4 UJ
Calcium	ug/L	170000	183000	180000	191000	129000	205000	243000	96800	116000	114000
Cobalt	ug/L	1.1 UJ	3.9 UJ	0.37 UJ	0.36 UJ	0.84 UJ	50 U	0.82 UJ	0.59 UJ	0.8 UJ	0.61 UJ
Copper	ug/L	5.9 UJ	47.2	5 UJ	15.2	2.7 UJ	2.2 UJ	6.7 UJ	6.6	4.2 UJ	2.6 UJ
Chromium	ug/L	27.4	296	5.2	20.1	2 UJ	1.8	11	5.3	1.9 UJ	3.1 UJ
Iron	ug/L	475	3430	38.9 UJ	258	181	79.1 UJ	430	381	263	545
Lead	ug/L	3.1 UJ	2.9 UJ	3.8	3.3 UJ	3 U	3 U	0.84 J	2.3 UJ	0.92 UJ	1.4 UJ
Magnesium	ug/L	83600	94500	83000	110000	69700	98300	99900	52400	42500	62500
Manganese	ug/L	19.6	829	12.9 J	59.7	60.5	24	71.5	145	20.5	8.9
Mercury	ug/L	0.18	0.2 U	0.037 J	0.098	0.021	0.2 U	0.027 J	0.12	0.05 J	0.038 J
Nickel	ug/L	105	54.2	4.8 UJ	31.1	4.9 UJ	2.9 UJ	12.6 J	5.2 UJ	3.8 UJ	5.1 UJ
Potassium	ug/L	3410	5670	5750	3100	7810	5350	5800	11100	4190	3520
Selenium	ug/L	14.3	15.3	35.8	12.4	21.6	26	33.2	4.8 J	13.3	7.5 J
Silver	ug/L	1.2	0.4	1	0.53	10 U	10 U	10 U	10 U	10 U	10 U
Sodium	ug/L	451000	413000	303000	386000	464000	358000	371000	364000	329000	413000
Thallium	ug/L	10 U	10 U	10 U	10 U	8 UJ	6.6 UJ	6.8 UJ	10 U	7.1 UJ	9.5 UJ
Vanadium	ug/L	25.2	8	15.8	43.6	19.7	17.2	18.3	5.7	33.9	15.4
Zinc	ug/L	48	26.4	20 J	20.9	9 UJ	11.2 UJ	48.3 J	19.8	10.3 UJ	11.4 UJ
Miscellaneous											
Perchlorate	ug/L	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
pH	pH	7	7	6.89	6.84	7.12	6.78	6.7	7.28	7.25	7.21

NOTES:

µg/L = micrograms per liter
mg/L = milligram per liter
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds
SVOCs = semivolatile organic compounds
PAHs = polynuclear aromatic hydrocarbons

pH = the negative log of the hydrogen ion concentration
AA3 = Anomaly Area 3
RSE = Removal Site Evaluation
U = indicates the analyte was not detected at or above the stated limit.
UJ = indicates the analyte was not detected at or above the stated limit. The sample detection limit is an estimated value.
J = indicates an estimated value.

Table I-3: Round 2 Groundwater Sample Analytical Results - RSE Investigation

	Sample ID:	LK332	LK333	LK340	LK341	LK297	LK329	LK324	LK299	LK325
	Location ID:	AA3-MW01	AA3-MW01	AA3-MW02	AA3-MW02	AA3-MW03	AA3-MW04	AA3-MW05	AA3-MW06	AA3-MW(
	Sample Date:	4/1/2003	4/1/2003	4/2/2003	4/2/2003	3/19/2003	3/28/2003	3/27/2003	3/20/2003	3/27/200:
Parameter	Sample Type:	Regular	Duplicate	Regular	Duplicate	Regular	Regular	Regular	Regular	Regular
TPH (EPA Method 8015B DRO)	Units									
Motor Oils	mg/L	0.096 U	0.096 U	0.096 U	0.08 J	0.13 U	0.13 U	0.14 U	0.13 U	0.14 U
Diesel Fuel	mg/L	0.096 U	0.096 U	0.096 U	0.02 J	0.096 U	0.096 U	0.1 U	0.096 U	0.1 U
Gasoline	mg/L	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
VOCs (EPA Method 8260B)										
1,1,1,2-Tetrachloroethane	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,1-Trichloroethane	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-Trichloropropane	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	ug/L	5 UJ	5 UJ	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U
2-Hexanone	ug/L	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
4-Methyl-2-Pentanone	ug/L	50 U	50 U	50 U	2 J	50 U	50 U	50 U	0.5 J	50 U
Acetone	ug/L	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 U	100 UJ
Benzene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	ug/L	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Bromoform	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	ug/L	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U
Carbon Disulfide	ug/L	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U
Carbon Tetrachloride	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U
Chlorobenzene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	ug/L	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Chloromethane	ug/L	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U
Cis-1,2-Dichloroethene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,3-Dichloropropene	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorodibromomethane	ug/L	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Dichlorodifluoromethane (F12)	ug/L	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U
Diisopropyl Ether	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethyl-tert-butyl ether (ETBE)	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone (MEK)	ug/L	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ
Methylene Chloride	ug/L	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Methyl Tert-Butyl Ether	ug/L	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 UJ	3 U
Styrene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
tertiary-Butyl alcohol (TBA)	ug/L	2 UJ	2 UJ	2 UJ	2 UJ	2 U	2 U	2 U	2 UJ	2 U
Tetrachloroethene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,3-Dichloropropene	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Total Xylenes	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SVOCs (EPA Method 8270C)										
1,2,4-Trichlorobenzene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
1,2-Dichlorobenzene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
1,3-Dichlorobenzene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
1,4-Dichlorobenzene	ug/L	4.8 U	4.8 U	4.8 U	4.8 U	5 U	4.8 U	4.8 U	5 U	4.8 U
Bis(2-Chloro-1-Methylethyl)Ether	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
2,4,5-Trichlorophenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
2,4,6-Trichlorophenol	ug/L	4.8 U	4.8 U	4.8 U	4.8 U	5 U	4.8 U	4.8 U	5 U	4.8 U

Table I-3: Round 2 Groundwater Sample Analytical Results - RSE Investigation

	Sample ID:	LK332	LK333	LK340	LK341	LK297	LK329	LK324	LK299	LK325
	Location ID:	AA3-MW01	AA3-MW01	AA3-MW02	AA3-MW02	AA3-MW03	AA3-MW04	AA3-MW05	AA3-MW06	AA3-MW(
	Sample Date:	4/1/2003	4/1/2003	4/2/2003	4/2/2003	3/19/2003	3/28/2003	3/27/2003	3/20/2003	3/27/200
Parameter	Sample Type:	Regular	Duplicate	Regular	Duplicate	Regular	Regular	Regular	Regular	Regular
2,4-Dichlorophenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
2,4-Dimethylphenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
2,4-Dinitrophenol	ug/L	48 U	48 U	48 U	48 U	50 UJ	48 U	48 U	50 UJ	48 U
2,4-Dinitrotoluene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
2,6-Dinitrotoluene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
2-Chloronaphthalene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
2-Chlorophenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
2-Methylphenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
2-Nitroaniline	ug/L	48 U	48 U	48 U	48 U	50 U	48 U	48 U	50 U	48 U
2-Nitrophenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
3,3'-Dichlorobenzidine	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
4-Methylphenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
3-Nitroaniline	ug/L	48 U	48 U	48 U	48 U	50 U	48 U	48 U	50 U	48 U
4,6-Dinitro-2-Methylphenol	ug/L	48 U	48 U	48 U	48 U	50 U	48 U	48 U	50 U	48 U
4-Bromophenyl Phenyl Ether	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
4-Chloro-3-Methylphenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
4-Chloroaniline	ug/L	19 U	19 U	19 U	19 U	20 U	19 U	19 U	20 U	19 U
4-Chlorophenyl Phenyl Ether	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
4-Nitroaniline	ug/L	48 UJ	48 UJ	48 UJ	48 UJ	50 U	48 UJ	48 UJ	50 U	48 UJ
4-Nitrophenol	ug/L	48 U	48 U	48 U	48 U	50 UJ	48 U	48 U	50 UJ	48 U
Bis(2-Chloroethoxy)Methane	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
Bis(2-Chloroethyl)Ether	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
Bis(2-Ethylhexyl)Phthalate	ug/L	9.6 U	9.6 U	9.6 U	2 J	10 U	9.6 U	9.6 U	10 U	9.6 U
Butyl Benzyl Phthalate	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	0.7 J	9.6 U	10 U	9.6 U
Carbazole	ug/L	48 U	48 U	48 U	48 U	50 U	48 U	48 U	50 U	48 U
Dibenzofuran	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
Diethyl Phthalate	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
Dimethyl Phthalate	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
Di-N-Butyl Phthalate	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
Di-N-Octyl Phthalate	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
Hexachlorobenzene	ug/L	0.96 U	0.96 U	0.96 U	0.96 U	1 U	0.96 U	0.96 U	1 U	0.96 U
Hexachlorobutadiene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
Hexachlorocyclopentadiene	ug/L	48 U	48 U	48 U	48 U	50 U	48 U	48 U	50 U	48 U
Hexachloroethane	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
Isophorone	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
Nitrobenzene	ug/L	4.8 U	4.8 U	4.8 U	4.8 U	5 U	4.8 U	4.8 U	5 U	4.8 U
N-Nitroso-Di-N-Propylamine	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
N-Nitrosodiphenylamine	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
Pentachlorophenol	ug/L	12 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U
Phenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	10 U	9.6 U	9.6 U	10 U	9.6 U
PAHs (Method PAH-SIM)										
2-Methylnaphthalene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Acenaphthene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Acenaphthylene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Anthracene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Benz(A)Anthracene	ug/L	0.48 UJ	0.48 UJ	0.48 UJ	0.48 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ
Benzo(A)Pyrene	ug/L	0.19 U	0.19 U	0.19 U	0.19 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(B)Fluoranthene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Benzo(G,H,I)Perylene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Benzo(K)Fluoranthene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.5 UJ	0.5 U	0.5 U	0.5 UJ	0.5 U
Chrysene	ug/L	0.48 UJ	0.48 UJ	0.48 UJ	0.48 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ
Dibenz(A,H)Anthracene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Fluoranthene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Fluorene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Indeno(1,2,3-Cd)Pyrene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Naphthalene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Phenanthrene	ug/L	0.48 UJ	0.48 UJ	0.48 UJ	0.48 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ
Pyrene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Table I-3: Round 2 Groundwater Sample Analytical Results - RSE Investigation

	Sample ID:	LK332	LK333	LK340	LK341	LK297	LK329	LK324	LK299	LK325
	Location ID:	AA3-MW01	AA3-MW01	AA3-MW02	AA3-MW02	AA3-MW03	AA3-MW04	AA3-MW05	AA3-MW06	AA3-MW(
	Sample Date:	4/1/2003	4/1/2003	4/2/2003	4/2/2003	3/19/2003	3/28/2003	3/27/2003	3/20/2003	3/27/200:
Parameter	Sample Type:	Regular	Duplicate	Regular	Duplicate	Regular	Regular	Regular	Regular	Regular
Metals (EPA Method 6010B)										
Aluminum	ug/L	22.5 UJ	8.2 UJ	25.7 UJ	20.3 UJ	200 U	36.6	141	53.5 UJ	169
Antimony	ug/L	3.8	60 U	60 U	2.7	60 U	60 U	60 U	60 U	60 U
Arsenic	ug/L	5.3	3.7	11.1	13.4	7.2 UJ	22.8	7.8	12.4 UJ	8
Barium	ug/L	36.8	36.1	44.1	43.1	21.6	30	24.3	29.8	53.3
Beryllium	ug/L	0.067 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Cadmium	ug/L	5 U	0.15 UJ	5 U	5 U	5 U	5 U	5 U	5 UJ	0.71 UJ
Calcium	ug/L	134000	131000	177000	173000	173000	192000	134000	225000	238000
Cobalt	ug/L	0.55 UJ	50 U	50 U	50 U	50 U	50 U	50 U	50 UJ	50 U
Copper	ug/L	7.4	3.2	8.5	5	2	6.1	4.8	3.2 UJ	7.8
Chromium	ug/L	203	120	15.4	11.4	0.68 UJ	4.7	4.6	3.8 UJ	4
Iron	ug/L	992	613	3660	3150	100 U	430	199	54.2 UJ	244
Lead	ug/L	3 U	3 U	3 U	3 U	3 U	3 UJ	3 UJ	3 U	3 UJ
Magnesium	ug/L	68000	67600	96100	95000	83000	112000	73600	106000	104000
Manganese	ug/L	7.5	5.2	799	768	7.6	53.3	11.5	30.7	54.2
Mercury	ug/L	0.15 UJ	0.12 UJ	0.33	0.15 UJ	0.067	0.15	0.18	0.2	0.17
Nickel	ug/L	55.3 J	40.8 J	19.3 J	6.9 J	6.1 UJ	23.3 UJ	2.8 UJ	3.6 UJ	9.7 UJ
Potassium	ug/L	2670 J	2570 J	8690 J	8020 J	6620	3300	5260	5540 J	3800
Selenium	ug/L	11.8	13.4	5.7	8	49.9	19.2	27.6	28.2	32.8
Silver	ug/L	2.3 UJ	2.5 UJ	2.7 UJ	3 UJ	2.6 UJ	2 UJ	1.9 UJ	10 UJ	2.8 UJ
Sodium	ug/L	357000	359000	399000	397000	302000	389000	413000	406000	361000
Thallium	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	5.7	10 U
Vanadium	ug/L	22.6	22.3	0.98 UJ	0.8 UJ	14.2	37.1	21.3	18.9	20.3
Zinc	ug/L	6.6	6.6	6.6	115	20 U	11.8	40.8	5.9 UJ	40.8
Miscellaneous										
Perchlorate	ug/L	3 U	3 U	3 U	3 U	3 U	3 UJ	3 UJ	3 U	3 UJ
pH	pH	7	7.06	6.89	6.95	6.86	6.85	7.17	6.71	6.96

NOTES:

µg/L = micrograms per liter
mg/L = milligram per liter
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds
SVOCs = semivolatile organic compounds
PAHs = polynuclear aromatic hydrocarbons

pH = the negative log of the hydrogen ion concentration
AA3 = Anomaly Area 3
RSE = Removal Site Evaluation
U = indicates the analyte was not detected at or above the stated limit.
UJ = indicates the analyte was not detected at or above the stated limit. The sample detection limit is an estimated value.
J = indicates an estimated value.

Table I-4: Round 3 Groundwater Sample Analytical Results - RSE Investigation

Parameter	Sample ID:	LK362	LK363	LK368	LK369	LK346	LK359	LK355	LK347	LK358
	Location ID:	AA3-MW01	AA3-MW01	AA3-MW02	AA3-MW02	AA3-MW03	AA3-MW04	AA3-MW05	AA3-MW06	AA3-MW
	Sample Date:	11/18/2003	11/18/2003	11/19/2003	11/19/2003	11/11/2003	11/17/2003	11/13/2003	11/11/2003	11/17/20
	Sample Type:	Regular	Duplicate	Regular	Duplicate	Regular	Regular	Regular	Regular	Regula
TPH (EPA Method 8015B DRO)	**Units**									
Motor Oils	mg/L	0.13 U	0.13 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U
Diesel Fuel	mg/L	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U
Gasoline	mg/L	0.1 U	0.1 U	0.02 J	0.02 J	0.1 U	0.02 J	0.03 J	0.1 U	0.03 J
VOCs (EPA Method 8260B)										
1,1,1,2-Tetrachloroethane	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,1-Trichloroethane	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-Trichloropropane	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	ug/L	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ
2-Hexanone	ug/L	50 U	50 U	50 U	50 U	50 UJ	50 U	50 U	50 UJ	50 U
4-Methyl-2-Pentanone	ug/L	50 UJ	50 UJ	50 U	50 U	50 UJ	50 UJ	50 UJ	50 UJ	50 UJ
Acetone	ug/L	100 UJ	100 UJ	100 U	100 U	100 U	100 UJ	100 UJ	100 U	100 UJ
Benzene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	ug/L	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Bromoform	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	ug/L	1 UJ	1 UJ	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
Carbon Disulfide	ug/L	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
Carbon Tetrachloride	ug/L	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorobenzene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	ug/L	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 UJ
Chloroform	ug/L	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Chloromethane	ug/L	1 UJ	1 UJ	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
cis-1,2-Dichloroethene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chlorodibromomethane	ug/L	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Dichlorodifluoromethane (F12)	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Diisopropyl Ether	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethyl-tert-butyl ether (ETBE)	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone (MEK)	ug/L	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 U	100 U	100 UJ	100 U
Methylene Chloride	ug/L	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Methyl tert-butyl ether	ug/L	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Styrene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
tertiary-Butyl alcohol (TBA)	ug/L	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ
Tetrachloroethene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	ug/L	5 UJ	5 UJ	5 UJ	5 UJ	5 U	5 UJ	5 UJ	5 U	5 UJ
Vinyl chloride	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Total xylenes	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SVOCs (EPA Method 8270C)										
1,2,4-Trichlorobenzene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
1,2-Dichlorobenzene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
1,3-Dichlorobenzene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
1,4-Dichlorobenzene	ug/L	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U
Bis(2-Chloro-1-Methylethyl)Ether	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
2,4,5-Trichlorophenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
2,4,6-Trichlorophenol	ug/L	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U

Table I-4: Round 3 Groundwater Sample Analytical Results - RSE Investigation

	Sample ID:	LK362	LK363	LK368	LK369	LK346	LK359	LK355	LK347	LK358
	Location ID:	AA3-MW01	AA3-MW01	AA3-MW02	AA3-MW02	AA3-MW03	AA3-MW04	AA3-MW05	AA3-MW06	AA3-MW
	Sample Date:	11/18/2003	11/18/2003	11/19/2003	11/19/2003	11/11/2003	11/17/2003	11/13/2003	11/11/2003	11/17/20
Parameter	Sample Type:	Regular	Duplicate	Regular	Duplicate	Regular	Regular	Regular	Regular	Regular
2,4-Dichlorophenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
2,4-Dimethylphenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
2,4-Dinitrophenol	ug/L	48 U	48 U	48 U	48 U	48 U	48 U	48 U	48 U	48 U
2,4-Dinitrotoluene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
2,6-Dinitrotoluene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
2-Chloronaphthalene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
2-Chlorophenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
2-Methylphenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
2-Nitroaniline	ug/L	48 U	48 U	48 U	48 U	48 U	48 U	48 U	48 U	48 U
2-Nitrophenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
3,3'-Dichlorobenzidine	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
4-Methylphenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
3-Nitroaniline	ug/L	48 U	48 U	48 U	48 U	48 U	48 U	48 U	48 U	48 U
4,6-Dinitro-2-Methylphenol	ug/L	48 U	48 U	48 U	48 U	48 U	48 U	48 U	48 U	48 U
4-Bromophenyl Phenyl Ether	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
4-Chloro-3-Methylphenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
4-Chloroaniline	ug/L	19 U	19 U	19 U	19 U	19 U	19 U	19 U	19 U	19 U
4-Chlorophenyl Phenyl Ether	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
4-Nitroaniline	ug/L	48 UJ	48 UJ	48 UJ	48 UJ	48 U	48 UJ	48 U	48 U	48 UJ
4-Nitrophenol	ug/L	48 UJ	48 UJ	48 UJ	48 UJ	48 U	48 UJ	48 U	48 U	48 UJ
Bis(2-Chloroethoxy)Methane	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Bis(2-Chloroethyl)Ether	ug/L	9.6 UJ	9.6 UJ	9.6 UJ	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Bis(2-Ethylhexyl)Phthalate	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
butyl Benzyl phthalate	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Carbazole	ug/L	48 U	48 U	48 U	48 U	48 U	48 U	48 U	48 U	48 U
Dibenzofuran	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Diethyl Phthalate	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Dimethyl Phthalate	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Di-N-Butyl Phthalate	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Di-N-Octyl Phthalate	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Hexachlorobenzene	ug/L	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
Hexachlorobutadiene	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Hexachlorocyclopentadiene	ug/L	48 U	48 U	48 U	48 U	48 U	48 U	48 U	48 U	48 U
Hexachloroethane	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Isophorone	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Nitrobenzene	ug/L	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U
N-Nitroso-Di-N-Propylamine	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
N-Nitrosodiphenylamine	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Pentachlorophenol	ug/L	12 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U
Phenol	ug/L	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
PAHs (Method PAH-SIM)										
2-Methylnaphthalene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Acenaphthene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Acenaphthylene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Anthracene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benz(a)anthracene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(a)pyrene	ug/L	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Benzo(b)fluoranthene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(g,h,i)perylene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(k)fluoranthene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Chrysene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Dibenz(a,h)anthracene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Fluoranthene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Fluorene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Indeno(1,2,3-Cd)Pyrene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Naphthalene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Phenanthrene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Pyrene	ug/L	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U

Table I-4: Round 3 Groundwater Sample Analytical Results - RSE Investigation

	Sample ID:	LK362	LK363	LK368	LK369	LK346	LK359	LK355	LK347	LK358
	Location ID:	AA3-MW01	AA3-MW01	AA3-MW02	AA3-MW02	AA3-MW03	AA3-MW04	AA3-MW05	AA3-MW06	AA3-MW0
	Sample Date:	11/18/2003	11/18/2003	11/19/2003	11/19/2003	11/11/2003	11/17/2003	11/13/2003	11/11/2003	11/17/200
Parameter	Sample Type:	Regular	Duplicate	Regular	Duplicate	Regular	Regular	Regular	Regular	Regular
Metals (EPA Method 6010B)										
Aluminum	ug/L	38.2 UJ	24.4 UJ	33.9 UJ	28.1 UJ	9.4 UJ	31.2 UJ	43.1 UJ	21.4 UJ	370
Antimony	ug/L	5.8 UJ	7.8 UJ	5.9 UJ	2.5 UJ	60 UJ	60 U	60 U	60 UJ	3.2
Arsenic	ug/L	10 UJ	1.7 J	10 UJ	10 UJ	6.2 UJ	24.5	6.6	4.5 UJ	4.6
Barium	ug/L	36.4	36	41.5	40.5	19.6	31.2	23.2	21.9	71.3
Beryllium	ug/L	0.11 UJ	0.098 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Cadmium	ug/L	5 U	5 U	5 U	5 U	5 U	0.4 UJ	5 U	0.25 UJ	0.84 UJ
Calcium	ug/L	126000	128000	176000	173000	163000	196000	138000	203000	244000
Cobalt	ug/L	50 U	50 U	50 U	50 U	0.39 UJ	50 U	50 U	50 U	50 U
Copper	ug/L	6.3	3.6	6	5.8	3.1 UJ	5 UJ	4.3 UJ	4.4 UJ	5.1 UJ
Chromium	ug/L	5.1	3.5	12.8	12.8	27.5	2	1.9 UJ	4.1 J	3.7
Iron	ug/L	49.3 UJ	28.8 UJ	1100	1060	143 J	100 U	46.5 UJ	26.3 UJ	421
Lead	ug/L	1 UJ	1 UJ	3 U	3 U	3 U	3 U	1.3 UJ	3 U	3 U
Magnesium	ug/L	68600	69200	97600	95700	76000	108000	77600	101000	99600
Manganese	ug/L	2.1 UJ	2.1 UJ	688	663	11	27.3	10.9	2.4 UJ	104
Mercury	ug/L	0.067 J	0.07 J	0.036 J	0.017 J	0.087 J	0.2 U	0.013	0.057 J	0.014
Nickel	ug/L	7.1	6.9	12.8	12.2	14.2	10.9	1.8 UJ	5.4 UJ	12.2
Potassium	ug/L	2500	2590	7090	6520	5880	3090	5020	4810	3440
Selenium	ug/L	17.9	16.1	11.9	10.9	30.6	17.5 UJ	32.4	18.1	34.3
Silver	ug/L	0.94 UJ	2.5 UJ	3.1 UJ	3.3 UJ	2.6 UJ	1.7 UJ	1.7 UJ	2.5 UJ	2.7 UJ
Sodium	ug/L	377000	383000	413000	407000	315000	387000	426000	389000	355000
Thallium	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Vanadium	ug/L	22.2	22.7	1.3 UJ	1.3 UJ	15	42	21.4	18.2	22.8
Zinc	ug/L	26.2 J	33.4 J	24 J	6.3 J	15.1 J	30.9	14.2	16 J	27.5
Miscellaneous										
Perchlorate	ug/L	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
pH	pH	6.99	7	6.9	6.97	6.82	6.91	6.97	6.76	6.81

NOTES:

µg/L = micrograms per liter
mg/L = milligram per liter
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds
SVOCs = semivolatile organic compounds
PAHs = polynuclear aromatic hydrocarbons

pH = the negative log of the hydrogen ion concentration
AA3 = Anomaly Area 3
RSE = Removal Site Evaluation
U = indicates the analyte was not detected at or above the stated *limit*.
UJ = indicates the analyte was not detected at or above the stated limit. The sample detection limit is an estimated value.
J = indicates an estimated value.

Table I-5: Round 4 Groundwater Sample Analytical Results - RSE Investigation

	Sample ID:	LK391	LK392	LK393	LK394	LK395	LK396	LK397	LK398	LK384	LK378	LK389
	Location ID:	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW04	AA3-MW05	AA3-MW06
	Sample Date:	4/6/2004	4/6/2004	4/6/2004	4/6/2004	4/6/2004	4/6/2004	4/6/2004	4/6/2004	4/5/2004	4/1/2004	4/6/2004
Parameter	Sample Type:	Regular	Regular	Duplicate	Duplicate	Regular	Regular	Duplicate	Duplicate	Regular	Regular	Regular
TPH (EPA Method 8015B DRO)	**Units**											
Motor Oils	mg/L	0.096 U	–	0.096 U	–	0.096 U	–	0.096 U	–	0.096 U	0.096 U	0.096 U
Diesel Fuel	mg/L	0.096 U	–	0.096 U	–	0.096 U	–	0.096 U	–	0.096 U	0.096 U	0.096 U
Gasoline	mg/L	0.02 J	–	0.03 J	–	0.03 J	–	0.1 U	–	0.04 J	0.03 J	0.03 J
VOCs (EPA Method 8260B)												
1,1,1,2-Tetrachloroethane	ug/L	0.5 U	–	0.5 U	–	0.5 U	–	0.5 U	–	0.5 U	0.5 U	0.5 U
1,1,1-Trichloroethane	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 U	1 U	1 U
1,1,2-Trichloroethane	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/L	5 U	–	5 U	–	5 U	–	5 U	–	5 U	5 U	5 U
1,1-Dichloroethane	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 U	1 U	1 U
1,1-Dichloroethene	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 U	1 U	1 U
1,2,3-Trichloropropane	ug/L	0.5 U	–	0.5 U	–	0.5 U	–	0.5 U	–	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	ug/L	0.5 U	–	0.5 U	–	0.5 U	–	0.5 U	–	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 U	1 U	1 U
1,2-Dichlorotetrafluoroethane	ug/L	5 U	–	5 U	–	5 U	–	5 U	–	5 U	5 U	5 U
2-Hexanone	ug/L	50 UJ	–	50 UJ	–	50 UJ	–	50 UJ	–	50 U	50 UJ	50 UJ
4-Methyl-2-Pentanone	ug/L	50 UJ	–	50 UJ	–	50 UJ	–	50 UJ	–	50 U	50 U	50 UJ
Acetone	ug/L	100 UJ	–	100 UJ	–	100 UJ	–	100 UJ	–	100 U	100 UJ	100 UJ
Benzene	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 U	1 U	1 U
Bromodichloromethane	ug/L	0.11 U	–	0.11 U	–	0.11 U	–	0.11 U	–	0.1 U	0.11 U	0.11 U
Bromoform	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 U	1 U	1 U
Bromomethane	ug/L	1 UJ	–	1 UJ	–	1 UJ	–	1 UJ	–	1 U	1 U	1 UJ
Carbon Disulfide	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 U	1 U	1 U
Carbon Tetrachloride	ug/L	0.5 U	–	0.5 U	–	0.5 U	–	0.5 U	–	0.5 U	0.5 U	0.5 U
Chlorobenzene	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 U	1 U	1 U
Chloroethane	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 UJ	1 U	1 U
Chloroform	ug/L	0.11 U	–	0.11 U	–	0.11 U	–	0.11 U	–	0.1 U	0.11 U	0.11 U
Chloromethane	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 U	1 U	1 U
cis-1,2-Dichloroethene	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 U	1 U	1 U
cis-1,3-Dichloropropene	ug/L	0.5 U	–	0.5 U	–	0.5 U	–	0.5 U	–	0.5 U	0.5 U	0.5 U
Chlorodibromomethane	ug/L	0.13 U	–	0.13 U	–	0.13 U	–	0.13 U	–	0.1 U	0.13 U	0.13 U
Dichlorodifluoromethane (F12)	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 U	1 U	1 U
Diisopropyl Ether	ug/L	5 U	–	5 U	–	5 U	–	5 U	–	5 U	5 U	5 U
Ethyl-tert-butyl ether (ETBE)	ug/L	5 U	–	5 U	–	5 U	–	5 U	–	5 U	5 UJ	5 U
Ethylbenzene	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 U	1 U	1 U
2-Butanone (MEK)	ug/L	100 UJ	–	100 UJ	–	100 UJ	–	100 UJ	–	100 U	100 UJ	100 UJ
Methylene Chloride	ug/L	3 UJ	–	3 UJ	–	3 UJ	–	3 UJ	–	3 U	3 U	3 UJ
Methyl tert-butyl ether	ug/L	3 U	–	3 U	–	3 U	–	3 U	–	3 U	3 UJ	3 U
Styrene	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 U	1 U	1 U
tert-Amyl methyl ether (TAME)	ug/L	5 U	–	5 U	–	5 U	–	5 U	–	5 U	5 UJ	5 U
tertiary-Butyl alcohol (TBA)	ug/L	2.2 UJ	–	2.2 UJ	–	2.2 UJ	–	2.2 UJ	–	2.7 UJ	2.2 UJ	2.2 UJ
Tetrachloroethene	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 U	1 U	1 U
Toluene	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 U	1 U	1 U
trans-1,2-Dichloroethene	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 U	1 U	1 U
trans-1,3-Dichloropropene	ug/L	0.5 U	–	0.5 U	–	0.5 U	–	0.5 U	–	0.5 U	0.5 U	0.5 U
Trichloroethene	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 U	1 U	1 U
Trichlorofluoromethane	ug/L	5 U	–	5 U	–	5 U	–	5 U	–	5 U	5 U	5 U
Vinyl chloride	ug/L	0.5 U	–	0.5 U	–	0.5 U	–	0.5 U	–	0.5 U	0.5 U	0.5 U
Total xylenes	ug/L	1 U	–	1 U	–	1 U	–	1 U	–	1 U	1 U	1 U
SVOCs (EPA Method 8270C)												
1,2,4-Trichlorobenzene	ug/L	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	9.6 U	9.6 U
1,2-Dichlorobenzene	ug/L	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	9.6 U	9.6 U
1,3-Dichlorobenzene	ug/L	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	9.6 U	9.6 U
1,4-Dichlorobenzene	ug/L	4.8 U	–	4.8 U	–	4.8 U	–	4.8 U	–	4.8 U	4.8 U	4.8 U
Bis(2-Chloro-1-Methylethyl)Ether	ug/L	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	9.6 U	9.6 U
2,4,5-Trichlorophenol	ug/L	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	9.6 U	9.6 U
2,4,6-Trichlorophenol	ug/L	4.8 U	–	4.8 U	–	4.8 U	–	4.8 U	–	4.8 U	4.8 U	4.8 U
2,4-Dichlorophenol	ug/L	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	9.6 U	9.6 U
2,4-Dimethylphenol	ug/L	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	9.6 U	9.6 U
2,4-Dinitrophenol	ug/L	48 U	–	48 U	–	48 U	–	48 U	–	48 U	48 U	48 U
2,4-Dinitrotoluene	ug/L	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	9.6 U	9.6 U
2,6-Dinitrotoluene	ug/L	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	9.6 U	9.6 U
2-Chloronaphthalene	ug/L	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	9.6 U	9.6 U
2-Chlorophenol	ug/L	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	9.6 U	9.6 U
2-Methylphenol	ug/L	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	9.6 U	9.6 U
2-Nitroaniline	ug/L	48 U	–	48 U	–	48 U	–	48 U	–	48 U	48 U	48 U
2-Nitrophenol	ug/L	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	–	9.6 U	9.6 U	9.6 U

Table I-5: Round 4 Groundwater Sample Analytical Results - RSE Investigation

	Sample ID:	LK391	LK392	LK393	LK394	LK395	LK396	LK397	LK398	LK384	LK378	LK389
	Location ID:	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW04	AA3-MW05	AA3-MW06
	Sample Date:	4/6/2004	4/6/2004	4/6/2004	4/6/2004	4/6/2004	4/6/2004	4/6/2004	4/6/2004	4/5/2004	4/1/2004	4/6/2004
Parameter	Sample Type:	Regular	Regular	Duplicate	Duplicate	Regular	Regular	Duplicate	Duplicate	Regular	Regular	Regular
3,3'-Dichlorobenzidine	ug/L	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U
4-Methylphenol	ug/L	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U
3-Nitroaniline	ug/L	48 U	--	48 U	--	48 U	--	48 U	--	48 U	48 U	48 U
4,6-Dinitro-2-Methylphenol	ug/L	48 U	--	48 U	--	48 U	--	48 U	--	48 U	48 U	48 U
4-Bromophenyl Phenyl Ether	ug/L	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U
4-Chloro-3-Methylphenol	ug/L	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U
4-Chloroaniline	ug/L	19 U	--	19 U	--	19 U	--	19 U	--	19 U	19 U	19 U
4-Chlorophenyl Phenyl Ether	ug/L	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U
4-Nitroaniline	ug/L	48 U	--	48 U	--	48 U	--	48 U	--	48 U	48 U	48 U
4-Nitrophenol	ug/L	48 U	--	48 U	--	48 U	--	48 U	--	48 U	48 U	48 U
Bis(2-Chloroethoxy)Methane	ug/L	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U
Bis(2-Chloroethyl)Ether	ug/L	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U
Bis(2-Ethylhexyl)Phthalate	ug/L	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U
butyl Benzyl phthalate	ug/L	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U
Carbazole	ug/L	48 U	--	48 U	--	48 U	--	48 U	--	48 U	48 U	48 U
Dibenzofuran	ug/L	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U
Diethyl Phthalate	ug/L	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U
Dimethyl Phthalate	ug/L	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U
Di-N-Butyl Phthalate	ug/L	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U
Di-N-Octyl Phthalate	ug/L	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U
Hexachlorobenzene	ug/L	1.1 U	--	1.1 U	--	1.1 U	--	1.1 U	--	1.1 U	1.1 U	1.1 U
Hexachlorobutadiene	ug/L	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U
Hexachlorocyclopentadiene	ug/L	48 U	--	48 U	--	48 U	--	48 U	--	48 U	48 U	48 U
Hexachloroethane	ug/L	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U
Isophorone	ug/L	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U
Nitrobenzene	ug/L	4.8 U	--	4.8 U	--	4.8 U	--	4.8 U	--	4.8 U	4.8 U	4.8 U
N-Nitroso-Di-N-Propylamine	ug/L	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U
N-Nitrosodiphenylamine	ug/L	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U
Pentachlorophenol	ug/L	15 U	--	15 U	--	15 U	--	15 U	--	15 U	15 U	15 U
Phenol	ug/L	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U
PAHs (Method PAH-SIM)												
2-Methylnaphthalene	ug/L	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U
Acenaphthene	ug/L	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U
Acenaphthylene	ug/L	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U
Anthracene	ug/L	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U
Benz(a)anthracene	ug/L	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U
Benzo(a)pyrene	ug/L	0.19 U	--	0.19 U	--	0.19 U	--	0.19 U	--	0.19 U	0.19 U	0.19 U
Benzo(b)fluoranthene	ug/L	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U
Benzo(g,h,i)perylene	ug/L	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U
Benzo(k)fluoranthene	ug/L	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U
Chrysene	ug/L	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U
Dibenz(a,h)anthracene	ug/L	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U
Fluoranthene	ug/L	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U
Fluorene	ug/L	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U
Indeno(1,2,3-Cd)Pyrene	ug/L	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U
Naphthalene	ug/L	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U
Phenanthrene	ug/L	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U
Pyrene	ug/L	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U
Metals (EPA Method 6010B)												
Aluminum	ug/L	16.7 J	12.9 J	200 UJ	200 UJ	11.4 J	7.8 J	14.7 J	18.7 J	6 J	33	76.1
Antimony	ug/L	8.2 UJ	60 U	3.1 UJ	3.1 UJ	2.3 UJ	6.5 UJ	2.3 UJ	3.5 UJ	5 UJ	60 UJ	4.1 UJ
Arsenic	ug/L	7.5 UJ	7.2 UJ	7.1 UJ	5.8 UJ	5.3 UJ	7 UJ	5.3 UJ	6.8 UJ	22.3 UJ	7.3	9.9 UJ
Barium	ug/L	36	36.9	35.1	37.9	41.6	41.5	40.3	40	27.4	18.8	26 UJ
Beryllium	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Cadmium	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	0.39 UJ	0.62 J	0.31 J
Calcium	ug/L	135000	139000	133000	138000	188000	193000	187000	186000	189000	122000	219000
Cobalt	ug/L	0.63 UJ	50 U	50 U	0.29 UJ	0.71 UJ	0.66 UJ	0.56 UJ	0.54 UJ	50 U	50 U	50 U
Copper	ug/L	8.4 J	5.3	4.5 J	6.8	5.8 J	4.7	6.8 J	9.6	3.8 J	5	7.1 J
Chromium	ug/L	47.4	2.3	18.9	3.5	11.8	1.8	13.2	5.7	1.3	0.79 J	7.6
Iron	ug/L	227 J	148	86.4 J	122	1030 J	894 J	1440 J	1190 J	20 J	42.8 J	611 J
Lead	ug/L	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	2.9 UJ	2.5	3 U
Magnesium	ug/L	69000	71700	68700	70500	96400	99400	96400	96200	106000	65400	104000
Manganese	ug/L	3.9 UJ	4.1 UJ	3.2 UJ	4.5	714	729	710	706	26.1	3.8	10.9
Mercury	ug/L	0.11 J	0.15	0.085 J	0.099	0.15 J	0.081	0.064 J	0.15	0.08 J	0.028 J	0.12 J
Nickel	ug/L	29.1	15	16.6	16.1	18.4	17.6	18.4	16.7	33.8	0.95 UJ	2.1 UJ
Potassium	ug/L	2670 J	2810 J	2690 J	2670 J	7150 J	7200 J	6630 J	6670 J	3060	4640	5050 J
Selenium	ug/L	12.4	13.3	14.1	13.5	15.1	14.3	13.8	14	12.7 J	26.5	23.2
Silver	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U

Table I-5: Round 4 Groundwater Sample Analytical Results - RSE Investigation

	Sample ID:	LK391	LK392	LK393	LK394	LK395	LK396	LK397	LK398	LK384	LK378	LK389
	Location ID:	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW04	AA3-MW05	AA3-MW06
	Sample Date:	4/6/2004	4/6/2004	4/6/2004	4/6/2004	4/6/2004	4/6/2004	4/6/2004	4/6/2004	4/5/2004	4/1/2004	4/6/2004
Parameter	Sample Type:	Regular	Regular	Duplicate	Duplicate	Regular	Regular	Duplicate	Duplicate	Regular	Regular	Regular
Sodium	ug/L	395000	410000	394000	405000	430000	444000	433000	433000	462000	454000	390000
Thallium	ug/L	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 U	10 U	10 U
Vanadium	ug/L	23.8	21.6	20.6	24.5	3.4	2.9 UJ	3.7	3.8	39.7	18.3	21.3
Zinc	ug/L	5.1 J	2.8 UJ	1.9 UJ	4 UJ	2.7 UJ	2.9 UJ	14.4 J	7.4	2.3 UJ	4.4 UJ	7.5 J
Miscellaneous												
Perchlorate	ug/L	3 U	–	3 U	–	3 U	–	3 U	–	3 U	3 U	3 U
pH	pH	7.01	–	6.97	–	6.89	–	6.94	–	6.8	7.01	6.84
Chromium, hexavalent	ug/L	1 U	–	–	–	1 U	–	1 U	–	–	–	0.24

NOTES:

µg/L = micrograms per liter
mg/L = milligram per liter
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds
SVOCs = semivolatile organic compounds
PAHs = polynuclear aromatic hydrocarbons

pH = the negative log of the hydrogen ion concentration
AA3 = Anomaly Area 3
RSE = Removal Site Evaluation
U = indicates the analyte was not detected at or above the stated limit.
UJ = indicates the analyte was not detected at or above the stated limit. The sample detection limit is an estimated value.
J = indicates an estimated value.

Table I-6: Round 5 Groundwater Sample Analytical Results - RSE Investigation

Parameter	Sample ID:	LK419	LK420	LK421	LK425	LK426	LK427	LK428	LK418	LK412	LK409	LK410
	Location ID:	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW04	AA3-MW05	AA3-MW06	AA3-MW06
	Sample Date:	7/6/2004	7/6/2004	7/6/2004	7/7/2004	7/7/2004	7/7/2004	7/7/2004	7/6/2004	7/1/2004	7/1/2004	7/1/2004
	Sample Type:	Regular	Regular	Duplicate	Regular	Duplicate	Regular	Duplicate	Regular	Regular	Regular	Duplicate
TPH (EPA Method 8015B DRO)	**Units**											
Motor Oils	mg/L	0.096 U	--	0.03 J	0.02 J	0.02 J	--	--	0.096 U	0.096 U	0.01 J	--
Diesel Fuel	mg/L	0.096 U	--	0.096 U	0.02 J	0.02 J	--	--	0.096 U	0.01 J	0.01 J	--
Gasoline	mg/L	0.1 U	--	0.1 U	0.1 U	0.1 U	--	--	0.1 U	0.1 U	0.1 U	--
VOCs (EPA Method 8260B)												
1,1,1,2-Tetrachloroethane	ug/L	0.5 U	--	0.5 U	0.5 U	0.5 U	--	--	0.5 U	0.5 UJ	0.5 UJ	--
1,1,1-Trichloroethane	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 UJ	1 UJ	--
1,1,2,2-Tetrachloroethane	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
1,1,2-Trichloroethane	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/L	5 U	--	5 U	5 U	5 U	--	--	5 U	5 U	5 U	--
1,1-Dichloroethane	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
1,1-Dichloroethene	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
1,2,3-Trichloropropane	ug/L	0.5 U	--	0.5 U	0.5 U	0.5 U	--	--	0.5 U	0.5 U	0.5 U	--
1,2-Dichloroethane	ug/L	0.5 U	--	0.5 U	0.5 U	0.5 U	--	--	0.5 U	0.5 U	0.5 U	--
1,2-Dichloropropane	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
1,2-Dichlorotetrafluoroethane	ug/L	5 U	--	5 U	5 U	5 U	--	--	5 U	5 U	5 U	--
2-Hexanone	ug/L	50 U	--	50 U	50 U	50 U	--	--	50 U	50 UJ	50 UJ	--
4-Methyl-2-Pentanone	ug/L	50 U	--	50 U	50 U	50 U	--	--	50 U	50 U	50 U	--
Acetone	ug/L	100 UJ	--	100 UJ	100 UJ	100 UJ	--	--	100 UJ	100 UJ	100 UJ	--
Benzene	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
Bromodichloromethane	ug/L	0.11 U	--	0.11 U	0.11 U	0.11 U	--	--	0.11 U	0.11 U	0.11 U	--
Bromoform	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
Bromomethane	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
Carbon Disulfide	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
Carbon Tetrachloride	ug/L	0.5 UJ	--	0.5 UJ	0.5 UJ	0.5 UJ	--	--	0.5 UJ	0.5 UJ	0.5 UJ	--
Chlorobenzene	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
Chloroethane	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
Chloroform	ug/L	0.11 U	--	0.11 U	0.11 U	0.11 U	--	--	0.11 U	0.11 U	0.11 U	--
Chloromethane	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
cis-1,2-Dichloroethene	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
cis-1,3-Dichloropropene	ug/L	0.5 U	--	0.5 U	0.5 U	0.5 U	--	--	0.5 U	0.5 U	0.5 U	--
Chlorodibromomethane	ug/L	0.13 U	--	0.13 U	0.13 U	0.13 U	--	--	0.13 U	0.13 U	0.13 U	--
Dichlorodifluoromethane (F12)	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
Diisopropyl Ether	ug/L	5 U	--	5 U	5 U	5 U	--	--	5 U	5 UJ	5 UJ	--
Ethyl-tert-butyl ether (ETBE)	ug/L	5 U	--	5 U	5 U	5 U	--	--	5 U	5 UJ	5 UJ	--
Ethylbenzene	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
2-Butanone (MEK)	ug/L	100 UJ	--	100 UJ	100 UJ	100 UJ	--	--	100 UJ	100 UJ	100 UJ	--
Methylene Chloride	ug/L	3 U	--	3 U	3 U	3 U	--	--	3 U	3 U	3 U	--
Methyl tert-butyl ether	ug/L	3 U	--	3 U	3 U	3 U	--	--	3 U	3 UJ	3 UJ	--
Styrene	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
tert-Amyl methyl ether (TAME)	ug/L	5 U	--	5 U	5 U	5 U	--	--	5 U	5 UJ	5 UJ	--
tertiary-Butyl alcohol (TBA)	ug/L	2.2 U	--	2.2 U	2.2 U	2.2 U	--	--	2.2 U	2.2 U	2.2 U	--
Tetrachloroethene	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
Toluene	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
trans-1,2-Dichloroethene	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
trans-1,3-Dichloropropene	ug/L	0.5 U	--	0.5 U	0.5 U	0.5 U	--	--	0.5 U	0.5 U	0.5 U	--
Trichloroethene	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
Trichlorofluoromethane	ug/L	5 U	--	5 U	5 U	5 U	--	--	5 U	5 U	5 U	--
Vinyl chloride	ug/L	0.5 U	--	0.5 U	0.5 U	0.5 U	--	--	0.5 U	0.5 U	0.5 U	--
Total xylenes	ug/L	1 U	--	1 U	1 U	1 U	--	--	1 U	1 U	1 U	--
SVOCs (EPA Method 8270C)												
1,2,4-Trichlorobenzene	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
1,2-Dichlorobenzene	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
1,3-Dichlorobenzene	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
1,4-Dichlorobenzene	ug/L	4.8 U	--	4.8 U	4.8 U	4.8 U	--	--	4.8 U	4.8 U	4.8 U	--
Bis(2-Chloro-1-Methylethyl)Ether	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
2,4,5-Trichlorophenol	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
2,4,6-Trichlorophenol	ug/L	4.8 U	--	4.8 U	4.8 U	4.8 U	--	--	4.8 U	4.8 U	4.8 U	--
2,4-Dichlorophenol	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
2,4-Dimethylphenol	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
2,4-Dinitrophenol	ug/L	48 U	--	48 U	48 U	48 U	--	--	48 U	48 U	48 U	--
2,4-Dinitrotoluene	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
2,6-Dinitrotoluene	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
2-Chloronaphthalene	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
2-Chlorophenol	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
2-Methylphenol	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
2-Nitroaniline	ug/L	48 U	--	48 U	48 U	48 U	--	--	48 U	48 U	48 U	--
2-Nitrophenol	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--

Table I-6: Round 5 Groundwater Sample Analytical Results - RSE Investigation

	Sample ID:	LK419	LK420	LK421	LK425	LK426	LK427	LK428	LK418	LK412	LK409	LK410
	Location ID:	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW04	AA3-MW05	AA3-MW06	AA3-MW06
	Sample Date:	7/6/2004	7/6/2004	7/6/2004	7/7/2004	7/7/2004	7/7/2004	7/7/2004	7/6/2004	7/1/2004	7/1/2004	7/1/2004
Parameter	Sample Type:	Regular	Regular	Duplicate	Regular	Duplicate	Regular	Duplicate	Regular	Regular	Regular	Duplicate
3,3'-Dichlorobenzidine	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
4-Methylphenol	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
3-Nitroaniline	ug/L	48 U	--	48 U	48 U	48 U	--	--	48 U	48 U	48 U	--
4,6-Dinitro-2-Methylphenol	ug/L	48 U	--	48 U	48 U	48 U	--	--	48 U	48 U	48 U	--
4-Bromophenyl Phenyl Ether	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
4-Chloro-3-Methylphenol	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
4-Chloroaniline	ug/L	19 U	--	19 U	19 U	19 U	--	--	19 U	19 U	19 U	--
4-Chlorophenyl Phenyl Ether	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
4-Nitroaniline	ug/L	48 U	--	48 U	48 U	48 U	--	--	48 U	48 U	48 U	--
4-Nitrophenol	ug/L	48 U	--	48 U	48 U	48 U	--	--	48 U	48 U	48 U	--
Bis(2-Chloroethoxy)Methane	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
Bis(2-Chloroethyl)Ether	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
Bis(2-Ethylhexyl)Phthalate	ug/L	9.6 U	--	9.6 U	9.6 U	3 J	--	--	9.6 U	9.6 U	9.6 U	--
butyl Benzyl phthalate	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
Carbazole	ug/L	48 U	--	48 U	48 U	48 U	--	--	48 U	48 U	48 U	--
Dibenzofuran	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
Diethyl Phthalate	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
Dimethyl Phthalate	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
Di-N-Butyl Phthalate	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
Di-N-Octyl Phthalate	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
Hexachlorobenzene	ug/L	1.1 U	--	1.1 U	1.1 U	1.1 U	--	--	1.1 U	1.2 U	1.2 U	--
Hexachlorobutadiene	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
Hexachlorocyclopentadiene	ug/L	48 U	--	48 U	48 U	48 U	--	--	48 U	48 U	48 U	--
Hexachloroethane	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
Isophorone	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
Nitrobenzene	ug/L	4.8 U	--	4.8 U	4.8 U	4.8 U	--	--	4.8 U	4.8 U	4.8 U	--
N-Nitroso-Di-N-Propylamine	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
N-Nitrosodiphenylamine	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
Pentachlorophenol	ug/L	15 U	--	15 U	15 U	15 U	--	--	15 U	12 U	12 U	--
Phenol	ug/L	9.6 U	--	9.6 U	9.6 U	9.6 U	--	--	9.6 U	9.6 U	9.6 U	--
PAHs (Method PAH-SIM)												
2-Methylnaphthalene	ug/L	0.48 U	--	0.48 U	0.48 U	0.48 U	--	--	0.48 U	0.48 U	0.48 U	--
Acenaphthene	ug/L	0.48 U	--	0.48 U	0.48 U	0.48 U	--	--	0.48 U	0.48 U	0.48 U	--
Acenaphthylene	ug/L	0.48 U	--	0.48 U	0.48 U	0.48 U	--	--	0.48 U	0.48 U	0.48 U	--
Anthracene	ug/L	0.48 U	--	0.48 U	0.48 U	0.48 U	--	--	0.48 U	0.48 U	0.48 U	--
Benz(a)anthracene	ug/L	0.48 U	--	0.48 U	0.48 U	0.48 U	--	--	0.48 U	0.48 U	0.48 U	--
Benzo(a)pyrene	ug/L	0.19 U	--	0.19 U	0.19 U	0.19 U	--	--	0.19 U	0.19 U	0.19 U	--
Benzo(b)fluoranthene	ug/L	0.48 U	--	0.48 U	0.48 U	0.48 U	--	--	0.48 U	0.48 U	0.48 U	--
Benzo(g,h,i)perylene	ug/L	0.48 U	--	0.48 U	0.48 U	0.48 U	--	--	0.48 U	0.48 U	0.48 U	--
Benzo(k)fluoranthene	ug/L	0.48 U	--	0.48 U	0.48 U	0.48 U	--	--	0.48 U	0.48 U	0.48 U	--
Chrysene	ug/L	0.48 U	--	0.48 U	0.48 U	0.48 U	--	--	0.48 U	0.49 U	0.48 U	--
Dibenz(a,h)anthracene	ug/L	0.48 U	--	0.48 U	0.48 U	0.48 U	--	--	0.48 U	0.48 U	0.48 U	--
Fluoranthene	ug/L	0.48 U	--	0.48 U	0.48 U	0.48 U	--	--	0.48 U	0.48 U	0.48 U	--
Fluorene	ug/L	0.48 U	--	0.48 U	0.48 U	0.48 U	--	--	0.48 U	0.48 U	0.48 U	--
Indeno(1,2,3-Cd)Pyrene	ug/L	0.48 U	--	0.48 U	0.48 U	0.48 U	--	--	0.48 U	0.48 U	0.48 U	--
Naphthalene	ug/L	0.48 U	--	0.48 U	0.48 U	0.48 U	--	--	0.48 U	0.48 U	0.48 U	--
Phenanthrene	ug/L	0.48 U	--	0.48 U	0.48 U	0.48 U	--	--	0.48 U	0.48 U	0.48 U	--
Pyrene	ug/L	0.48 U	--	0.48 U	0.48 U	0.48 U	--	--	0.48 U	0.48 U	0.48 U	--
Metals (EPA Method 6010B)												
Aluminum	ug/L	6.9 UJ	14.6 UJ	14.8 UJ	29.5 UJ	34.1	12.5 UJ	23.5 UJ	19.6 UJ	42.4 UJ	575	--
Antimony	ug/L	3.3 UJ	2.5 UJ	60 U	7.2 UJ	7.2 UJ	7.3 UJ	3.1 UJ	60 U	60 U	60 U	--
Arsenic	ug/L	4.2 UJ	6 UJ	4.7 UJ	2.6	10 U	10 U	10 U	24.6	4.7	4.5	--
Barium	ug/L	38	40	37.5	45	44.5	42.5	44.1	33	22.3	38.8	--
Beryllium	ug/L	5 U	0.055 UJ	0.07 UJ	0.067 UJ	5 U	0.045 UJ	0.08 UJ	0.056 UJ	5 U	5 U	--
Cadmium	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	0.55 UJ	--
Calcium	ug/L	145000	144000	139000	191000	191000	188000	193000	205000	143000	213000	--
Cobalt	ug/L	50 U	50 U	50 U	0.9 UJ	0.96 UJ	0.74 UJ	0.47 UJ	0.59 UJ	50 U	0.75 UJ	--
Copper	ug/L	6.4 UJ	11 UJ	4 UJ	7.7	14.8	5.3	5.7	12.6 UJ	6.8 UJ	7.7 UJ	--
Chromium	ug/L	4.8	1.3	10.1	15.8	10.3	2	1.8	1.2	1.6 J	4.3 J	--
Iron	ug/L	33.8 J	57.9 J	61.7 J	516	495	458	394	37.3 J	45.9 J	495	--
Lead	ug/L	1.6	2.6	1.4	3 U	3 U	1.4	3 U	2.5	2.4 UJ	3 U	--
Magnesium	ug/L	70100	70900	68300	99700	100000	98600	100000	111000	78400	103000	--
Manganese	ug/L	1.8 UJ	2.9 UJ	2 UJ	725	722	712	723	30	7.5	16.8	--
Mercury	ug/L	0.018	0.046	0.027	0.021 J	0.2 U	0.2 U	0.019	0.076	0.047 J	0.035 J	--
Nickel	ug/L	2.2 UJ	3.1 UJ	4.8 UJ	18.6	17.3	14.8	18.3	33	1.4 UJ	2.9 UJ	--
Potassium	ug/L	3010	2890	2780	6790	6650	6190	6580	3440	5440	5120	--
Selenium	ug/L	21.9	17.2	16.7	21	17.6	18	19.5	18.1	37.2	26.1	--
Silver	ug/L	1.5 UJ	1.1 UJ	10 U	1.4 UJ	10 U	1.4 UJ	10 U	1.6 UJ	1.3 UJ	2.2 UJ	--

Table I-6: Round 5 Groundwater Sample Analytical Results - RSE Investigation

	Sample ID:	LK419	LK420	LK421	LK425	LK426	LK427	LK428	LK418	LK412	LK409	LK410
	Location ID:	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW04	AA3-MW05	AA3-MW08	AA3-MW06
	Sample Date:	7/6/2004	7/6/2004	7/6/2004	7/7/2004	7/7/2004	7/7/2004	7/7/2004	7/8/2004	7/1/2004	7/1/2004	7/1/2004
Parameter	Sample Type:	Regular	Regular	Duplicate	Regular	Duplicate	Regular	Duplicate	Regular	Regular	Regular	Duplicate
Sodium	ug/L	369000	375000	360000	411000	417000	413000	416000	394000	466000	380000	--
Thallium	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	--
Vanadium	ug/L	20.6	20.7	20.1	3.4	4.1	4.9	4.3	44.4	22.1	22.9	--
Zinc	ug/L	4.3 J	29.3 J	17.6 J	4 J	5.6 J	5.4	6.1	9.1 J	5 J	12.9 J	--
Miscellaneous												
Perchlorate	ug/L	--	--	--	--	--	--	--	--	--	--	--
pH	pH	7.03	--	7.06	6.94	6.93	--	--	6.89	7.03	6.86	--
Chromium, hexavalent	ug/L	1 U	--	--	1 U	--	--	--	--	--	0.6	0.54

NOTES:

µg/L = micrograms per liter
mg/L = milligram per liter
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds
SVOCs = semivolatile organic compounds
PAHs = polynuclear aromatic hydrocarbons

pH = the negative log of the hydrogen ion concentration
AA3 = Anomaly Area 3
RSE = *Removal Site Evaluation*
U = indicates the analyte was not detected at or above the stated limit.
UJ = indicates the analyte was not detected at or above the stated limit. The sample detection limit is an estimated value.
J = indicates an estimated value.

Table I-7: Round 6 Groundwater Sample Analytical Results - RSE Investigation

	Sample ID:	LK454	LK455	LK456	LK460	LK461	LK462	LK451	LK446	LK441	LK442	LK443	LK449	L
	Location ID:	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW04	AA3-MW05	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW07	AA
	Sample Date:	10/7/2004	10/7/2004	10/7/2004	10/8/2004	10/8/2004	10/8/2004	10/7/204	10/6/2004	10/6/2004	10/6/2004	10/6/2004	10/7/2004	10
Parameter	Sample Type:	Regular	Duplicate	Regular	Regular	Duplicate	Regular	Regular	Regular	Regular	Duplicate	Regular	Regular	R
TPH (EPA Method 8015B DRO)	**Units**													
Motor Oils	mg/L	0.096 U	0.096 U	–	0.096 U	0.096 U	–	0.096 U	0.096 U	0.096 U	–	–	0.096 U	0
Diesel Fuel	mg/L	0.096 U	0.096 U	–	0.096 U	0.096 U	–	0.008 J	0.096 U	0.01 J	–	–	0.096 U	0
Gasoline	mg/L	0.05 J	0.1 U	–	0.1 U	0.02 J	–	0.1 U	0.02 J	0.1 U	–	–	0.02 J	0
VOCs (EPA Method 8260B)														
1,1,1,2-Tetrachloroethane	ug/L	0.5 U	0.5 U	–	0.5 U	0.5 U	–	0.5 U	0.5 U	0.5 U	–	–	0.5 U	
1,1,1-Trichloroethane	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	
1,1,2,2-Tetrachloroethane	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	
1,1,2-Trichloroethane	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/L	5 U	5 U	–	5 U	5 U	–	5 U	5 U	5 U	–	–	5 U	
1,1-Dichloroethane	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	
1,1-Dichloroethene	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	
1,2,3-Trichloropropane	ug/L	0.5 U	0.5 U	–	0.5 U	0.5 U	–	0.5 U	0.5 U	0.5 U	–	–	0.5 U	0
1,2-Dichloroethane	ug/L	0.5 U	0.5 U	–	0.5 U	0.5 U	–	0.5 U	0.5 U	0.5 U	–	–	0.5 U	0
1,2-Dichloropropane	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	
1,2-Dichlorotetrafluoroethane	ug/L	5 U	5 U	–	5 U	5 U	–	5 U	5 U	5 U	–	–	5 U	
2-Hexanone	ug/L	50 U	50 U	–	50 U	50 U	–	50 U	50 U	50 U	–	–	50 U	5
4-Methyl-2-Pentanone	ug/L	50 UJ	50 UJ	–	50 UJ	50 UJ	–	50 UJ	50 U	50 U	–	–	50 U	5
Acetone	ug/L	100 UJ	100 UJ	–	100 UJ	100 UJ	–	100 UJ	100 U	100 U	–	–	100 U	10
Benzene	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	
Bromodichloromethane	ug/L	0.1 U	0.1 U	–	0.1 U	0.1 U	–	0.1 U	0.1 U	0.1 U	–	–	0.1 U	0
Bromoform	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	
Bromomethane	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	
Carbon Disulfide	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	
Carbon Tetrachloride	ug/L	0.5 U	0.5 U	–	0.5 U	0.5 U	–	0.5 U	0.5 U	0.5 U	–	–	0.5 U	0
Chlorobenzene	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	
Chloroethane	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	
Chloroform	ug/L	0.1 U	0.1 U	–	0.1 U	0.1 U	–	0.1 U	0.1 U	0.1 U	–	–	0.1 U	0
Chloromethane	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	
cis-1,2-Dichloroethene	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	
cis-1,3-Dichloropropene	ug/L	0.5 U	0.5 U	–	0.5 U	0.5 U	–	0.5 U	0.5 U	0.5 U	–	–	0.5 U	0.
Chlorodibromomethane	ug/L	0.1 U	0.1 U	–	0.1 U	0.1 U	–	0.1 U	0.1 U	0.1 U	–	–	0.1 U	0.
Dichlorodifluoromethane (F12)	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	1
Diisopropyl Ether	ug/L	5 U	5 U	–	5 U	5 U	–	5 U	5 U	5 U	–	–	5 U	5
Ethyl-tert-butyl ether (ETBE)	ug/L	5 U	5 U	–	5 U	5 U	–	5 U	5 U	5 U	–	–	5 U	5
Ethylbenzene	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	1
2-Butanone (MEK)	ug/L	100 U	100 U	–	100 U	100 U	–	100 U	100 U	100 U	–	–	100 U	
Methylene Chloride	ug/L	3 U	3 U	–	3 U	3 U	–	3 U	0.5 J	3 U	–	–	3 U	3
Methyl tert-butyl ether	ug/L	3 U	3 U	–	3 U	3 U	–	3 U	3 U	3 U	–	–	3 U	3
Styrene	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	1
tert-Amyl methyl ether (TAME)	ug/L	5 U	5 U	–	5 U	5 U	–	5 U	5 U	5 U	–	–	5 U	5
tertiary-Butyl alcohol (TBA)	ug/L	2.7 UJ	2.7 UJ	–	2.7 UJ	2.7 UJ	–	2.7 UJ	2.7 U	2.7 U	–	–	2.7 U	2.7
Tetrachloroethene	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	1
Toluene	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	1
trans-1,2-Dichloroethene	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	1
trans-1,3-Dichloropropene	ug/L	0.5 U	0.5 U	–	0.5 U	0.5 U	–	0.5 U	0.5 U	0.5 U	–	–	0.5 U	0.
Trichloroethene	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	1
Trichlorofluoromethane	ug/L	5 U	5 U	–	5 U	5 U	–	5 U	5 U	5 U	–	–	5 U	5
Vinyl chloride	ug/L	0.5 U	0.5 U	–	0.5 U	0.5 U	–	0.5 U	0.5 U	0.5 U	–	–	0.5 U	0.
Total xylenes	ug/L	1 U	1 U	–	1 U	1 U	–	1 U	1 U	1 U	–	–	1 U	1
SVOCs (EPA Method 8270C)														
1,2,4-Trichlorobenzene	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	9.
1,2-Dichlorobenzene	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	9.
1,3-Dichlorobenzene	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	9.
1,4-Dichlorobenzene	ug/L	4.8 U	4.8 U	–	4.8 U	4.8 U	–	4.8 U	4.8 U	4.8 U	–	–	4.8 U	4.
Bis(2-Chloro-1-Methylethyl)Ether	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	9.
2,4,5-Trichlorophenol	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	9.
2,4,6-Trichlorophenol	ug/L	4.8 U	4.8 U	–	4.8 U	4.8 U	–	4.8 U	4.8 U	4.8 U	–	–	4.8 U	4.
2,4-Dichlorophenol	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	9.
2,4-Dimethylphenol	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	9.
2,4-Dinitrophenol	ug/L	48 U	48 U	–	48 U	48 U	–	48 U	48 U	48 U	–	–	48 U	48
2,4-Dinitrotoluene	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	9.
2,6-Dinitrotoluene	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	9.
2-Chloronaphthalene	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	9.
2-Chlorophenol	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	9.
2-Methylphenol	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	9.
2-Nitroaniline	ug/L	48 U	48 U	–	48 U	48 U	–	48 U	48 U	48 U	–	–	48 U	48
2-Nitrophenol	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	9.
3,3'-Dichlorobenzidine	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	9.
4-Methylphenol	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	9.
3-Nitroaniline	ug/L	48 U	48 U	–	48 U	48 U	–	48 U	48 U	48 U	–	–	48 U	48
4,6-Dinitro-2-Methylphenol	ug/L	48 U	48 U	–	48 U	48 U	–	48 U	48 U	48 U	–	–	48 U	48
4-Bromophenyl Phenyl Ether	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	9.
4-Chloro-3-Methylphenol	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	9.
4-Chloroaniline	ug/L	19 U	19 U	–	19 U	19 U	–	19 U	19 U	19 U	–	–	19 U	19
4-Chlorophenyl Phenyl Ether	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	9.
4-Nitroaniline	ug/L	48 U	48 U	–	48 U	48 U	–	48 U	48 U	48 U	–	–	48 U	48
4-Nitrophenol	ug/L	48 U	48 U	–	48 U	48 U	–	48 U	48 U	48 U	–	–	48 U	48

Table I-7: Round 6 Groundwater Sample Analytical Results - RSE Investigation

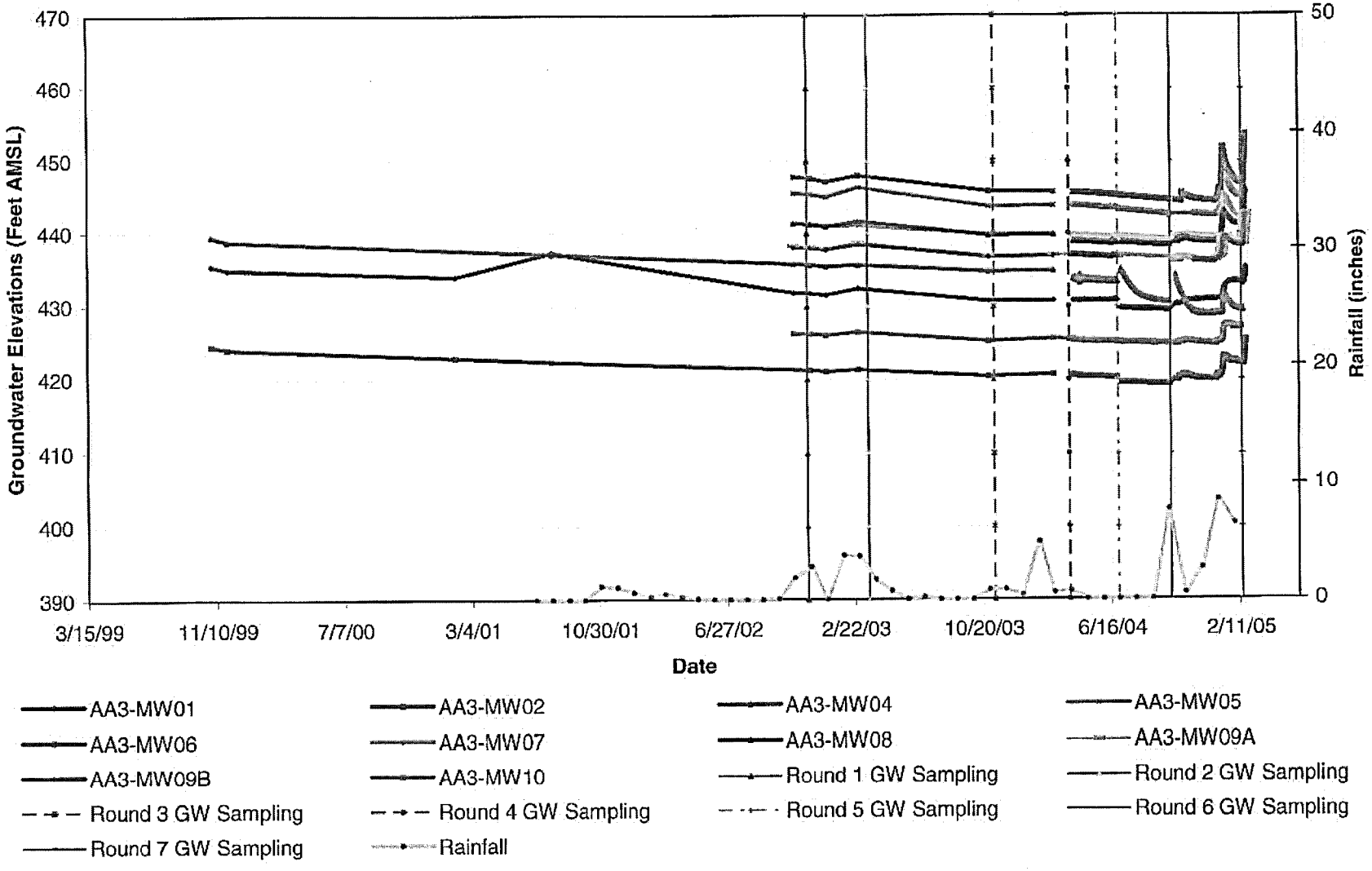
	Sample ID:	LK454	LK455	LK456	LK460	LK461	LK462	LK451	LK446	LK441	LK442	LK443	LK449	L
	Location ID:	AA3-MW01	AA3-MW01	AA3-MW01	AA3-MW02	AA3-MW02	AA3-MW02	AA3-MW04	AA3-MW05	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW07	AA
	Sample Date:	10/7/2004	10/7/2004	10/7/2004	10/8/2004	10/8/2004	10/8/2004	10/7/204	10/6/2004	10/6/2004	10/6/2004	10/6/2004	10/7/2004	10
Parameter	Sample Type:	Regular	Duplicate	Regular	Regular	Duplicate	Regular	Regular	Regular	Regular	Duplicate	Regular	Regular	R
Bis(2-Chloroethoxy)Methane	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	
Bis(2-Chloroethyl)Ether	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	
Bis(2-Ethylhexyl)Phthalate	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	
butyl Benzyl phthalate	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	
Carbazole	ug/L	48 U	48 U	–	48 U	48 U	–	48 U	48 U	48 U	–	–	48 U	
Dibenzofuran	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	
Diethyl Phthalate	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	
Dimethyl Phthalate	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	
Di-N-Butyl Phthalate	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	
Di-N-Octyl Phthalate	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	
Hexachlorobenzene	ug/L	1.1 U	1.1 U	–	1.1 U	1.1 U	–	1.1 U	1.1 U	1.1 U	–	–	1.1 U	
Hexachlorobutadiene	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	
Hexachlorocyclopentadiene	ug/L	48 U	48 U	–	48 U	48 U	–	48 U	48 U	48 U	–	–	48 U	
Hexachloroethane	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	
Isophorone	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	
Nitrobenzene	ug/L	4.8 U	4.8 U	–	4.8 U	4.8 U	–	4.8 U	4.8 U	4.8 U	–	–	4.8 U	
N-Nitroso-Di-N-Propylamine	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	
N-Nitrosodiphenylamine	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	
Pentachlorophenol	ug/L	15 U	15 U	–	15 U	15 U	–	15 U	15 U	15 U	–	–	15 U	
Phenol	ug/L	9.6 U	9.6 U	–	9.6 U	9.6 U	–	9.6 U	9.6 U	9.6 U	–	–	9.6 U	
PAHs (Method PAH-SIM)														
2-Methylnaphthalene	ug/L	0.48 U	0.48 U	–	0.48 U	0.48 U	–	0.48 U	0.48 U	0.48 U	–	–	0.48 U	
Acenaphthene	ug/L	0.48 U	0.48 U	–	0.48 U	0.48 U	–	0.48 U	0.48 U	0.48 U	–	–	0.48 U	
Acenaphthylene	ug/L	0.48 U	0.48 U	–	0.48 U	0.48 U	–	0.48 U	0.48 U	0.48 U	–	–	0.48 U	
Anthracene	ug/L	0.48 U	0.48 U	–	0.48 U	0.48 U	–	0.48 U	0.48 U	0.48 U	–	–	0.48 U	
Benz(a)anthracene	ug/L	0.48 U	0.48 U	–	0.48 U	0.48 U	–	0.48 U	0.48 U	0.48 U	–	–	0.48 U	
Benzo(a)pyrene	ug/L	0.19 U	0.19 U	–	0.19 U	0.19 U	–	0.19 U	0.19 U	0.19 U	–	–	0.19 U	
Benzo(b)fluoranthene	ug/L	0.48 U	0.48 U	–	0.48 U	0.48 U	–	0.48 U	0.48 U	0.48 U	–	–	0.48 U	
Benzo(g,h,i)perylene	ug/L	0.48 U	0.48 U	–	0.48 U	0.48 U	–	0.48 U	0.48 U	0.48 U	–	–	0.48 U	
Benzo(k)fluoranthene	ug/L	0.48 U	0.48 U	–	0.48 U	0.48 U	–	0.48 U	0.48 U	0.48 U	–	–	0.48 U	
Chrysene	ug/L	0.48 U	0.48 U	–	0.48 U	0.48 U	–	0.48 U	0.48 U	0.48 U	–	–	0.48 U	
Dibenz(a,h)anthracene	ug/L	0.48 U	0.48 U	–	0.48 U	0.48 U	–	0.48 U	0.48 U	0.48 U	–	–	0.48 U	
Fluoranthene	ug/L	0.48 U	0.48 U	–	0.48 U	0.48 U	–	0.48 U	0.48 U	0.48 U	–	–	0.48 U	
Fluorene	ug/L	0.48 U	0.48 U	–	0.48 U	0.48 U	–	0.48 U	0.48 U	0.48 U	–	–	0.48 U	
Indeno(1,2,3-Cd)Pyrene	ug/L	0.48 U	0.48 U	–	0.48 U	0.48 U	–	0.48 U	0.48 U	0.48 U	–	–	0.48 U	
Naphthalene	ug/L	0.48 U	0.48 U	–	0.48 U	0.48 U	–	0.48 U	0.48 U	0.48 U	–	–	0.48 U	
Phenanthrene	ug/L	0.48 U	0.48 U	–	0.48 U	0.48 U	–	0.48 U	0.48 U	0.48 U	–	–	0.48 U	
Pyrene	ug/L	0.48 U	0.48 U	–	0.48 U	0.48 U	–	0.48 U	0.48 U	0.48 U	–	–	0.48 U	
Metals (EPA Method 6010B)														
Aluminum	ug/L	83	11.4 UJ	32.3	12.7 UJ	18.3 UJ	50.6	23.4 J	96.4	25.3 J	–	3.7 J	72.8	2
Antimony	ug/L	60 UJ	3	2.4	60 U	2.9	60 U	3.7	4.7	5.7	–	3.7	60 U	
Arsenic	ug/L	4.9 UJ	3.8 UJ	2.6 UJ	2.9 UJ	3.1 UJ	3 UJ	26	8.5 UJ	8.5 UJ	–	5.7 UJ	7.7 UJ	6.
Barium	ug/L	42.9	36.8	3.4	41.2	40.1	39.7	31.5	22.1	23.6	–	23.2	53	1
Beryllium	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	–	5 U	5 U	5
Cadmium	ug/L	0.63 UJ	0.44 UJ	0.97 UJ	0.74 UJ	1.7	0.85 UJ	0.24 UJ	0.42 UJ	0.29 UJ	–	0.3 UJ	1.1 UJ	0.
Calcium	ug/L	135000	133000	116	182000	180000	171000	190000	137000	203000	–	207000	236000	99
Cobalt	ug/L	50 U	50 U	50 U	0.45	0.48	0.55	0.32 UJ	50 U	50 U	–	50 U	50 U	5
Copper	ug/L	6.6 UJ	11.5	12.1	5.1 UJ	6.8 UJ	8.1 UJ	5.9 J	8	3.6	–	3.3	6.5 J	2.
Chromium	ug/L	50.4	47.9	4.3	5.6	5.2	6	4.8 J	2.1	3.4	–	1.7	1.2 UJ	1.
Iron	ug/L	206	150	91.3	509	490	556	102 J	120	33.2 J	–	10.7 J	114 J	3
Lead	ug/L	2.9	3.7	9.3	3.2 J	12.3 J	5.9	1.9 UJ	3 U	3 U	–	3 U	3.1 UJ	2.
Magnesium	ug/L	63800	64400	56.5	88600	88000	82000	107000	75400	101000	–	99600	102000	53
Manganese	ug/L	4.8	3.2	3.9	717	707	659	21.5	7.8	0.88 J	–	15 U	156	1
Mercury	ug/L	1.1	0.97	0.96	1.4 J	1 J	0.9	0.85 J	0.63	0.57 J	–	0.57 J	0.58 J	0.
Nickel	ug/L	21.7	20	18.8	13.3	11.8	13.2	17.1	1.2	2.4	–	1.6	19.1	1.
Potassium	ug/L	2520	2270	1930	5090	4890	4370	3040	4810	5020	–	4720	3270	41
Selenium	ug/L	18.1	15.1	13.6	18.5 J	20.3 J	19.2	17 UJ	33.2 UJ	28.5 UJ	–	30.7 UJ	38 UJ	7
Silver	ug/L	10 UJ	10 U	0.97	10 U	10 U	53.8	3.6 J	0.64 J	3.1 J	–	10 UJ	1.5 J	1.
Sodium	ug/L	342000	348000	308000	373000	370000	347000	400000	458000	376000	–	377000	375000	410
Thallium	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	–	10 U	10 U	10
Vanadium	ug/L	18.6	18.9	16.1	4.4	4.9	4.8	41.9	21.3	19.6	–	18.4	21.2	2
Zinc	ug/L	22.1	4.2	13.1	2 J	2.9 J	13.5	11.9 J	14.3	14.3 J	–	11.5 J	14.5 J	13
Miscellaneous														
Perchlorate	ug/L	–	–	–	–	–		–	–	–	–	–	–	
pH	pH	7.26	7.29	–	7.09	7.1	–	6.86	6.96	6.63	–	–	6.84	7.
Chromium, hexavalent	ug/L	1 U	–	–	1 U	–	–	–	–	0.25 J	0.24	–	–	

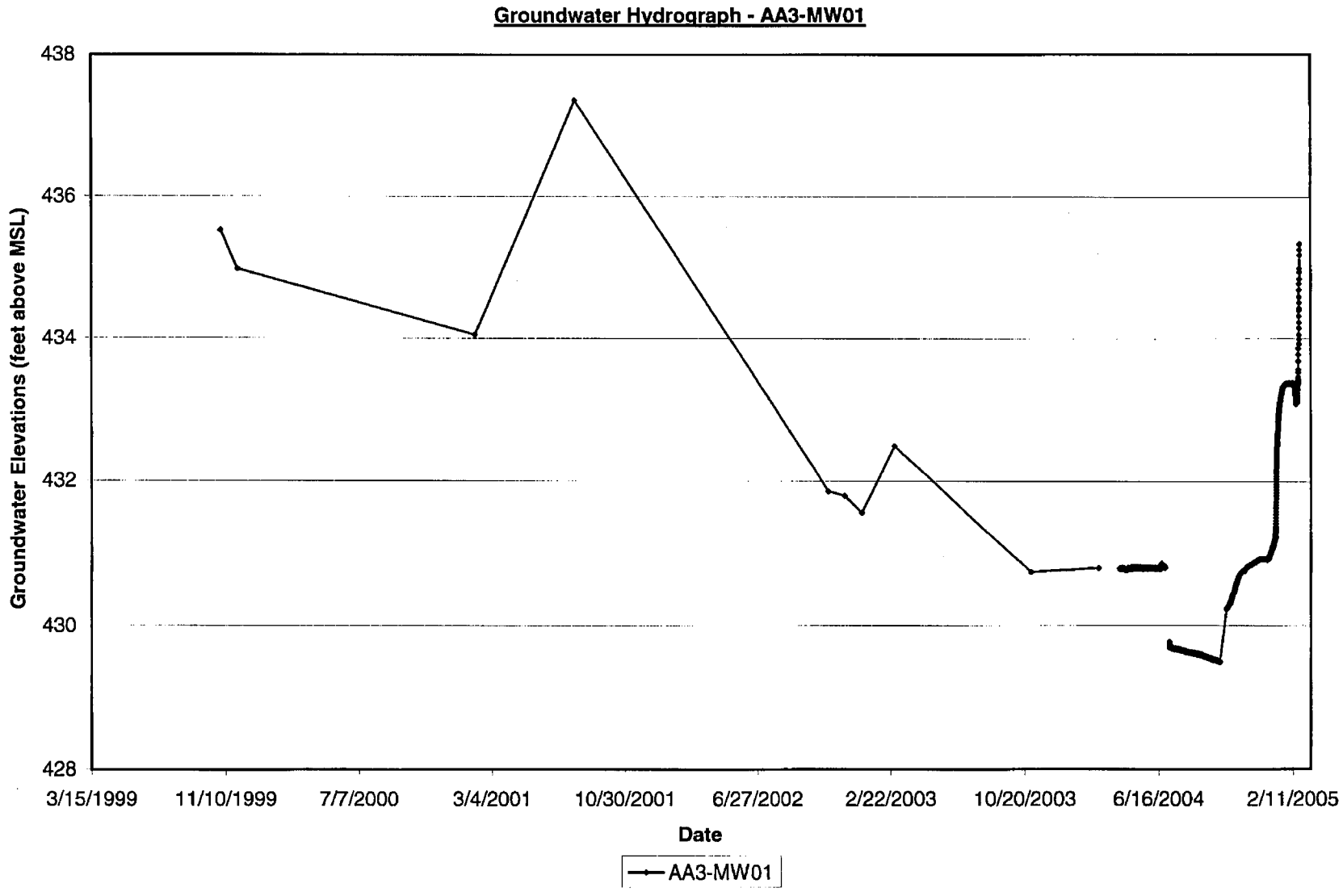
NOTES:

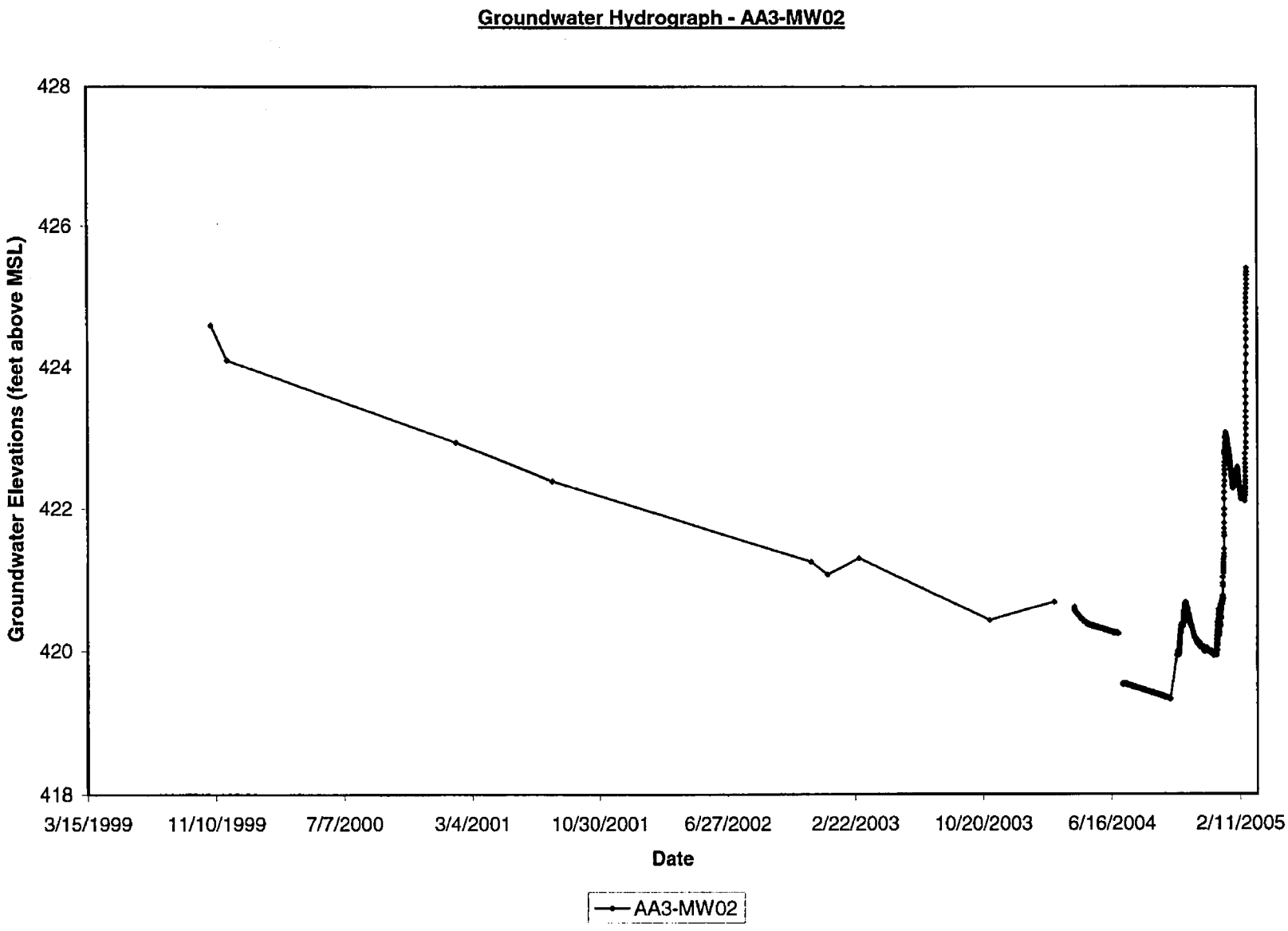
µg/L = micrograms per liter
mg/L = milligram per liter
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds
SVOCs = semivolatile organic compounds
PAHs = polynuclear aromatic hydrocarbons

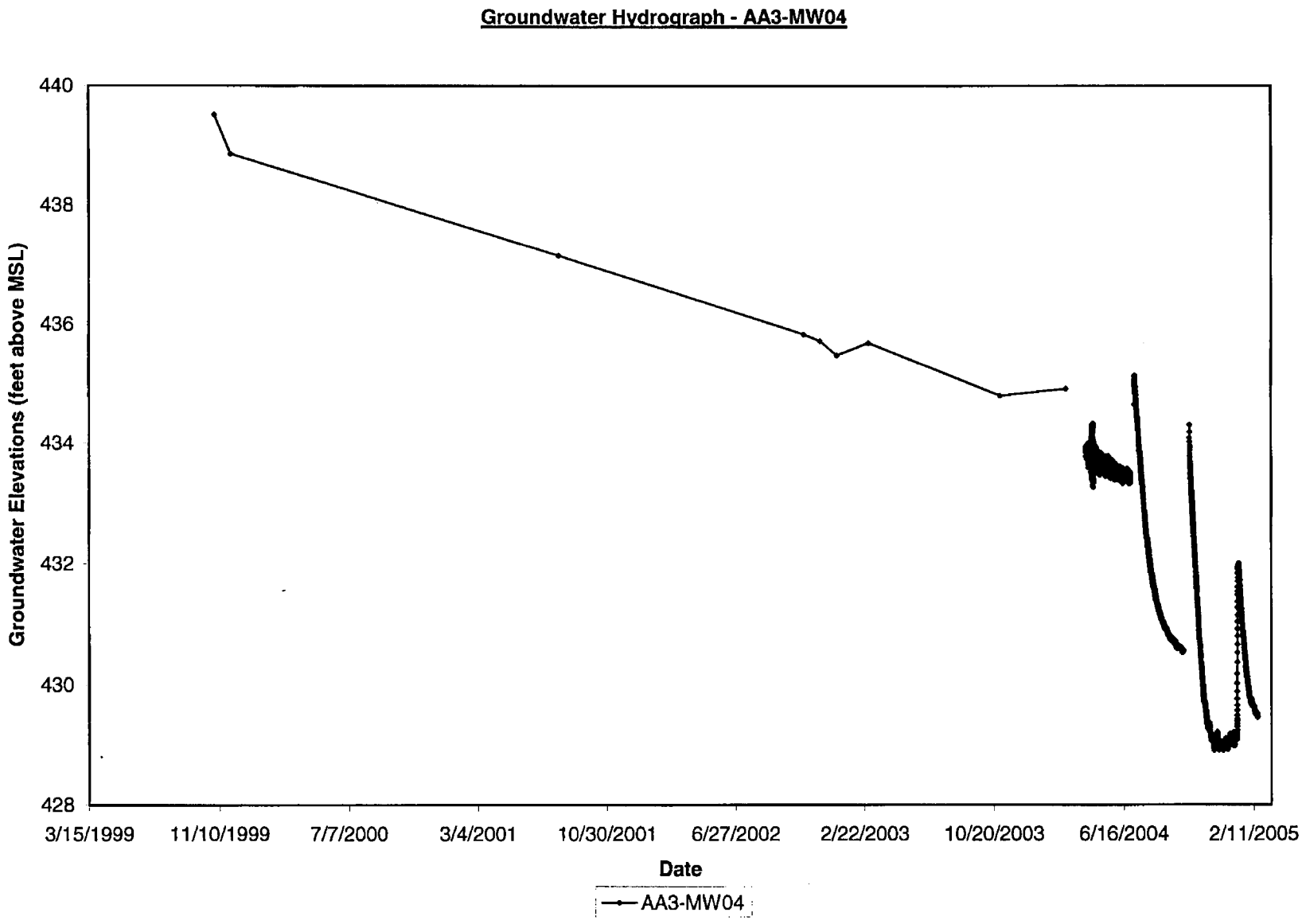
pH = the negative log of the hydrogen ion concentration
AA3 = Anomaly Area 3
RSE = Removal Site Evaluation
U = indicates the analyte was not detected at or above the stated limit.
UJ = indicates the analyte was not detected at or above the stated limit. The sample detection limit is an estimated value.
J = indicates an estimated value.

Groundwater Hydrographs
Anomaly Area 3

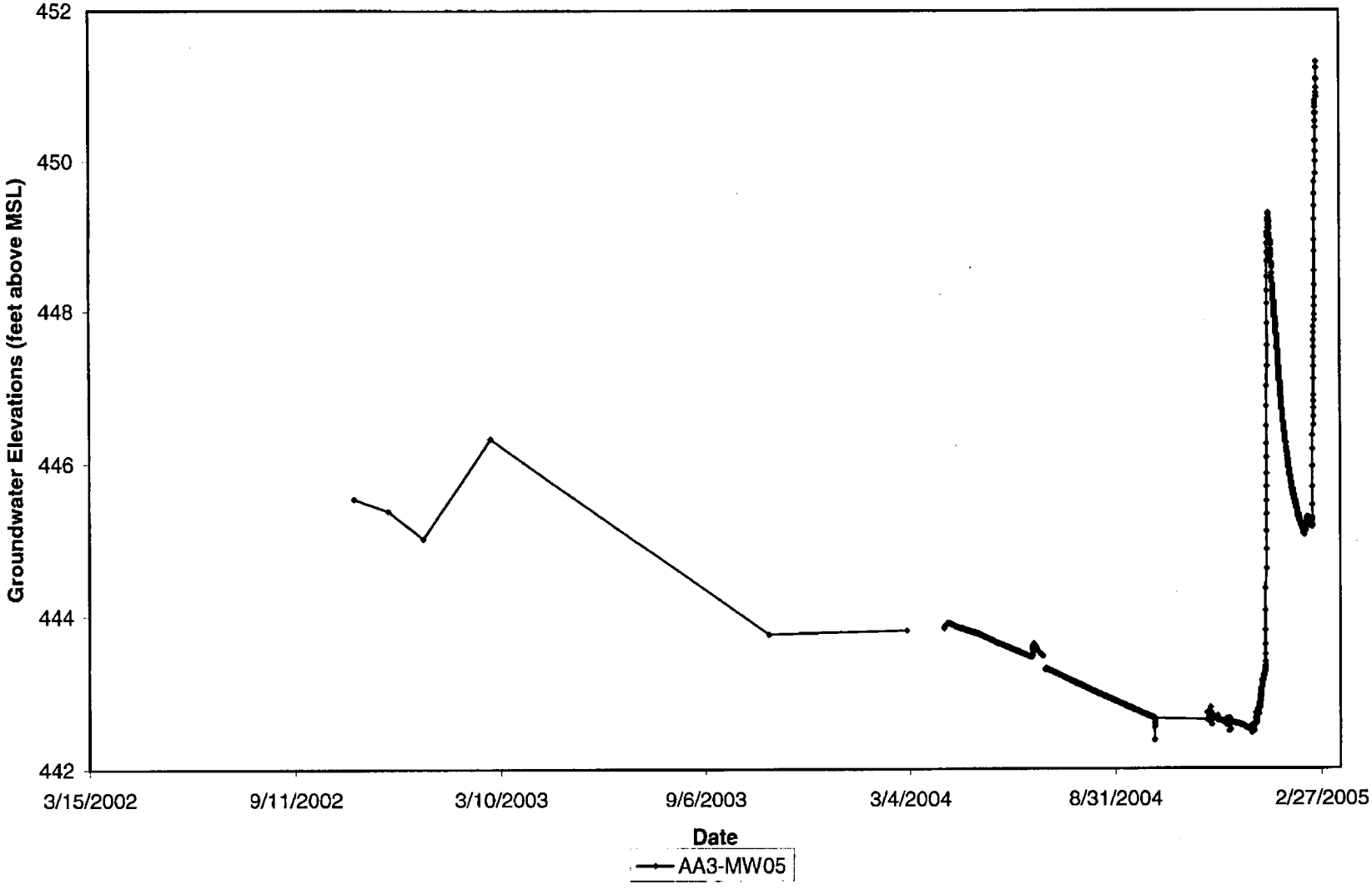


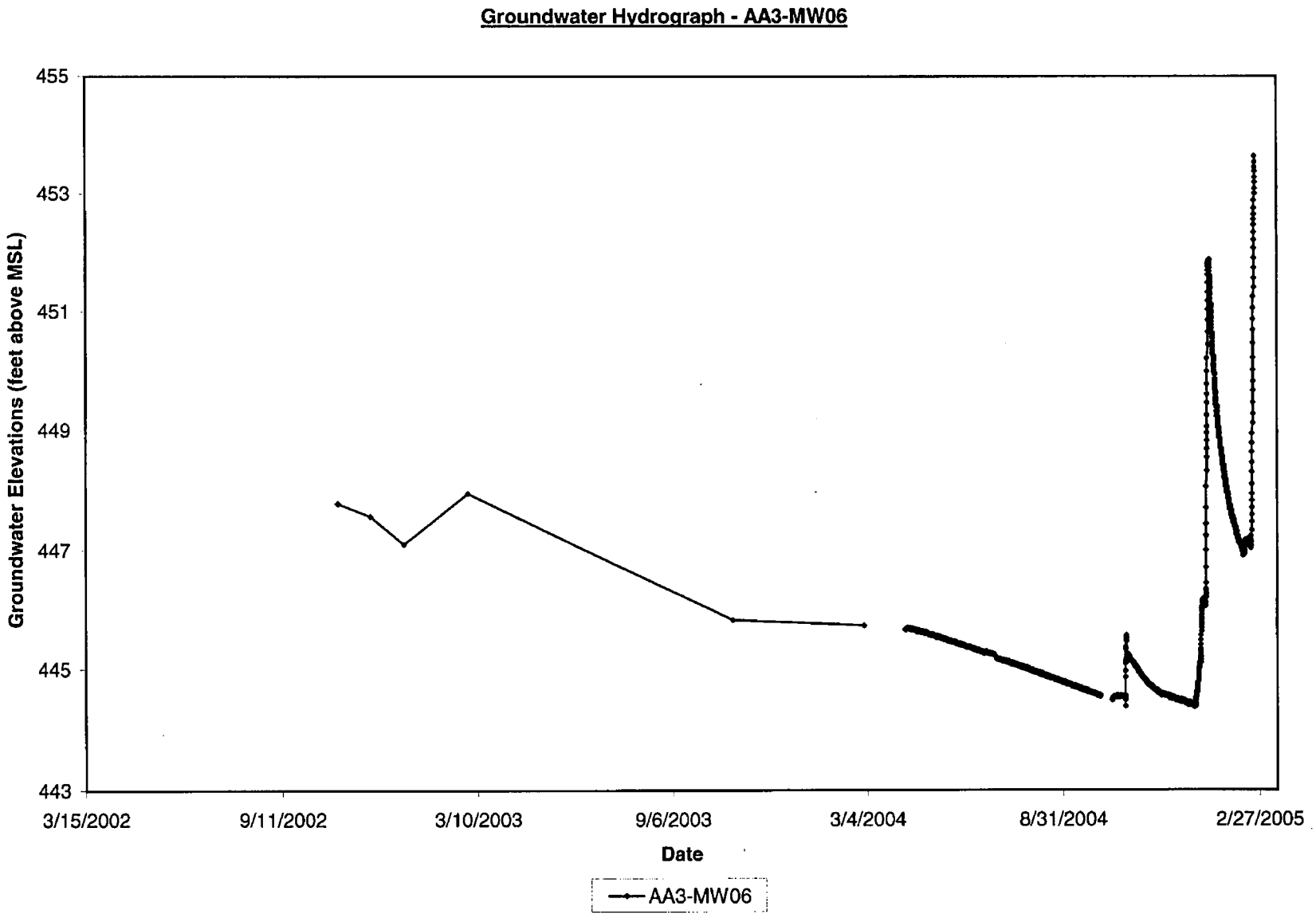

Groundwater Hydrograph - AA3-MW01
438
436
434
432
430
428
Groundwater Elevations (feet above MSL)
3/15/1999
11/10/1999
7/7/2000
3/4/2001
10/30/2001
6/27/2002
2/22/2003
10/20/2003
6/16/2004
2/11/2005
Date
AA3-MW01


Groundwater Hydrograph - AA3-MW02
428
426
424
422
420
418
Groundwater Elevations (feet above MSL)
3/15/1999
11/10/1999
7/7/2000
3/4/2001
10/30/2001
6/27/2002
2/22/2003
10/20/2003
6/16/2004
2/11/2005
Date
AA3-MW02

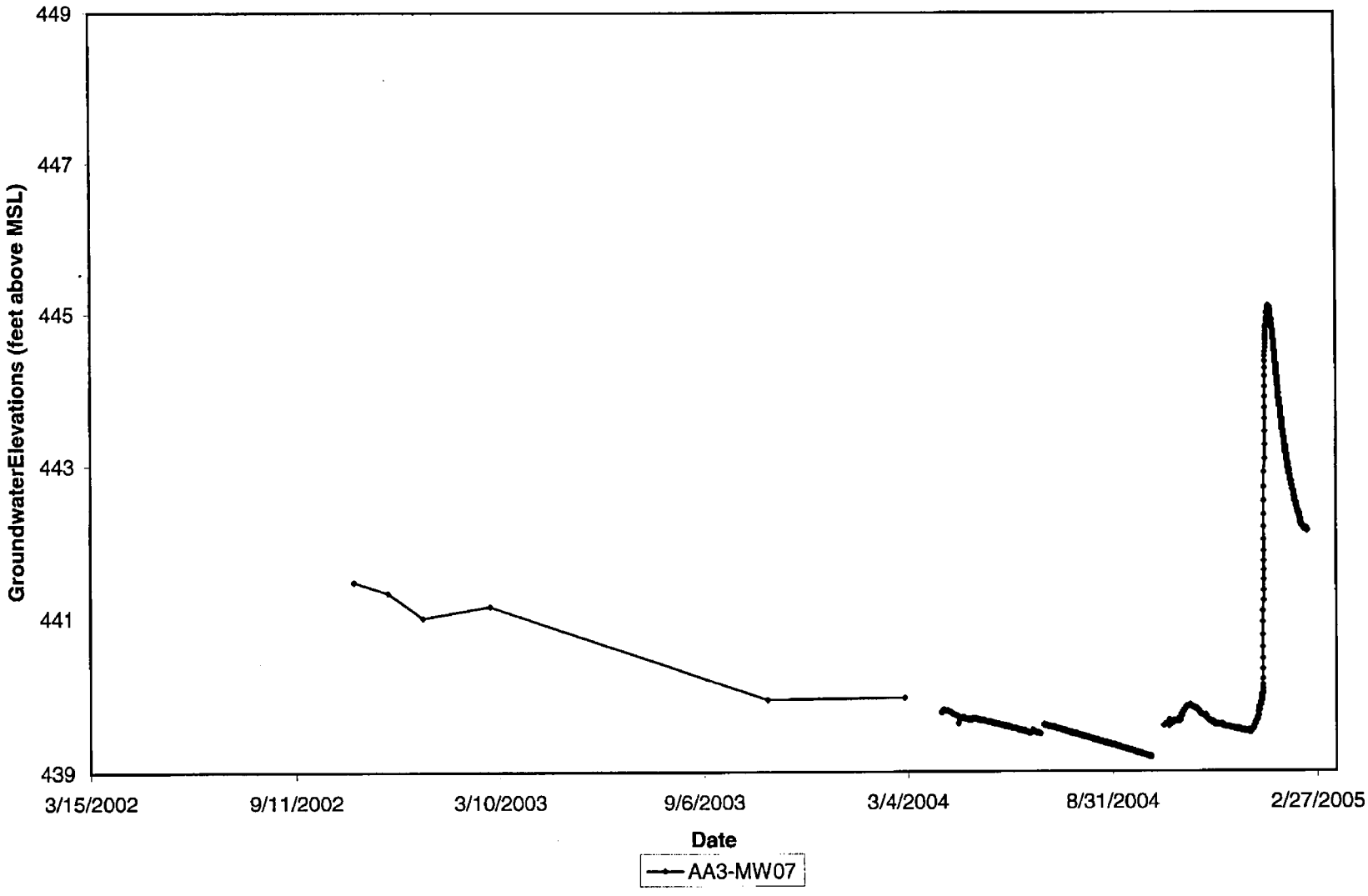

Groundwater Hydrograph - AA3-MW04
440
438
436
434
432
430
428
Groundwater Elevations (feet above MSL)
3/15/1999
11/10/1999
7/7/2000
3/4/2001
10/30/2001
6/27/2002
2/22/2003
10/20/2003
6/16/2004
2/11/2005
Date
AA3-MW04

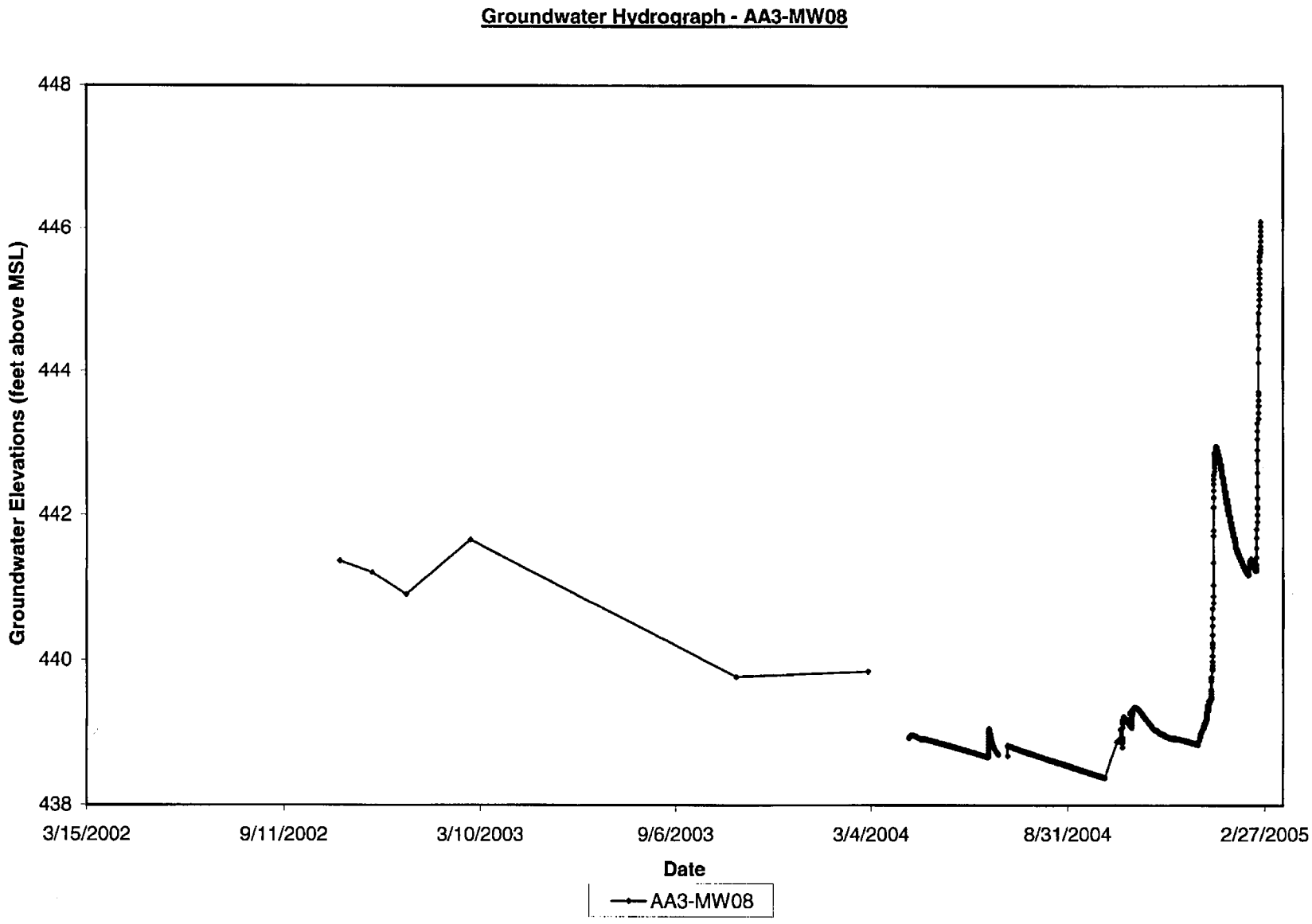
Groundwater Hydrograph - AA3-MW05

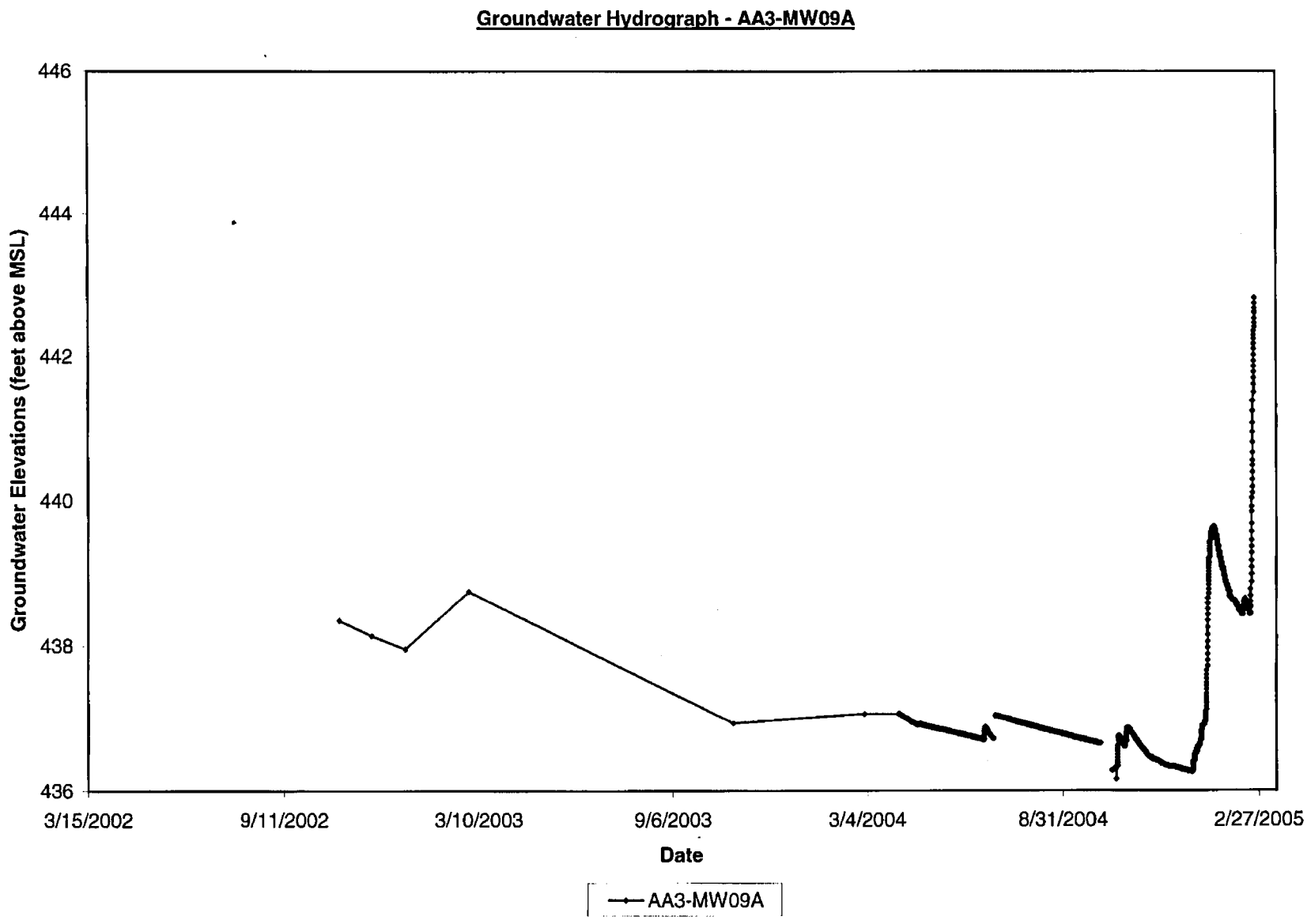


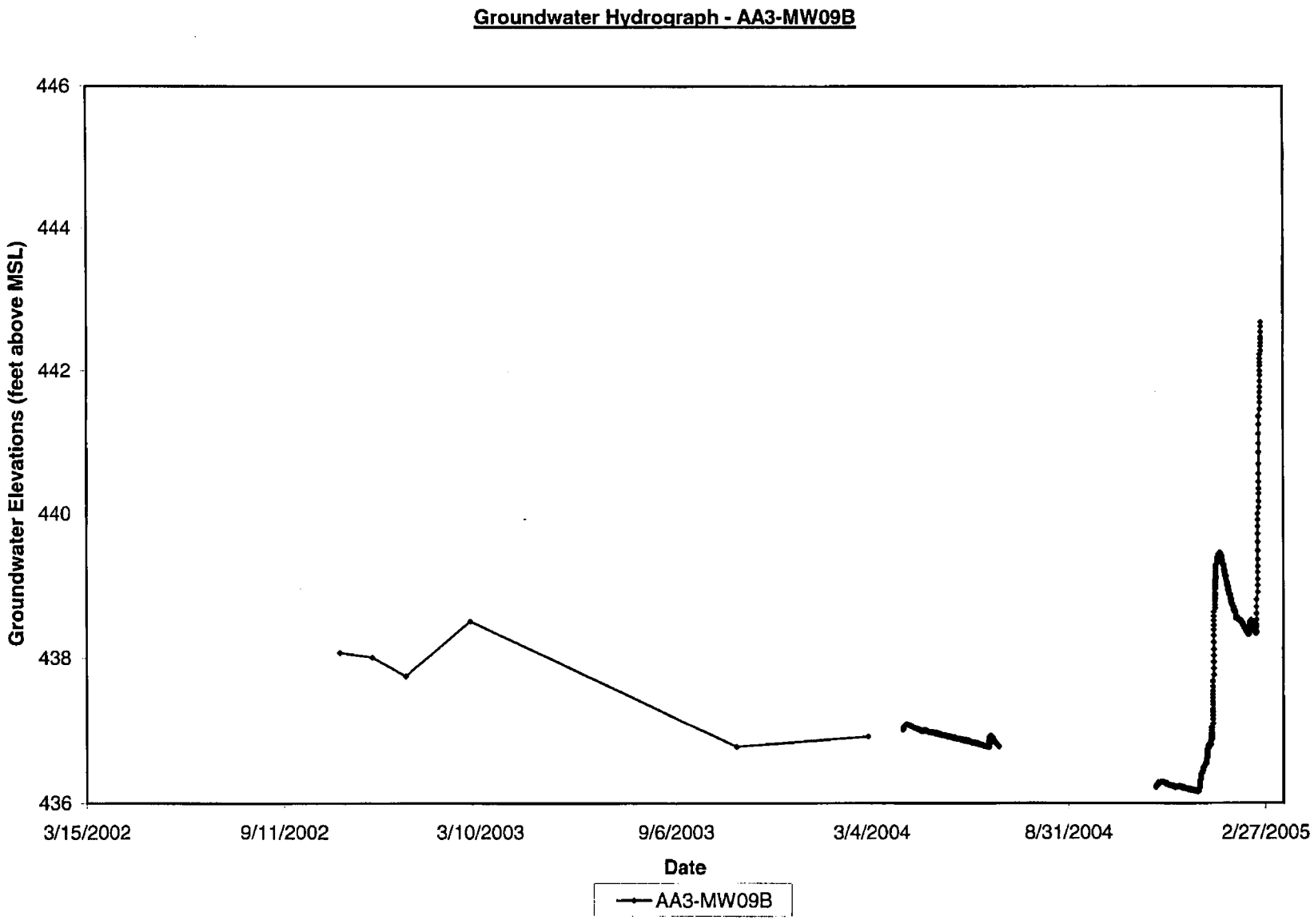

Groundwater Hydrograph - AA3-MW06
455
453
451
449
447
445
443
Groundwater Elevations (feet above MSL)
3/15/2002
9/11/2002
3/10/2003
9/6/2003
3/4/2004
8/31/2004
2/27/2005
Date
AA3-MW06

Groundwater Hydrograph - AA3-MW07

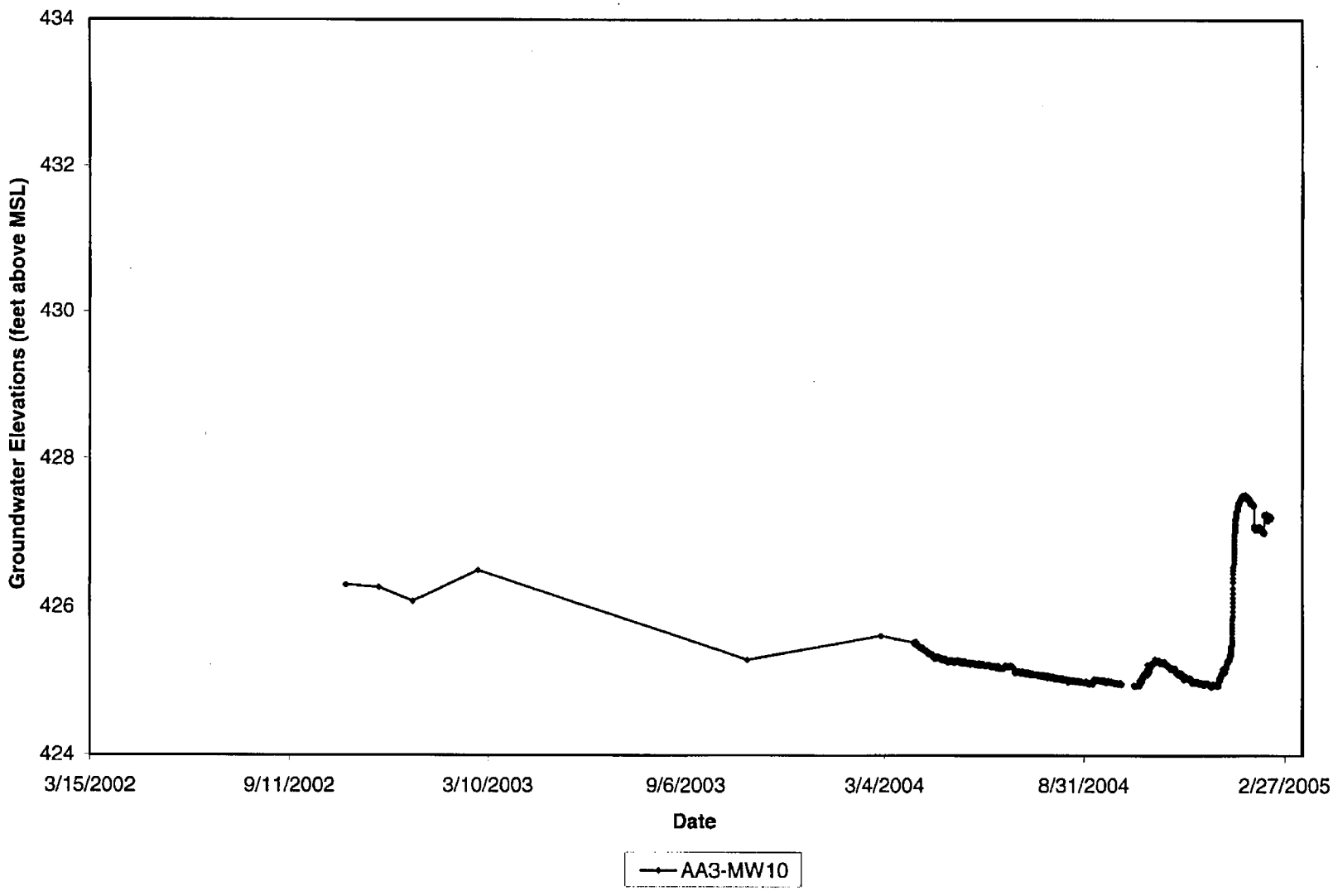



Groundwater Hydrograph - AA3-MW08
448
446
444
442
440
438
Groundwater Elevations (feet above MSL)
3/15/2002
9/11/2002
3/10/2003
9/6/2003
3/4/2004
8/31/2004
2/27/2005
Date
AA3-MW08


Groundwater Hydrograph - AA3-MW09A
446
444
442
440
438
436
Groundwater Elevations (feet above MSL)
3/15/2002
9/11/2002
3/10/2003
9/6/2003
3/4/2004
8/31/2004
2/27/2005
Date
AA3-MW09A


Groundwater Hydrograph - AA3-MW09B
446
444
442
440
438
436
Groundwater Elevations (feet above MSL)
3/15/2002
9/11/2002
3/10/2003
9/6/2003
3/4/2004
8/31/2004
2/27/2005
Date
AA3-MW09B

Groundwater Hydrograph - AA3-MW10



Appendix B6
Sediment Sampling Information

Table J-1: Details of Sediment Sampling – RSE Investigation

Location ID	EPA ID	Earth Tech ID	Sampling Date	Sampling Depths (feet bgs)	Sample Type	pH	Petroleum Hydrocarbons	VOCs	SVOCs	PAHs	Metals	Dioxins and Furans
SD1	LK289	AA 3-SD1SS-S01-D000	02/23/2003	Surface	Regular	√	√	√	√	√	√	—
SD2	LK290	AA 3-SD2SS-S01-D000	02/23/2003	Surface	Regular	√	√	√	√	√	√	—
SD3	LK291	AA 3-SD3SS-S01-D000	02/23/2003	Surface	Regular	√	√	√	√	√	√	—
SD4	LK292	AA 3-SD4SS-S01-D000	02/23/2003	Surface	Regular	√	√	√	√	√	√	—

Table J-2: Sediment Sample Analytical Results - RSE Investigation

	Sample ID:	LK289	LK290	LK291	LK292
	Location ID:	AA3-SD1	AA3-SD2	AA3-SD3	AA3-SD4
	Sample Date:	2/23/2003	2/23/2003	2/23/2003	2/23/2003
PARAMETER	SampleType:	Regular	Regular	Regular	Regular
TPH (EPA Method 8015B DRO)	Units				
Gasoline	mg/kg	13U	14U	11U	11U
Motor Oils	mg/kg	20	11U	11U	11U
PHC as diesel fuel	mg/kg	12U	11U	11U	11U
VOCs (EPA Method 8260B)					
1,1,1,2-Tetrachloroethane	ug/kg	5.9U	6.1U	5.5U	5.6U
1,1,1-Trichloroethane	ug/kg	5.9U	6.1U	5.5U	5.6U
1,1,2,2-Tetrachloroethane	ug/kg	5.9U	6.1U	5.5U	5.6U
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/kg	5.9U	6.1U	5.5U	5.6U
1,1,2-Trichloroethane	ug/kg	5.9U	6.1U	5.5U	5.6U
1,1-Dichloroethane	ug/kg	5.9U	6.1U	5.5U	5.6U
1,1-Dichloroethene	ug/kg	5.9U	6.1U	5.5U	5.6U
1,2,3-Trichloropropane	ug/kg	5.9U	6.1U	5.5U	5.6U
1,2-Dichloroethane	ug/kg	5.9U	6.1U	5.5U	5.6U
1,2-Dichloropropane	ug/kg	5.9U	6.1U	5.5U	5.6U
1,2-Dichlorotetrafluoroethane	ug/kg	5.9U	6.1U	5.5U	5.6U
2-Butanone	ug/kg	120U	120U	110U	110U
2-Hexanone	ug/kg	59UJ	61UJ	55UJ	56UJ
4-Methyl-2-Pentanone	ug/kg	59UJ	61UJ	55UJ	56UJ
Acetone	ug/kg	120UJ	120UJ	110UJ	110UJ
Benzene	ug/kg	5.9U	6.1U	5.5U	5.6U
Bromodichloromethane	ug/kg	5.9U	6.1U	5.5U	5.6U
Bromoform	ug/kg	5.9U	6.1U	5.5U	5.6U
Bromomethane	ug/kg	5.9U	6.1U	5.5U	5.6U
2-Methoxy-2-Methyl- Butane	ug/kg	5.9U	6.1U	5.5U	5.6U
Carbon Disulfide	ug/kg	5.9U	6.1U	5.5U	5.6U
Carbon Tetrachloride	ug/kg	5.9UJ	6.1UJ	5.5UJ	5.6UJ
Chlorobenzene	ug/kg	5.9U	6.1U	5.5U	5.6U
Chlorodibromomethane	ug/kg	5.9U	6.1U	5.5U	5.6U
Chloroethane	ug/kg	5.9U	6.1U	5.5U	5.6U
Chloroform	ug/kg	5.9U	6.1U	5.5U	5.6U
Chloromethane	ug/kg	5.9U	6.1U	5.5U	5.6U
Cis-1,2-Dichloroethene	ug/kg	5.9U	6.1U	5.5U	5.6U
Cis-1,3-Dichloropropene	ug/kg	5.9U	6.1U	5.5U	5.6U
Dichlorodifluoromethane	ug/kg	5.9U	6.1U	5.5U	5.6U
Diisopropyl Ether	ug/kg	5.9U	6.1U	5.5U	5.6U
Ethylbenzene	ug/kg	5.9U	6.1U	5.5U	5.6U
Methyl Tert-Butyl Ether	ug/kg	5.9U	6.1U	5.5U	5.6U
Methylene Chloride	ug/kg	5.9U	6.1U	5.5U	5.6U
2-Ethoxy-2-Methyl-Propane	ug/kg	5.9U	6.1U	5.5U	5.6U
Styrene	ug/kg	5.9U	6.1U	5.5U	5.6U
Tert-Butyl Alcohol	ug/kg	24UJ	24UJ	22UJ	23UJ
Tetrachloroethene	ug/kg	5.9U	6.1U	5.5U	5.6U
Toluene	ug/kg	5.9U	6.1U	5.5U	5.6U
Total Xylenes	ug/kg	18U	18U	17U	17U
Trans-1,2-Dichloroethene	ug/kg	5.9U	6.1U	5.5U	5.6U
Trans-1,3-Dichloropropene	ug/kg	5.9U	6.1U	5.5U	5.6U
Trichloroethene	ug/kg	5.9U	6.1U	5.5U	5.6U
Trichlorofluoromethane	ug/kg	5.9UJ	6.1UJ	5.5UJ	5.6UJ
Vinyl Chloride	ug/kg	5.9U	6.1U	5.5U	5.6U

Table J-2: Sediment Sample Analytical Results - RSE Investigation

	Sample ID:	LK289	LK290	LK291	LK292
	Location ID:	AA3-SD1	AA3-SD2	AA3-SD3	AA3-SD4
	Sample Date:	2/23/2003	2/23/2003	2/23/2003	2/23/2003
SVOCs (EPA Method 8270C)					
1,2,4-Trichlorobenzene	ug/kg	590U	560U	550U	550U
1,2-Dichlorobenzene	ug/kg	590U	560U	550U	550U
1,3-Dichlorobenzene	ug/kg	590U	560U	550U	550U
1,4-Dichlorobenzene	ug/kg	590U	560U	550U	550U
2,4,5-Trichlorophenol	ug/kg	590U	560U	550U	550U
2,4,6-Trichlorophenol	ug/kg	590U	560U	550U	550U
2,4-Dichlorophenol	ug/kg	590U	560U	550U	550U
2,4-Dimethylphenol	ug/kg	590U	560U	550U	550U
2,4-Dinitrophenol	ug/kg	3000U	2800U	2700U	2700U
2,4-Dinitrotoluene	ug/kg	590U	560U	550U	550U
2,6-Dinitrotoluene	ug/kg	590U	560U	550U	550U
2-Chloronaphthalene	ug/kg	590U	560U	550U	550U
2-Chlorophenol	ug/kg	590U	560U	550U	550U
2-Methylphenol	ug/kg	590U	560U	550U	550U
2-Nitroaniline	ug/kg	3000U	2800U	2700U	2700U
2-Nitrophenol	ug/kg	590U	560U	550U	550U
3,3'-Dichlorobenzidine	ug/kg	1200U	1100U	1100U	1100U
3-Nitroaniline	ug/kg	3000U	2800U	2700U	2700U
4,6-Dinitro-2-Methylphenol	ug/kg	3000U	2800U	2700U	2700U
4-Bromophenyl Phenyl Ether	ug/kg	590U	560U	550U	550U
4-Chloro-3-Methylphenol	ug/kg	590U	560U	550U	550U
4-Chloroaniline	ug/kg	1200U	1100U	1100U	1100U
4-Chlorophenyl Phenyl Ether	ug/kg	590U	560U	550U	550U
4-Methylphenol	ug/kg	590U	560U	550U	550U
4-Nitroaniline	ug/kg	3000U	2800U	2700U	2700U
4-Nitrophenol	ug/kg	3000U	2800U	2700U	2700U
Bis(2-Chloro-1-Methylethyl)Ether	ug/kg	590U	560U	550U	550U
Bis(2-Chloroethoxy)Methane	ug/kg	590U	560U	550U	550U
Bis(2-Chloroethyl)Ether	ug/kg	190U	180U	180U	180U
Bis(2-Ethylhexyl)Phthalate	ug/kg	590U	560U	550U	550U
Butyl Benzyl Phthalate	ug/kg	590U	560U	550U	550U
Carbazole	ug/kg	590U	560U	550U	550U
Dibenzofuran	ug/kg	590U	560U	550U	550U
Diethyl Phthalate	ug/kg	590U	560U	550U	550U
Dimethyl Phthalate	ug/kg	590U	560U	550U	550U
Di-N-Butyl Phthalate	ug/kg	590U	560U	550U	550U
Di-N-Octyl Phthalate	ug/kg	590U	560U	550U	550U
Hexachlorobenzene	ug/kg	590U	560U	550U	550U
Hexachlorobutadiene	ug/kg	590U	560U	550U	550U
Hexachlorocyclopentadiene	ug/kg	3000U	2800U	2700U	2700U
Hexachloroethane	ug/kg	590U	560U	550U	550U
Isophorone	ug/kg	590U	560U	550U	550U
Nitrobenzene	ug/kg	590U	560U	550U	550U
N-Nitroso-Di-N-Propylamine	ug/kg	46U	44U	43U	43U
N-Nitrosodiphenylamine	ug/kg	3000U	2800U	2700U	2700U
Pentachlorophenol	ug/kg	2000U	1900U	1900U	1900U
Phenol	ug/kg	590U	560U	550U	550U
PAH Compounds (Method PAH-SIM)					
2-Methylnaphthalene	ug/kg	30U	28U	27U	27U
Acenaphthene	ug/kg	30U	28U	27U	27U
Acenaphthylene	ug/kg	30U	28U	27U	27U

Table J-2: Sediment Sample Analytical Results - RSE Investigation

	Sample ID:	LK289	LK290	LK291	LK292
	Location ID:	AA3-SD1	AA3-SD2	AA3-SD3	AA3-SD4
	Sample Date:	2/23/2003	2/23/2003	2/23/2003	2/23/2003
Anthracene	ug/kg	30U	28U	27U	27U
Benz(A)Anthracene	ug/kg	30UJ	28UJ	27UJ	27UJ
Benzo(A)Pyrene	ug/kg	30U	28U	27U	27U
Benzo(B)Fluoranthene	ug/kg	30U	28U	27U	27U
Benzo(G,H,I)Perylene	ug/kg	30U	28U	27U	27U
Benzo(K)Fluoranthene	ug/kg	30U	28U	27U	27U
Chrysene	ug/kg	30UJ	28UJ	27UJ	27UJ
Dibenz(A,H)Anthracene	ug/kg	30U	28U	27U	27U
Fluoranthene	ug/kg	30U	28U	27U	27U
Fluorene	ug/kg	30U	28U	27U	27U
Indeno(1,2,3-Cd)Pyrene	ug/kg	30U	28U	27U	27U
Naphthalene	ug/kg	30U	28U	27U	27U
Phenanthrene	ug/kg	30U	28U	27U	27U
Pyrene	ug/kg	30U	28U	27U	27U
Metals (EPA Method 6010B)					
Aluminum	mg/kg	3050	2420	2120	1750
Antimony	mg/kg	3.6U	3.4U	3.3U	3.3U
Arsenic	mg/kg	1.8	1.4	0.94UJ	1.4
Barium	mg/kg	85.7	39.6	25.6	110
Beryllium	mg/kg	0.24U	0.22U	0.22U	0.22U
Cadmium	mg/kg	0.26	0.17UJ	0.16UJ	0.23
Calcium	mg/kg	4570	3250	2620	3020
Chromium	mg/kg	4.4	2.8	2.7	2.5
Cobalt	mg/kg	2	1.6	1.2	1.4
Copper	mg/kg	2.5	1.8	1.5	1.3
Iron	mg/kg	5050	3830	2700	2890
Lead	mg/kg	1.9	1.2	1	1.5
Magnesium	mg/kg	1610	1330	1030	898
Manganese	mg/kg	120	82.8	54.6	130
Mercury	mg/kg	0.24U	0.22U	0.22U	0.006
Nickel	mg/kg	2.8	1.8	2.1	1.6
Potassium	mg/kg	821	699	418	422
Selenium	mg/kg	0.36U	0.34U	0.33U	0.17
Silver	mg/kg	0.59U	0.56U	0.55U	0.55U
Sodium	mg/kg	120U	23.1	47.7	110U
Thallium	mg/kg	0.47U	0.45U	0.44U	0.44U
Vanadium	mg/kg	13.9	9.4	7.5	7.9
Zinc	mg/kg	13.5	9.9	7.6	7.3
Miscellaneous					
Moisture (ASTM D 2216)	%	15.6	11	8.6	8.6
pH (EPA Method 9045)	pH	8.88	8.8	8.78	8.89

NOTES:

mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
PHC= petroleum hydrocarbons
VOCs = volatile organic compounds
SVOCs = semivolatile organic compounds

pH = the negative log of the hydrogen ion concentration
AA3 = Anomaly Area 3
RSE = Removal Site Evaluation
PAHs = polynuclear aromatic hydrocarbons
% = percentage

U = indicates the analyte was not detected at or above the stated limit.
UJ = indicates the analyte was not detected at or above the stated limit. The sample detection limit is an estimated value.
J = indicates an estimated value.

Appendix B7
Surface Water Sampling Information

Table K-1: Surface water Sampling Details – RSE Investigation

Location ID	Sample ID	Earth Tech ID	Sampling Date	Sample Type	pH	Petroleum Hydrocarbons	VOCs	SVOCs	PAH	Metals	Perchlorate
UGSW	LK286	AA 3-UGSWSW-S01-D000	02/25/2003	Regular	√	√	√	√	√	√	√
DGSW	LK297	AA 3-DGSWSW-S01-D000	02/25/2003	Regular	√	√	√	√	√	√	√

Table K-2: Surface water Sample Analytical Results - RSE Investigation

PARAMETER	Sample ID:	LK286	LK287
	Location ID:	AA3-UGSW	AA3-DGSW
	Sample Date:	2/25/2003	2/25/2003
	SampleType:	Regular	Regular
TPH (EPA Method 8015B DRO)	Units		
Gasoline	mg/L	0.1U	0.1U
Motor Oils	mg/L	0.13U	0.13U
PHC as Diesel Fuel	mg/L	0.096U	0.096U
VOCs (EPA Method 8260B)			
1,1,1,2-Tetrachloroethane	ug/L	0.5UJ	0.5UJ
1,1,1-Trichloroethane	ug/L	1U	1U
1,1,2,2-Tetrachloroethane	ug/L	1U	1U
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/L	5U	5U
1,1,2-Trichloroethane	ug/L	1U	1U
1,1-Dichloroethane	ug/L	1U	1U
1,1-Dichloroethene	ug/L	1U	1U
1,2,3-Trichloropropane	ug/L	0.5U	0.5U
1,2-Dichloroethane	ug/L	0.5U	0.5U
1,2-Dichloropropane	ug/L	1U	1U
1,2-Dichlorotetrafluoroethane	ug/L	5U	5U
2-Butanone	ug/L	100UJ	100UJ
2-Hexanone	ug/L	50U	50U
4-Methyl-2-Pentanone	ug/L	50U	50U
Acetone	ug/L	100U	100U
Benzene	ug/L	1U	1U
Bromodichloromethane	ug/L	0.1U	0.1U
Bromoform	ug/L	1U	1U
Bromomethane	ug/L	1U	1U
Butane, 2-Methoxy-2-Methyl-	ug/L	5U	5U
Carbon Disulfide	ug/L	1U	1U
Carbon Tetrachloride	ug/L	0.5U	0.5U
Chlorobenzene	ug/L	1U	1U
Chlorodibromomethane	ug/L	0.1U	0.1U
Chloroethane	ug/L	1U	1U
Chloroform	ug/L	0.1U	0.1U
Chloromethane	ug/L	1U	1U
Cis-1,2-Dichloroethene	ug/L	1U	1U
Cis-1,3-Dichloropropene	ug/L	0.5U	0.5U
Dichlorodifluoromethane	ug/L	1UJ	1UJ
Diisopropyl Ether	ug/L	5U	5U
Ethylbenzene	ug/L	1U	1U
Methyl Tert-Butyl Ether	ug/L	3U	3U
Methylene Chloride	ug/L	5UJ	5UJ
Propane, 2-Ethoxy-2-Methyl-	ug/L	5U	5U
Styrene	ug/L	1U	1U
Tert-Butyl Alcohol	ug/L	2UJ	2U
Tetrachloroethene	ug/L	1UJ	1UJ
Toluene	ug/L	1U	1U
Total Xylenes	ug/L	1U	1U
Trans-1,2-Dichloroethene	ug/L	1U	1U
Trans-1,3-Dichloropropene	ug/L	0.5U	0.5U
Trichloroethene	ug/L	1U	1U
Trichlorofluoromethane	ug/L	5U	5U
Vinyl Chloride	ug/L	0.5U	0.5U
SVOCs (EPA Method 8270C)			
1,2,4-Trichlorobenzene	ug/L	9.6U	9.6U
1,2-Dichlorobenzene	ug/L	9.6U	9.6U

Table K-2: Surface water Sample Analytical Results - RSE Investigation

	Sample ID:	LK286	LK287
	Location ID:	AA3-UGSW	AA3-DGSW
	Sample Date:	2/25/2003	2/25/2003
PARAMETER	SampleType:	Regular	Regular
1,3-Dichlorobenzene	ug/L	9.6U	9.6U
1,4-Dichlorobenzene	ug/L	4.8U	4.8U
2,4,5-Trichlorophenol	ug/L	9.6U	9.6U
2,4,6-Trichlorophenol	ug/L	4.8U	4.8U
2,4-Dichlorophenol	ug/L	9.6U	9.6U
2,4-Dimethylphenol	ug/L	9.6U	9.6U
2,4-Dinitrophenol	ug/L	48U	48U
2,4-Dinitrotoluene	ug/L	9.6U	9.6U
2,6-Dinitrotoluene	ug/L	9.6U	9.6U
2-Chloronaphthalene	ug/L	9.6U	9.6U
2-Chlorophenol	ug/L	9.6U	9.6U
2-Methylphenol	ug/L	9.6U	9.6U
2-Nitroaniline	ug/L	48U	48U
2-Nitrophenol	ug/L	9.6U	9.6U
3,3'-Dichlorobenzidine	ug/L	9.6UJ	9.6UJ
3-Nitroaniline	ug/L	48UJ	48UJ
4,6-Dinitro-2-Methylphenol	ug/L	48U	48U
4-Bromophenyl Phenyl Ether	ug/L	9.6U	9.6U
4-Chloro-3-Methylphenol	ug/L	9.6U	9.6U
4-Chloroaniline	ug/L	19UJ	19UJ
4-Chlorophenyl Phenyl Ether	ug/L	9.6U	9.6U
4-Methylphenol	ug/L	9.6U	9.6U
4-Nitroaniline	ug/L	48U	48U
4-Nitrophenol	ug/L	48U	48U
Bis(2-Chloro-1-Methylethyl)Ether	ug/L	9.6U	9.6U
Bis(2-Chloroethoxy)Methane	ug/L	9.6U	9.6U
Bis(2-Chloroethyl)Ether	ug/L	9.6U	9.6U
Bis(2-Ethylhexyl)Phthalate	ug/L	9.6U	9.6U
Butyl Benzyl Phthalate	ug/L	9.6U	9.6U
Carbazole	ug/L	48U	48U
Dibenzofuran	ug/L	9.6U	9.6U
Diethyl Phthalate	ug/L	9.6U	9.6U
Dimethyl Phthalate	ug/L	9.6U	9.6U
Di-N-Butyl Phthalate	ug/L	9.6U	9.6U
Di-N-Octyl Phthalate	ug/L	9.6U	9.6U
Hexachlorobenzene	ug/L	0.96U	0.96U
Hexachlorobutadiene	ug/L	9.6U	9.6U
Hexachlorocyclopentadiene	ug/L	48UJ	48UJ
Hexachloroethane	ug/L	9.6U	9.6U
Isophorone	ug/L	9.6U	9.6U
Nitrobenzene	ug/L	4.8U	4.8U
N-Nitroso-Di-N-Propylamine	ug/L	9.6U	9.6U
N-Nitrosodiphenylamine	ug/L	9.6U	9.6U
Pentachlorophenol	ug/L	12U	12U
Phenol	ug/L	9.6U	9.6U
PAH Compounds (Method PAH-SIM)			
2-Methylnaphthalene	ug/L	0.48U	0.48U
Acenaphthene	ug/L	0.48U	0.48U
Acenaphthylene	ug/L	0.48U	0.48U
Anthracene	ug/L	0.48U	0.48U
Benz(A)Anthracene	ug/L	0.48UJ	0.48UJ
Benzo(A)Pyrene	ug/L	0.19U	0.19U
Benzo(B)Fluoranthene	ug/L	0.48U	0.48U

Table K-2: Surface water Sample Analytical Results - RSE Investigation

PARAMETER	Sample ID: / Location ID: / Sample Date: / SampleType:	LK286 / AA3-UGSW / 2/25/2003 / Regular	LK287 / AA3-DGSW / 2/25/2003 / Regular
Benzo(G,H,I)Perylene	ug/L	0.48U	0.48U
Benzo(K)Fluoranthene	ug/L	0.48U	0.48U
Chrysene	ug/L	0.48UJ	0.48UJ
Dibenz(A,H)Anthracene	ug/L	0.48U	0.48U
Fluoranthene	ug/L	0.48U	0.48U
Fluorene	ug/L	0.48U	0.48U
Indeno(1,2,3-Cd)Pyrene	ug/L	0.48U	0.48U
Naphthalene	ug/L	0.48U	0.48U
Phenanthrene	ug/L	0.48U	0.48U
Pyrene	ug/L	0.48U	0.48U
Metals (EPA Method 6010B)			
Aluminum	ug/L	87500	86400
Antimony	ug/L	60U	60U
Arsenic	ug/L	33.8	34.2
Barium	ug/L	867	871
Beryllium	ug/L	2.7	2.7
Cadmium	ug/L	6	6.4
Calcium	ug/L	109000	115000
Chromium	ug/L	80.2	83.5
Cobalt	ug/L	30.8	31.5
Copper	ug/L	73UJ	74.4UJ
Iron	ug/L	70300	71900
Lead	ug/L	26.7	28.2
Magnesium	ug/L	49300	50400
Manganese	ug/L	1070	1070
Mercury	ug/L	0.19UJ	0.13UJ
Nickel	ug/L	75.5	78.5
Potassium	ug/L	18000	19300
Selenium	ug/L	5U	5U
Silver	ug/L	10U	10U
Sodium	ug/L	79700	79000
Thallium	ug/L	2.7UJ	4UJ
Vanadium	ug/L	222	227
Zinc	ug/L	242	286
Miscellaneous			
Perchlorate (EPA Method E314)	ug/L	3U	3U
pH (EPA Method 9040)	pH	6.9	7.34

NOTES:

µg/L = micrograms per liter
mg/L = milligram per liter
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds
SVOCs = semivolatile organic compounds
PAHs = polynuclear aromatic hydrocarbons
pH = the negative log of the hydrogen ion concentration
AA3 = Anomaly Area 3
RSE = Removal Site Evaluation
U = indicates the analyte was not detected at or above the stated limit.
UJ = indicates the analyte was not detected at or above the stated limit. The sample detection limit is an estimated value.
J = indicates an estimated value.

Appendix C
Cone Penetrometer Survey Information

FUGRO GEOSCIENCES, INC.

13049 East Florence Avenue
Santa Fe Springs, CA 90670
Phone : 562-903-0055
Fax: 562-903-9005

November 7, 2002
Report Number 0303-0731

Earth Tech
100 West Broadway
Long Beach, CA 90802

Attention: Mr. Crispin Wyanoke

REPORT FOR
PIEZOCONE PENETRATION TESTING
AND RELATED SERVICES
MCAS EL TORO, CALIFORNIA
NAVY CLEAN N62742-94-D-0048, CTO 0078, JOB NO. 37380

Dear Mr. Wyanoke:

Please find enclosed herewith the final results of the cone penetration tests conducted at the above referenced location.

For your information, the soil stratigraphy was identified using Campanella and Robertson's Simplified Soil Behavior Chart. Please note that because of the empirical nature of the soil behavior chart, the soil identification should be verified locally.

Fugro Geosciences, Inc. appreciates the opportunity to be of service to your organization. If you should have any questions, or if we can be of further assistance, please do not hesitate to contact us. We look forward to working with you in the future.

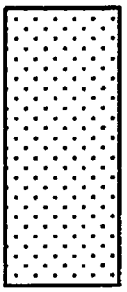
Very truly yours,
FUGRO GEOSCIENCES, INC.

Recep Yilmaz
President

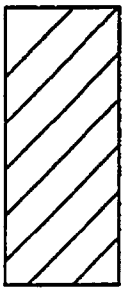
RY/jm

1 Diskette Enclosed

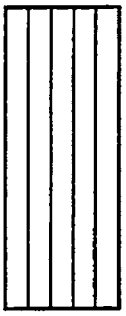
KEY TO SOIL BEHAVIOR TYPE



SAND AND SANDY SOIL



CLAY AND CLAYEY SOIL



SILT AND SILTY SOIL

ENCLOSURE

DISKETTE CONTAINING THE REPORT FOR PIEZOCONE PENETRATION TESTING AND RELATED SERVICES

THIS ENCLOSURE WAS NOT RECEIVED IN THE RESTORATION RECORD FILE.

FOR ADDITIONAL INFORMATION, CONTACT:

DIANE C. SILVA, RECORDS MANAGER
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1220 PACIFIC HIGHWAY
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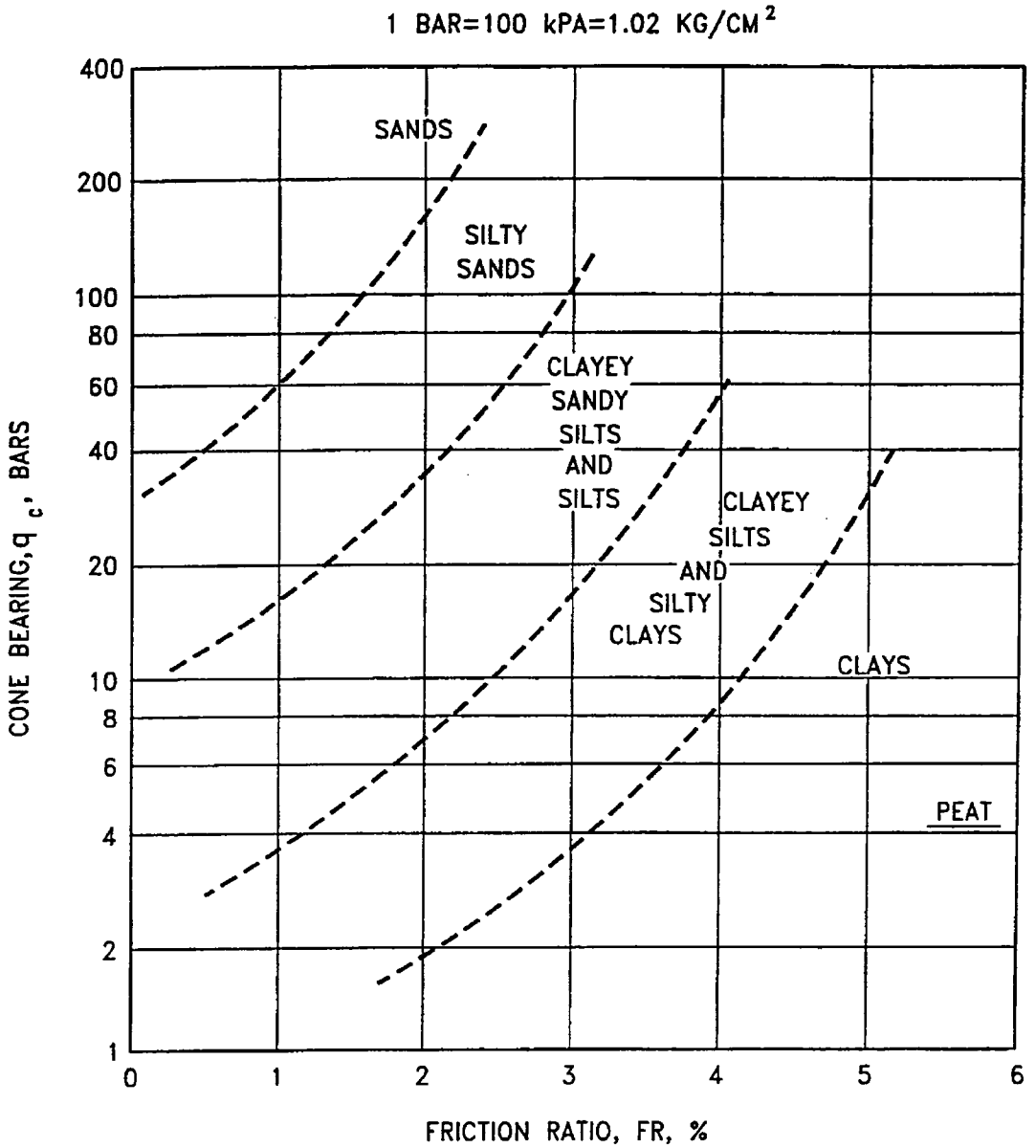
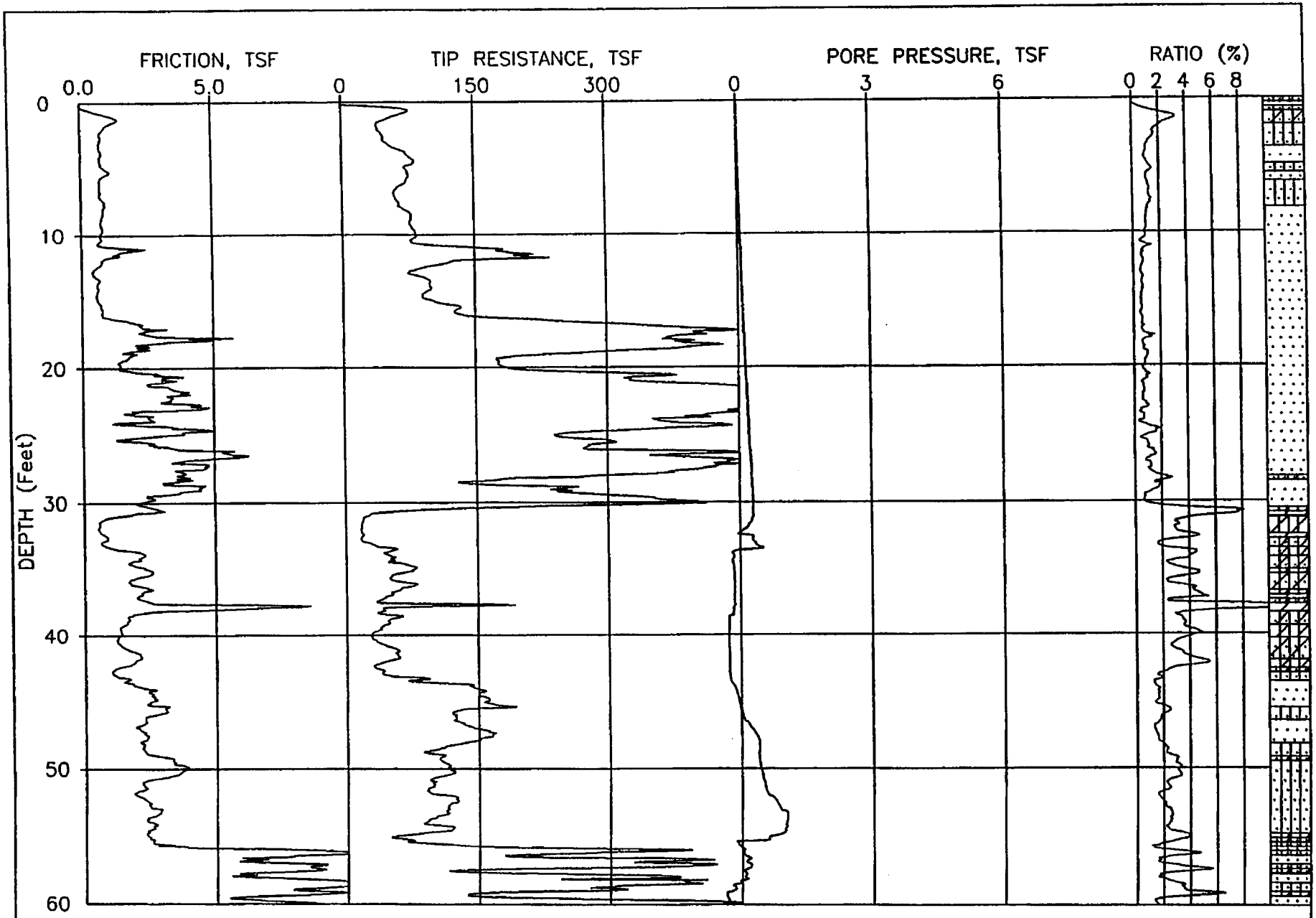
TELEPHONE: (619) 556-1280
E-MAIL: diane.silva@navy.mil



MODIFIED CAMPANELLA AND ROBERTSON SOIL BEHAVIOR CHART (1983)



JOB NUMBER: 0303-0731

CPT NUMBER: CPT1

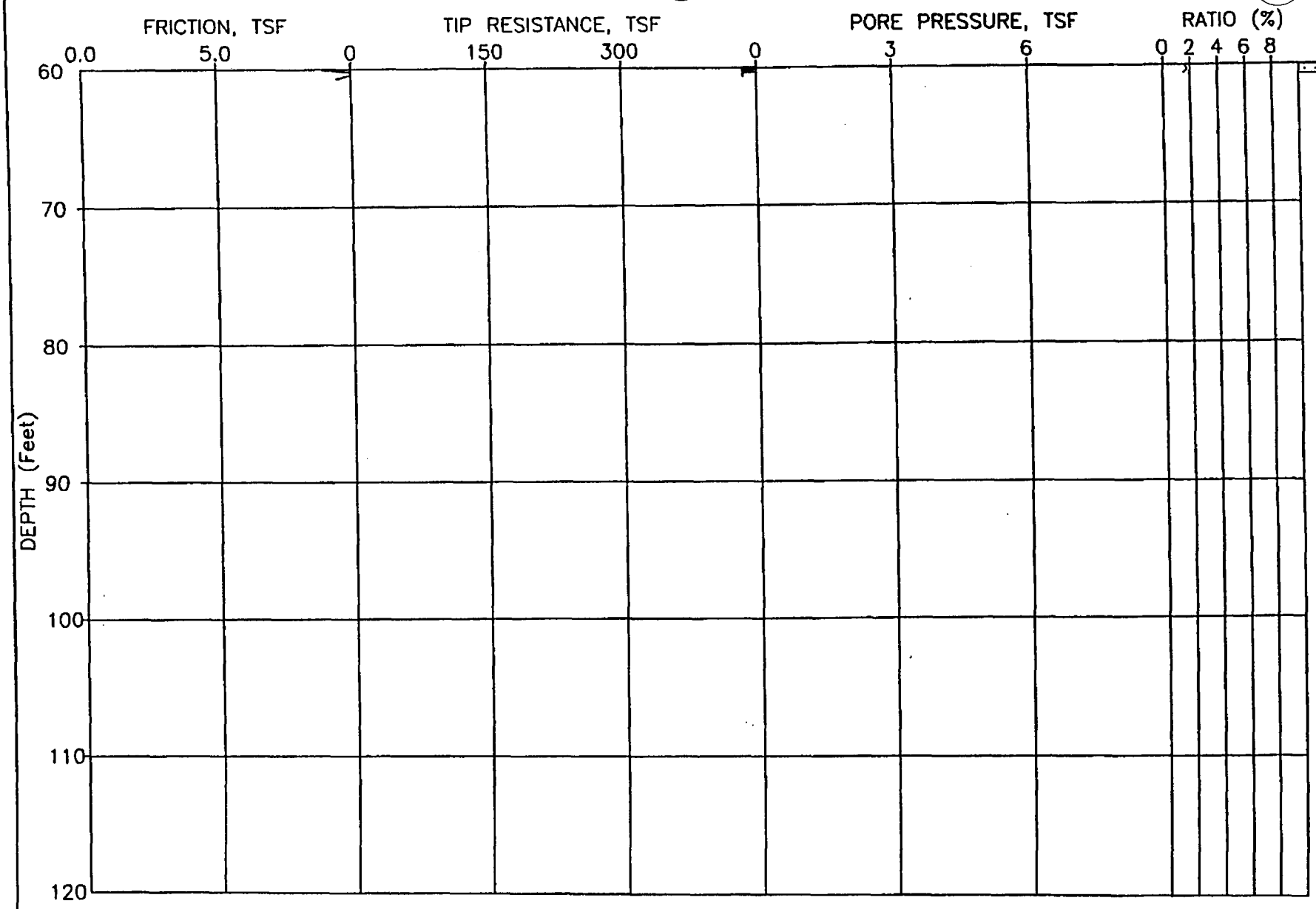
DATE: 10-17-2002

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1254

PLATE: 1 OF 2

FUGRO GEOSCIENCES,INC



JOB NUMBER: 0303-0731

CPT NUMBER: CPT1

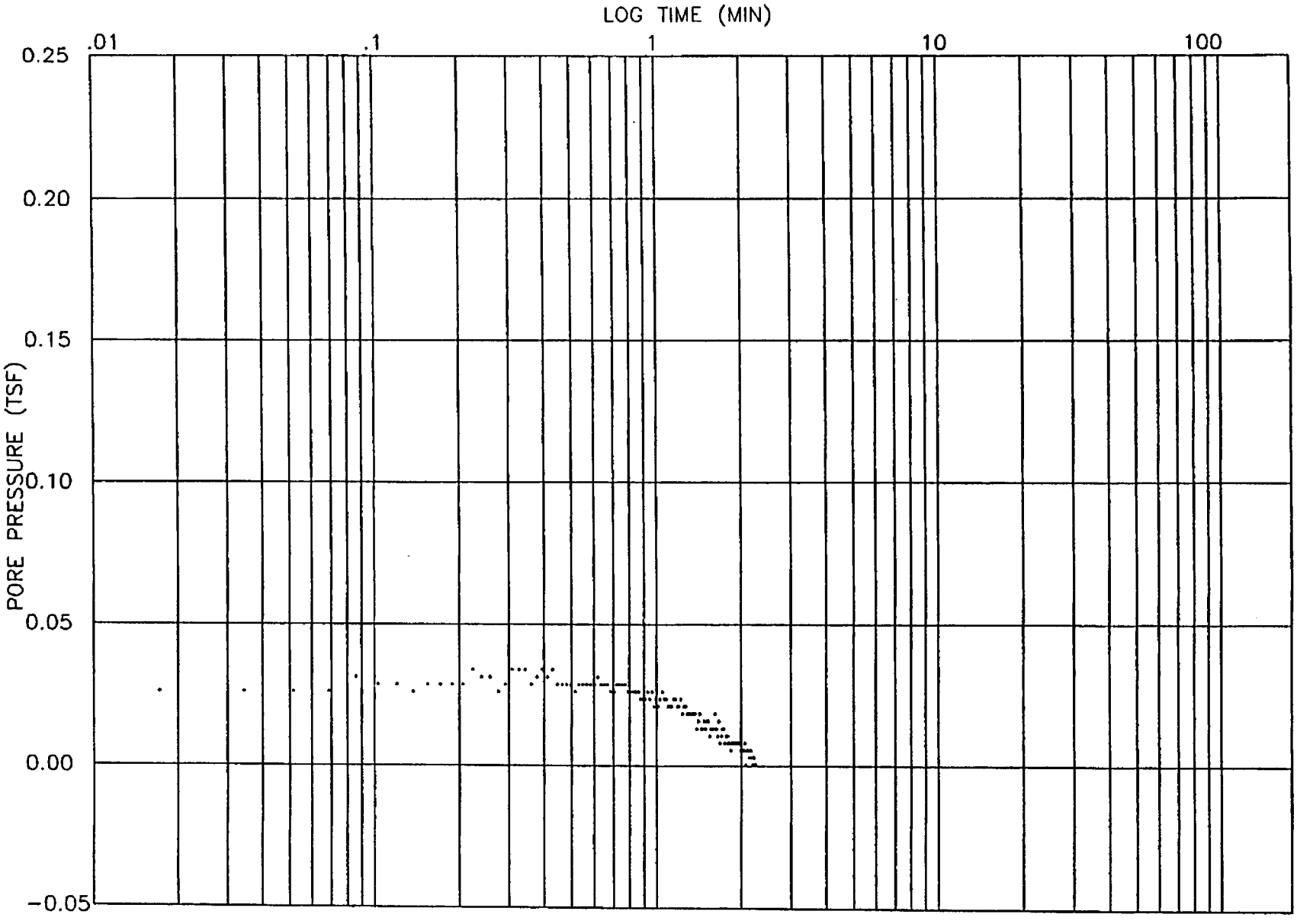
DATE: 10-17-2002

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1254

PLATE: 2 OF 2

FUGRO GEOSCIENCES,INC

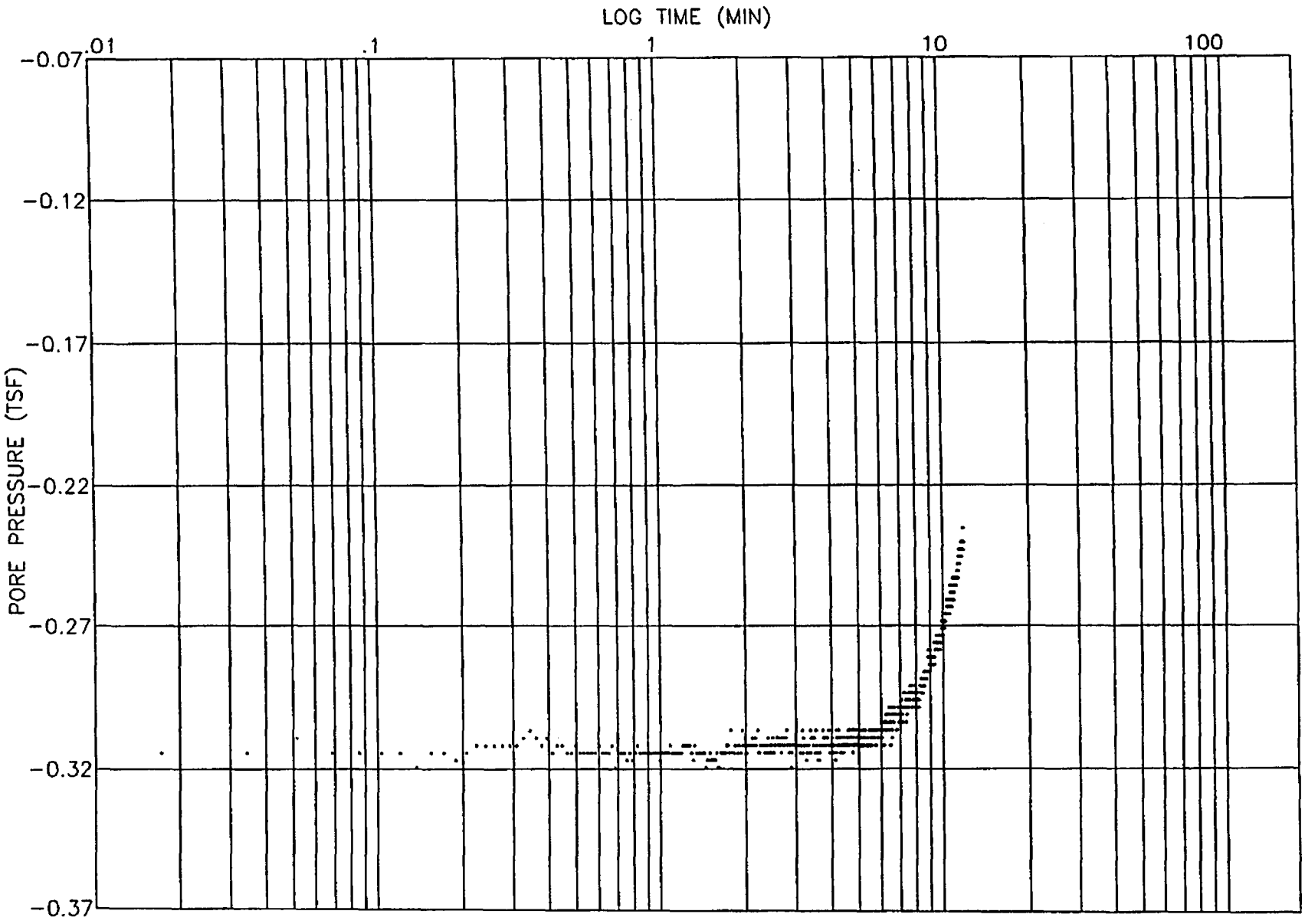


CPT NUMBER: CPT1
JOB NUMBER: 0303-0731

DISSIPATION TEST

DEPTH: 56.3 FEET
DATE: 10-17-2002

FUGRO GEOSCIENCES, INC.



CPT NUMBER: CPT1
JOB NUMBER: 0303-0731

DISSIPATION TEST

DEPTH: 61.1 FEET
DATE: 10-17-2002

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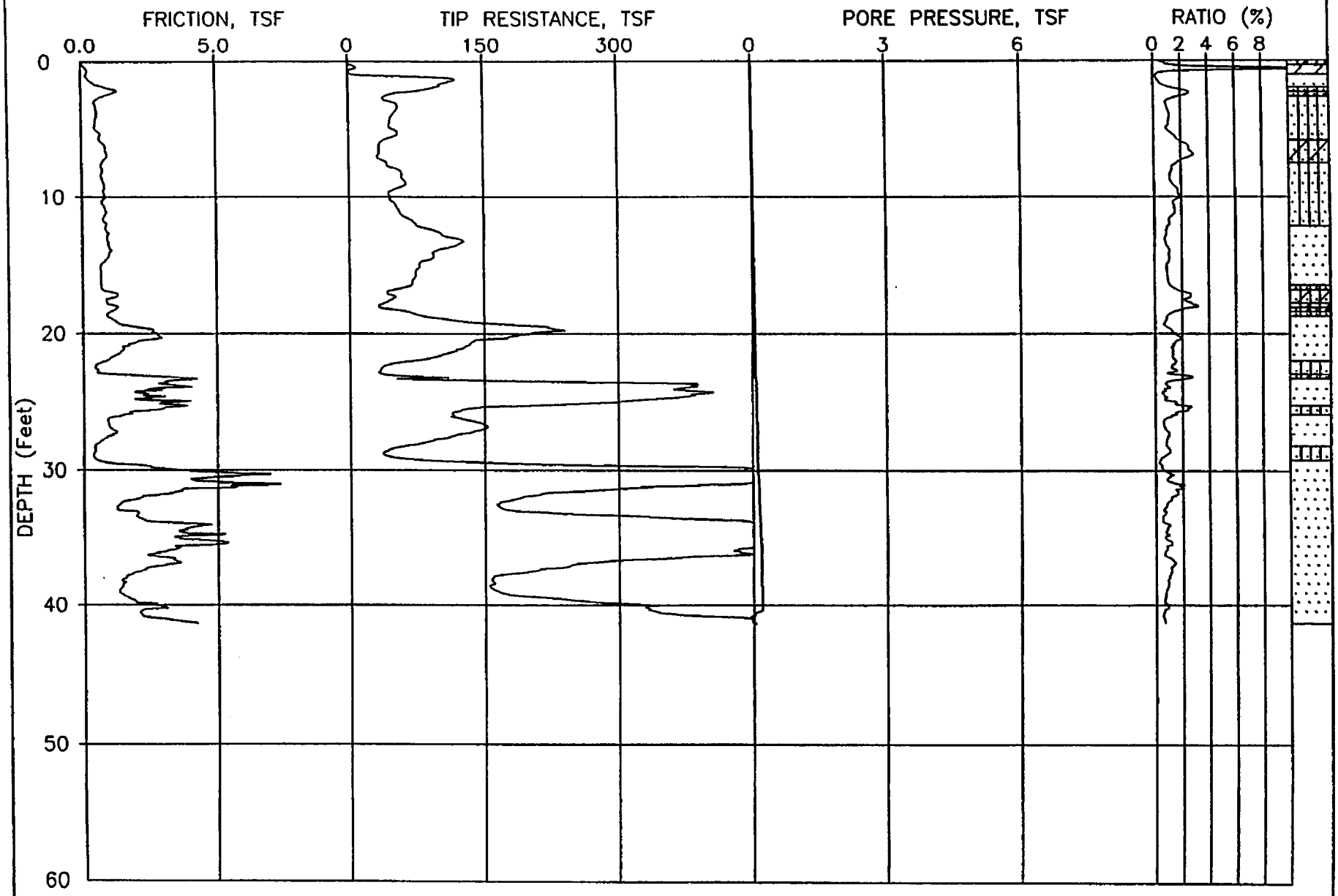


JOB NUMBER: 0303-0731

CPT NUMBER: CPT2

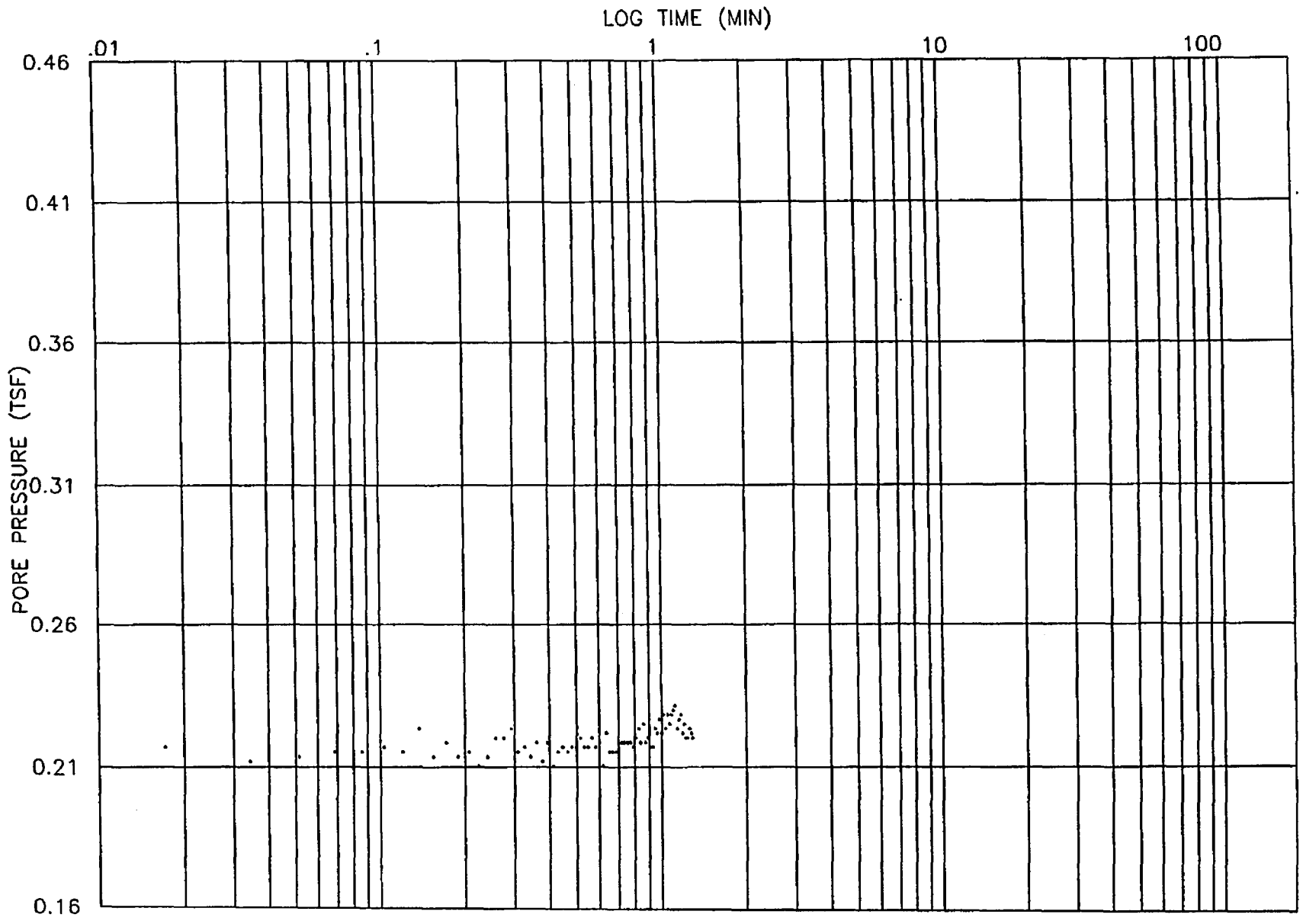
DATE: 10-17-2002

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1254

PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC

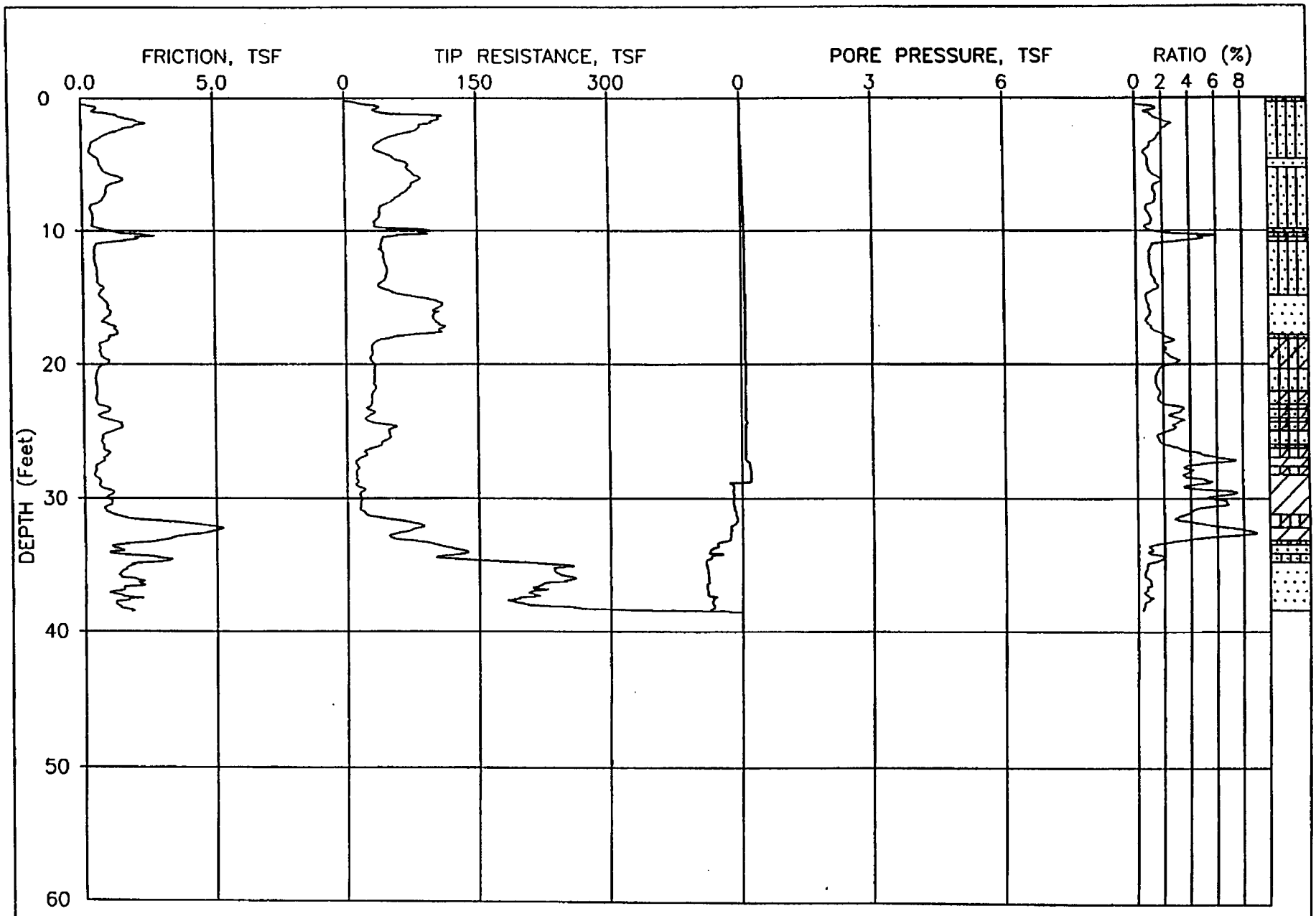


CPT NUMBER: CPT2
JOB NUMBER: 0303-0731

DISSIPATION TEST

DEPTH: 41.7 FEET
DATE: 10-17-2002

FUGRO GEOSCIENCES, INC.



JOB NUMBER: 0303-0731

CPT NUMBER: CPT3

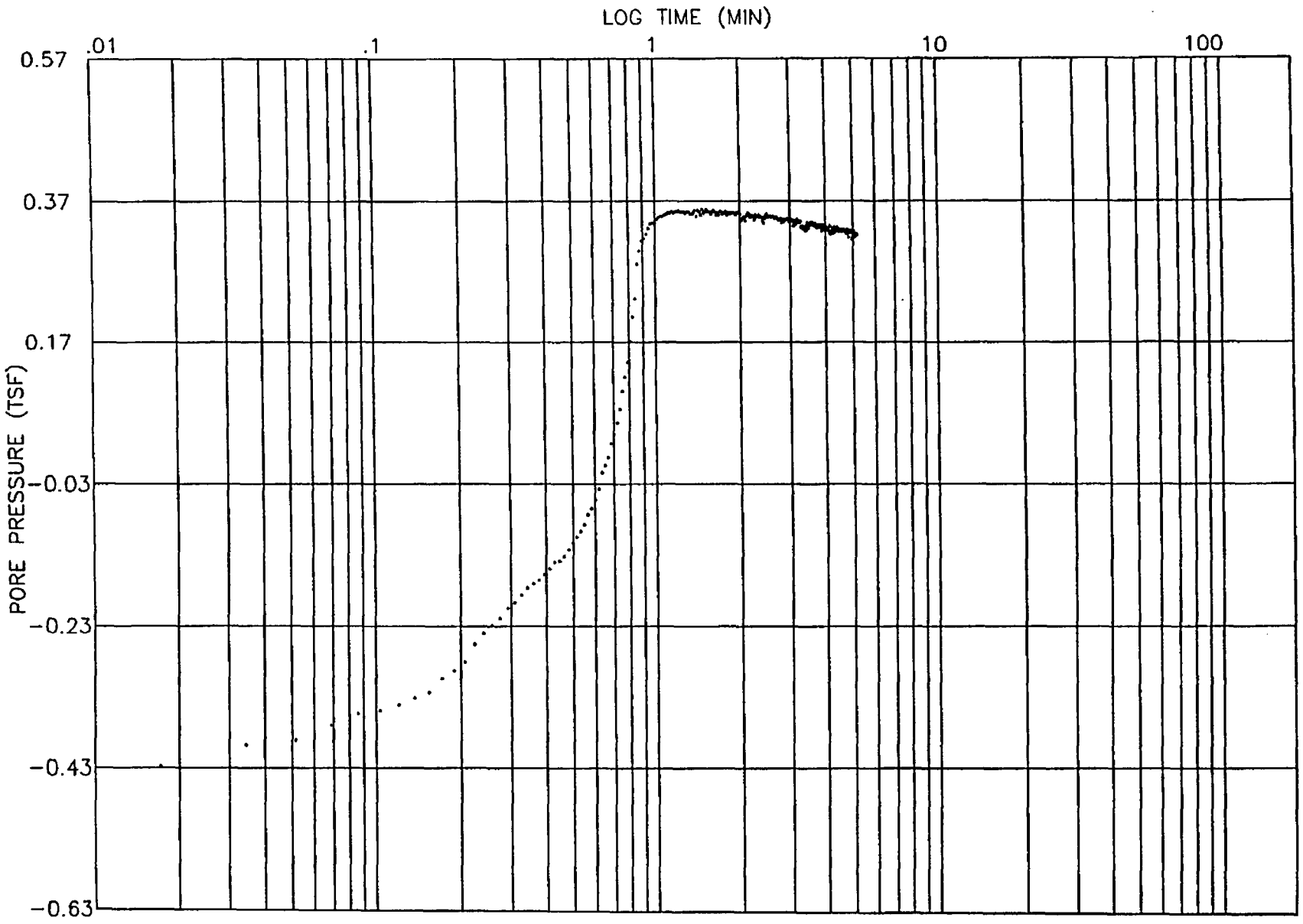
DATE: 10-18-2002

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1254

PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC

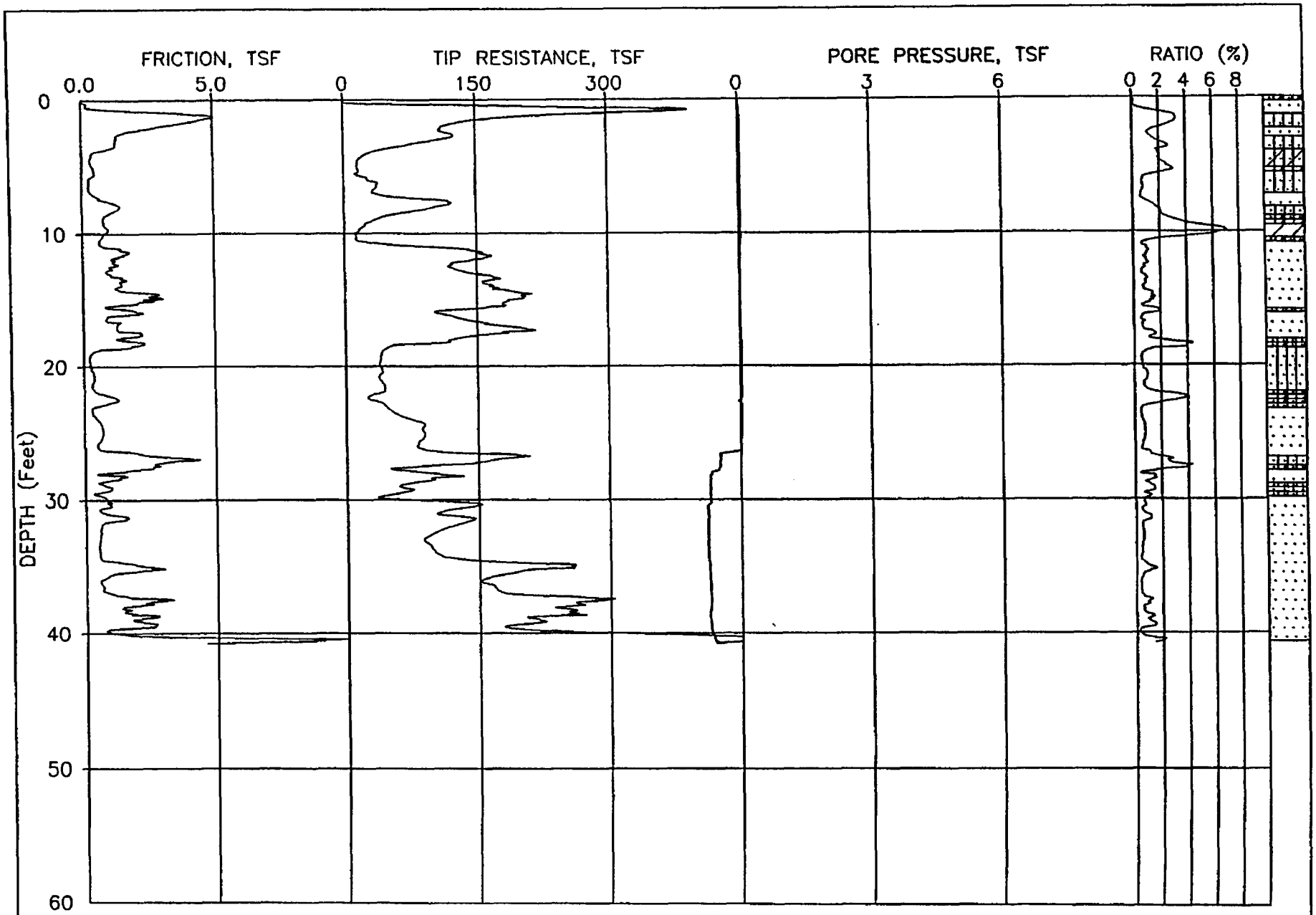


CPT NUMBER: CPT3
JOB NUMBER: 0303-0731

DISSIPATION TEST

DEPTH: 38.8 FEET
DATE: 10-18-2002

FUGRO GEOSCIENCES, INC.



JOB NUMBER: 0303-0731

CPT NUMBER: CPT4

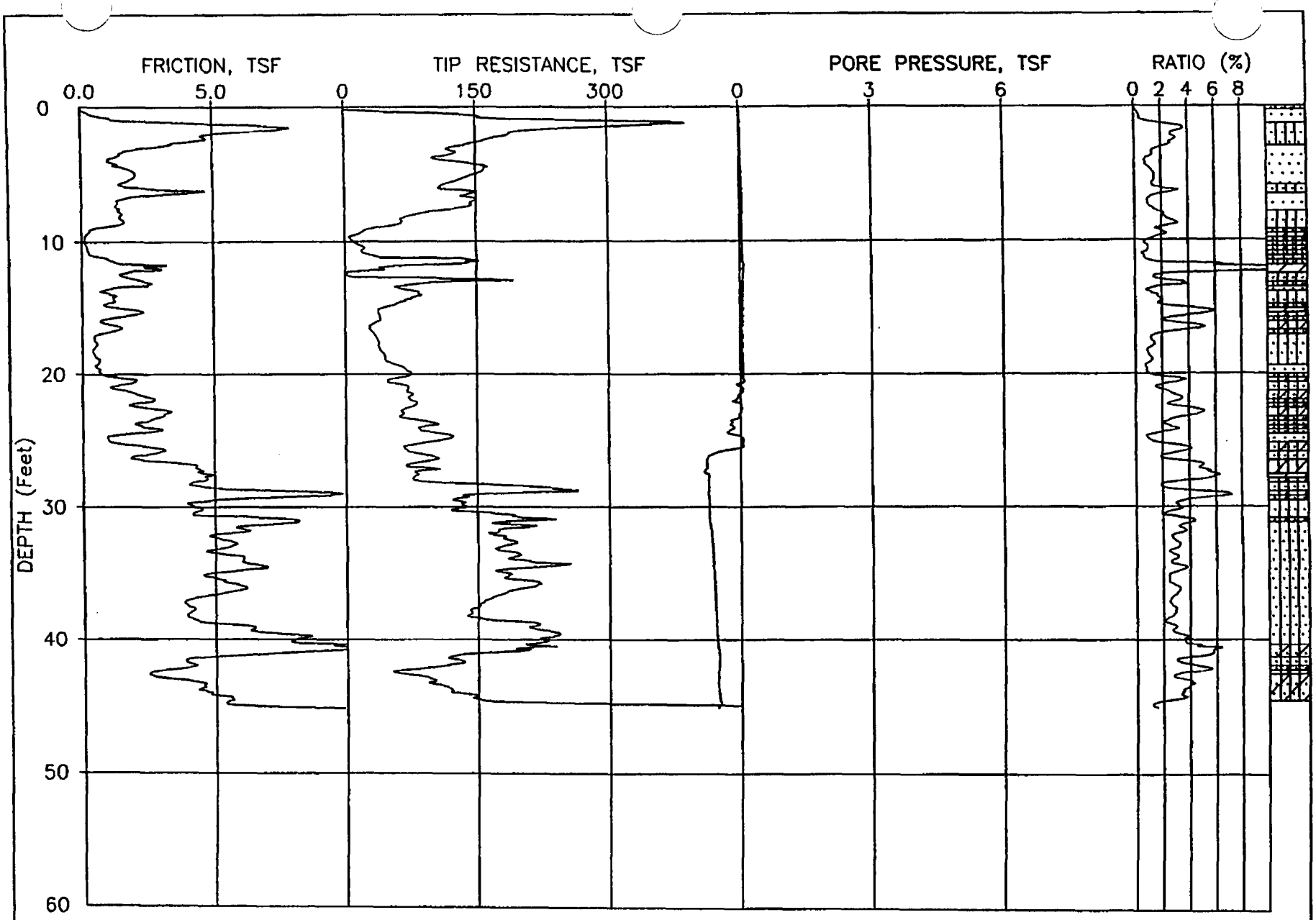
DATE: 10-17-2002

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1254

PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC



JOB NUMBER: 0303-0731

CPT NUMBER: CPT5

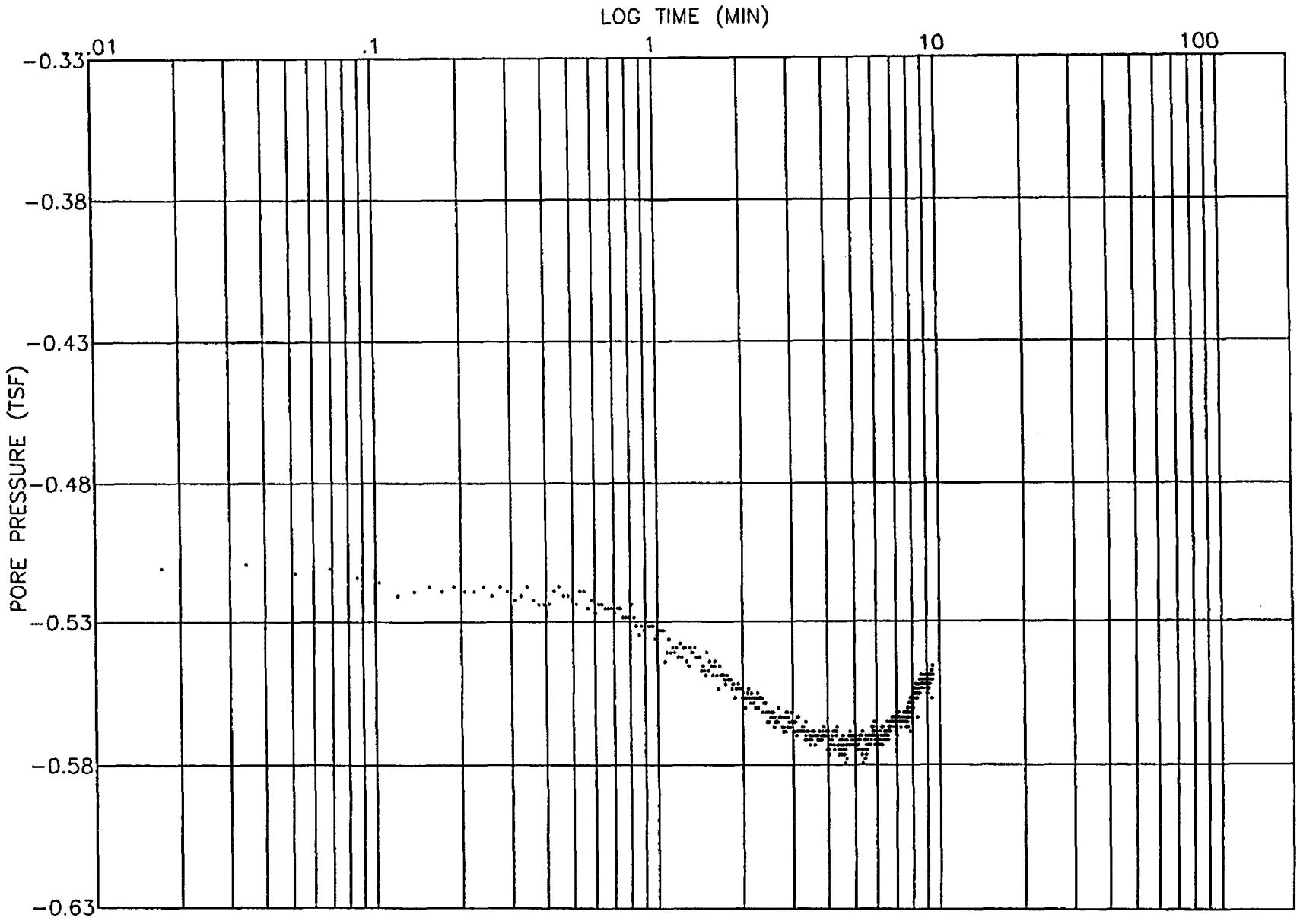
DATE: 10-17-2002

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1254

PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC

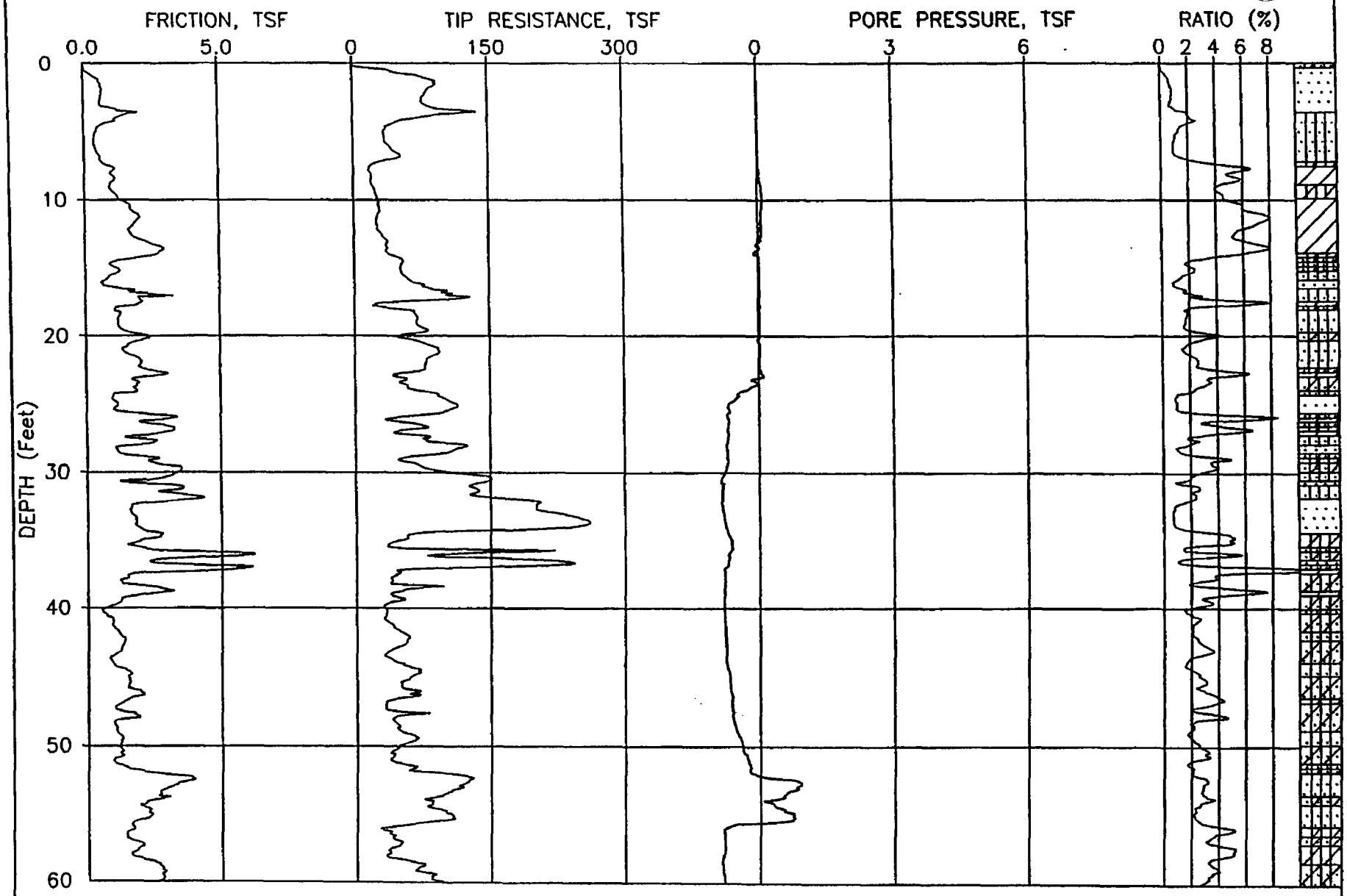


CPT NUMBER: CPT5
JOB NUMBER: 0303-0731

DISSIPATION TEST

DEPTH: 45.5 FEET
DATE: 10-17-2002

FUGRO GEOSCIENCES, INC.



JOB NUMBER: 0303-0731

CPT NUMBER: CPT6

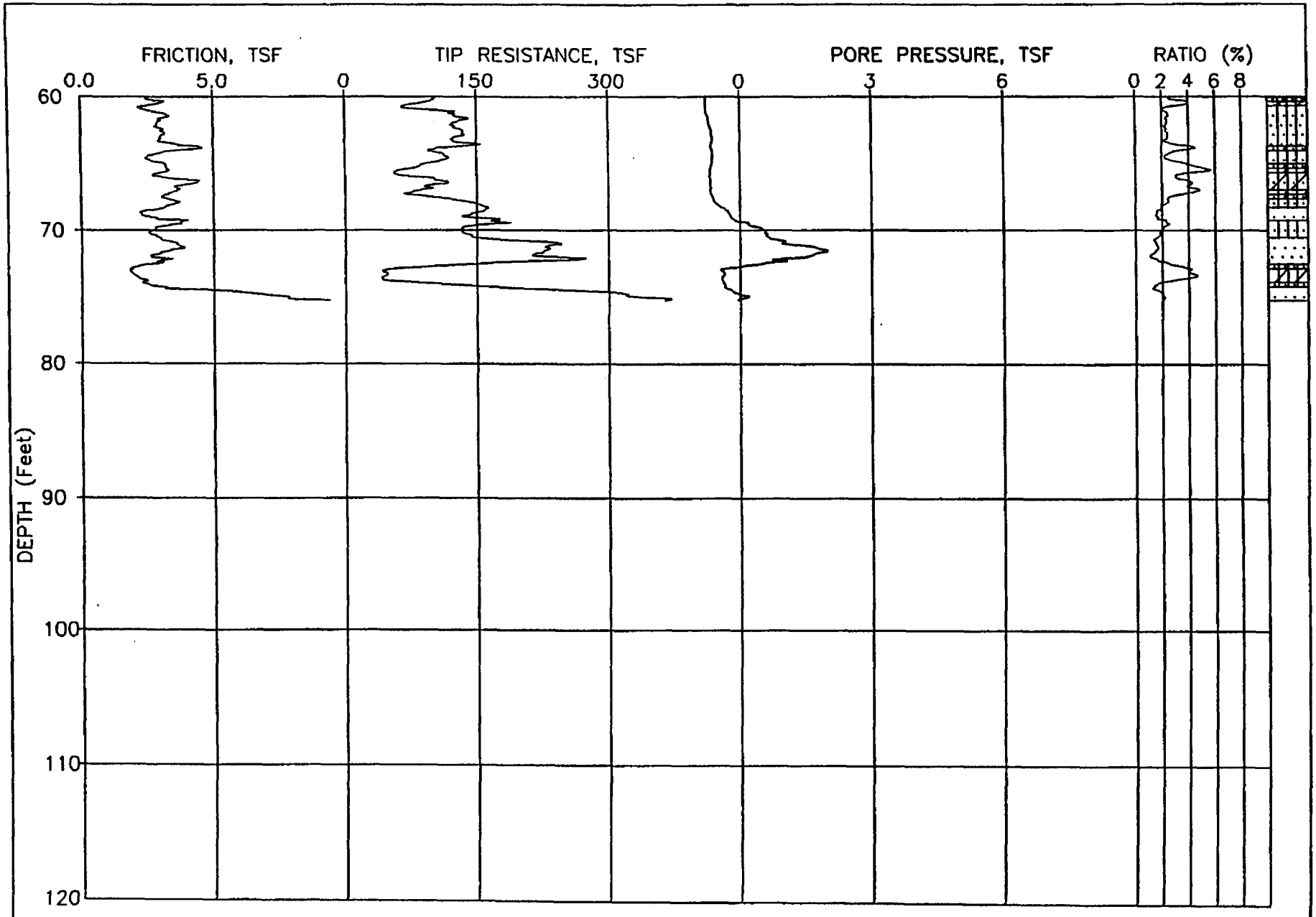
DATE: 10-17-2002

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1254

PLATE: 1 OF 2

FUGRO GEOSCIENCES,INC



JOB NUMBER: 0303-0731

ELEVATION: 0.00

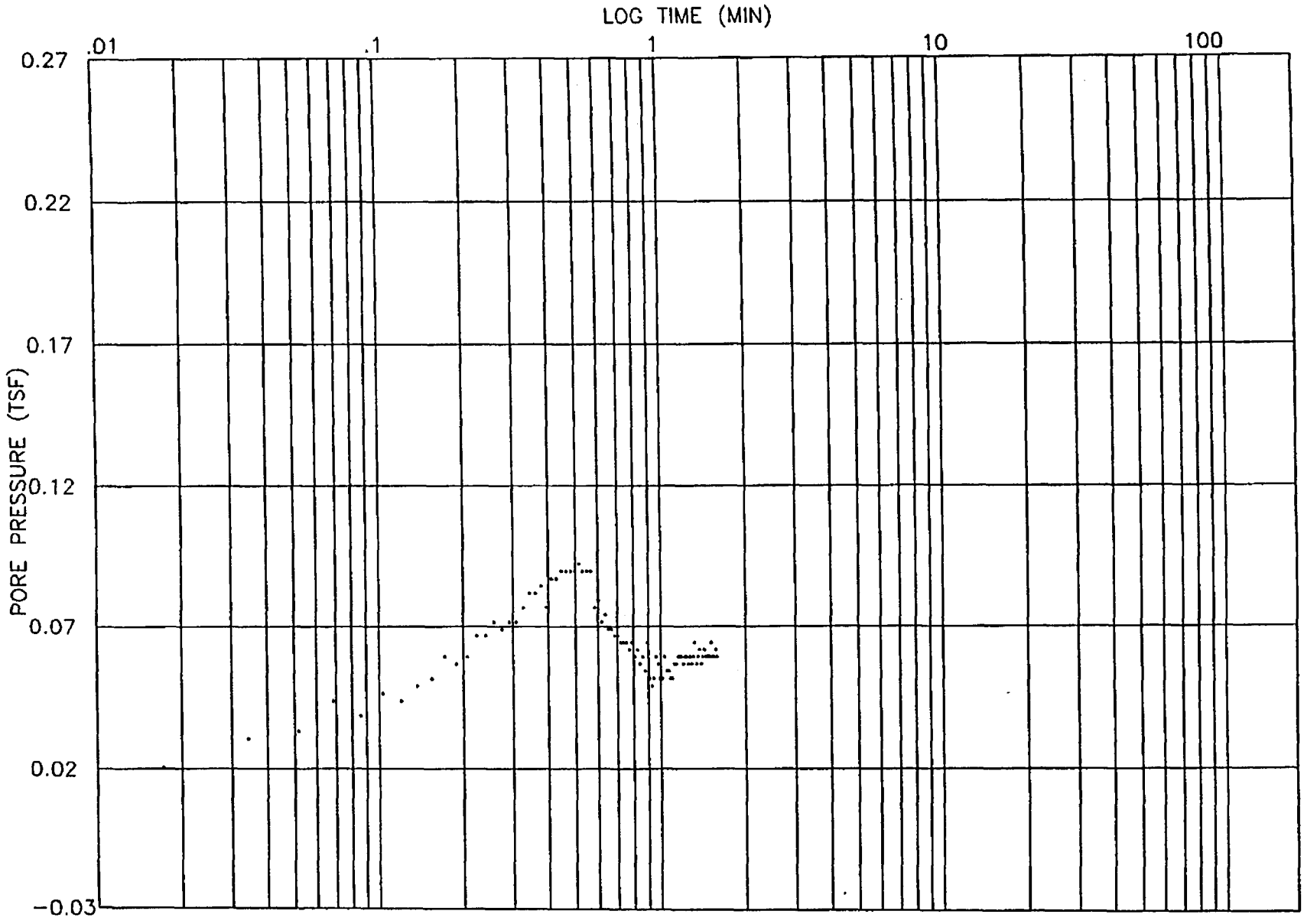
CPT NUMBER: CPT6

CONE NUMBER: F7.5CKEW1254

DATE: 10-17-2002

PLATE: 2 OF 2

FUGRO GEOSCIENCES,INC

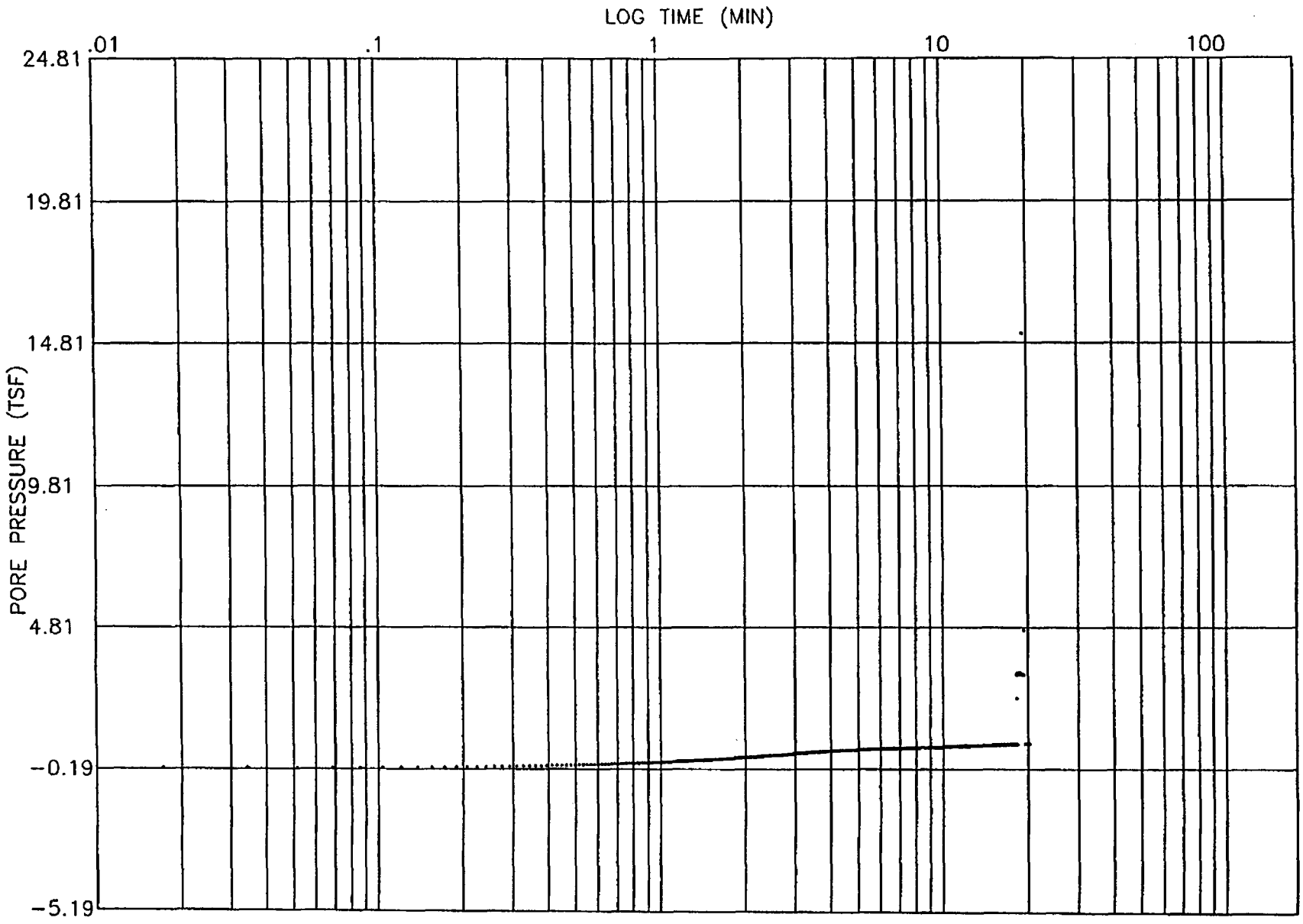


CPT NUMBER: CPT6
JOB NUMBER: 0303-0731

DISSIPATION TEST

DEPTH: 69.3 FEET
DATE: 10-17-2002

FUGRO GEOSCIENCES, INC.



CPT NUMBER: CPT6
JOB NUMBER: 0303-0731

DISSIPATION TEST

DEPTH: 75.6 FEET
DATE: 10-17-2002

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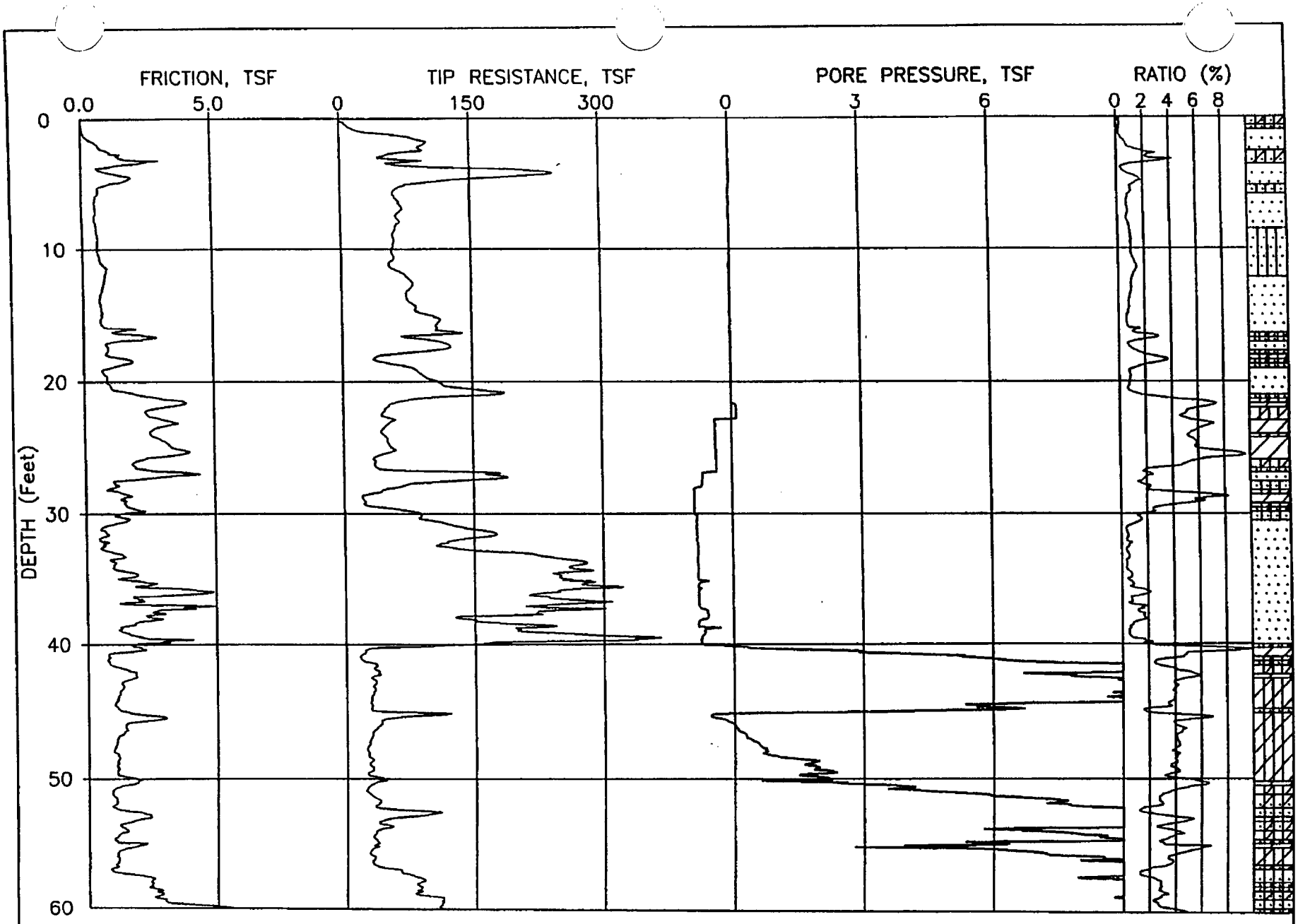


JOB NUMBER: 0303-0731

CPT NUMBER: CPT7A

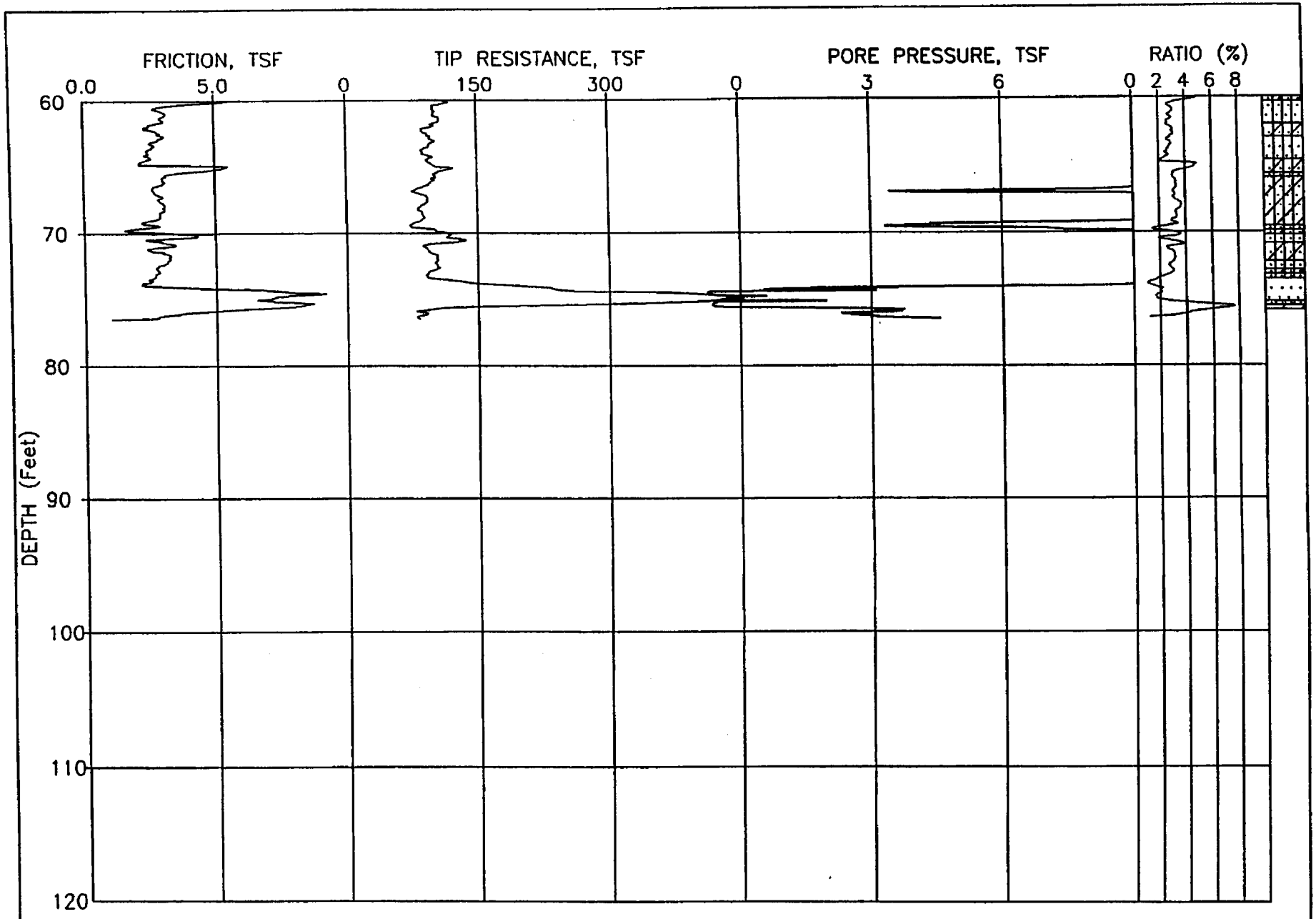
DATE: 10-18-2002

ELEVATION: 0.00

CONE NUMBER: F7.5CKE3SW1341

PLATE: 1 OF 2

FUGRO GEOSCIENCES,INC



JOB NUMBER: 0303-0731

CPT NUMBER: CPT7A

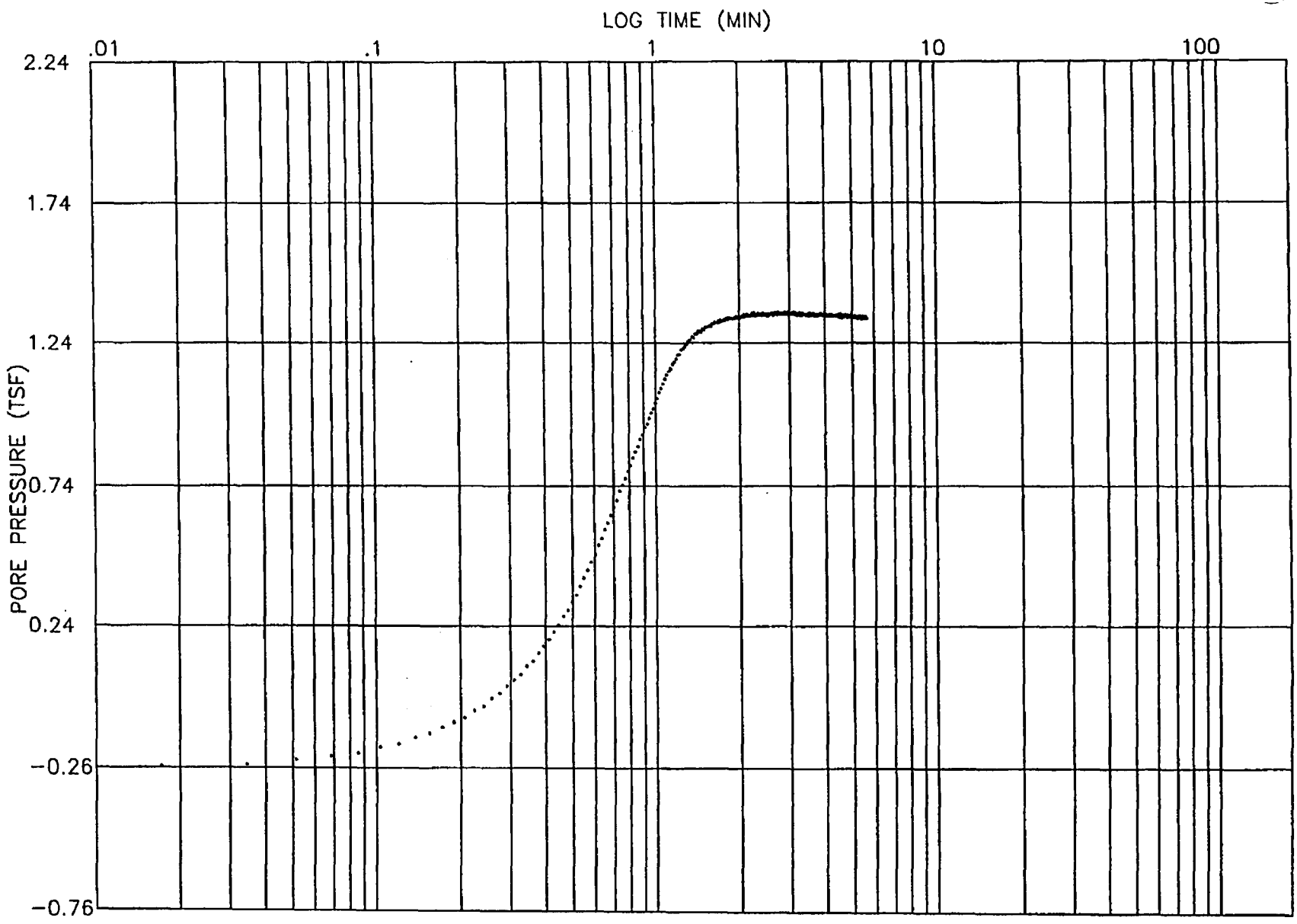
DATE: 10-18-2002

ELEVATION: 0.00

CONE NUMBER: F7.5CKE3SW1341

PLATE: 2 OF 2

FUGRO GEOSCIENCES,INC

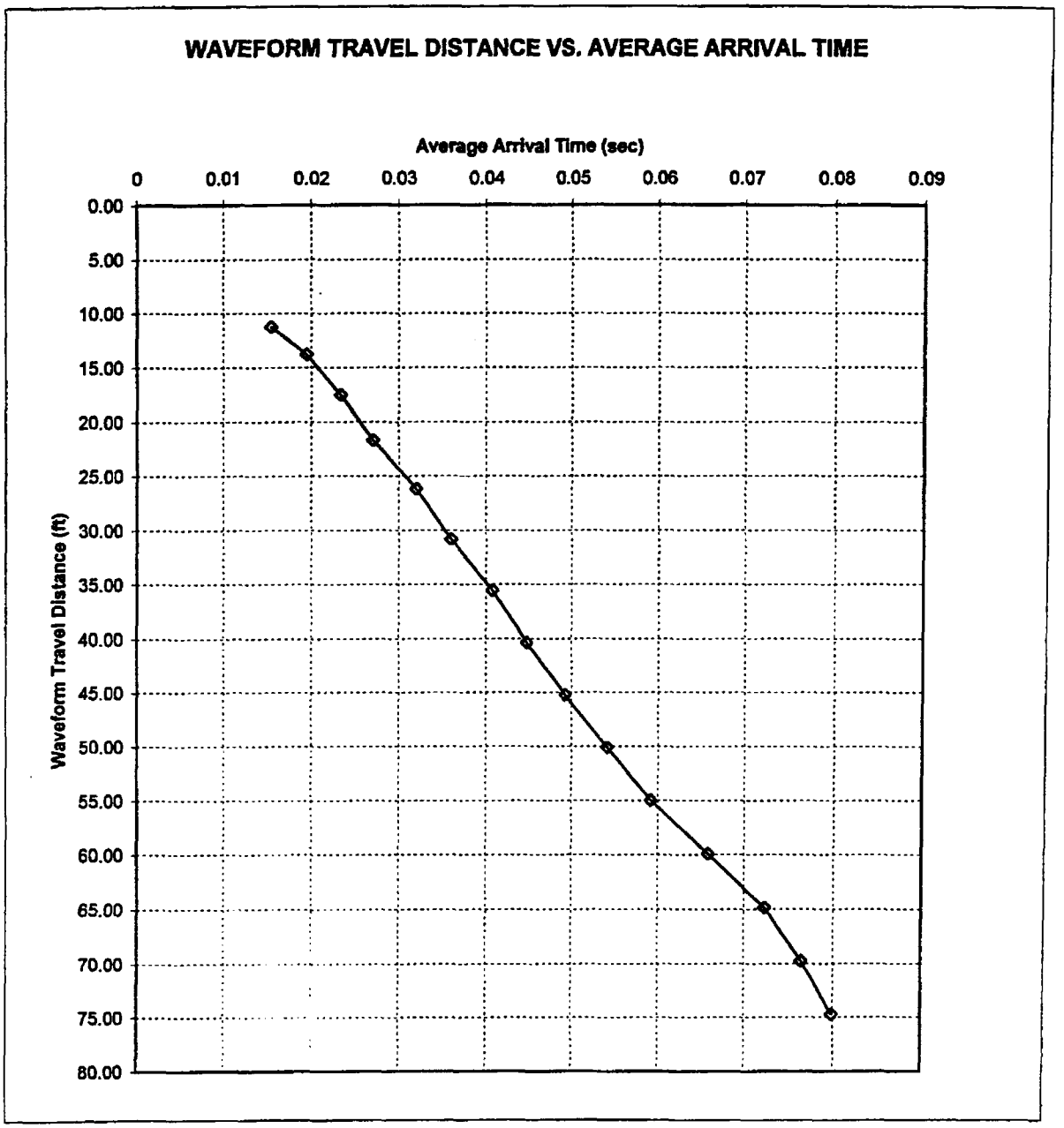


CPT NUMBER: CPT7A
JOB NUMBER: 0303-0731

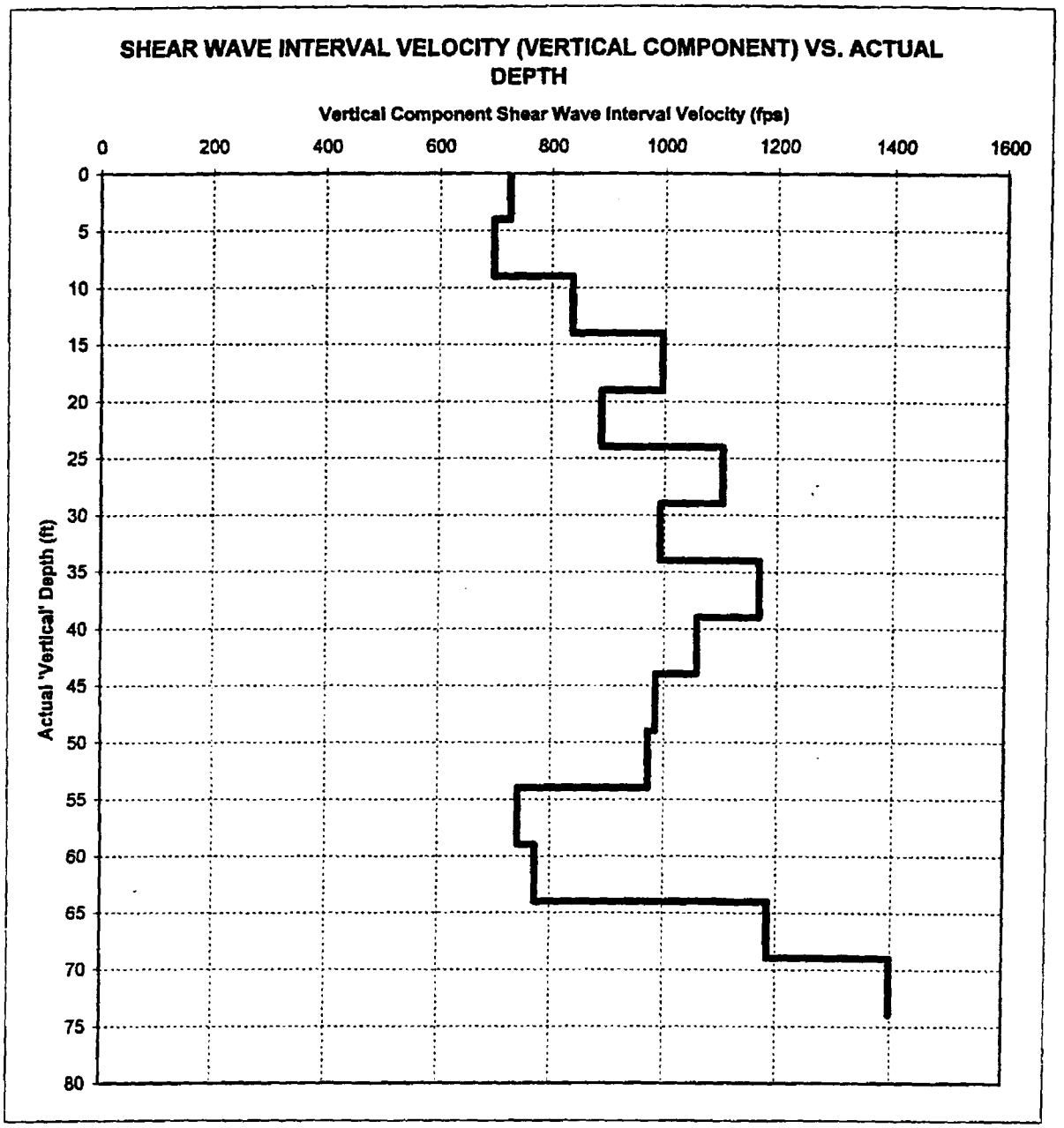
DISSIPATION TEST

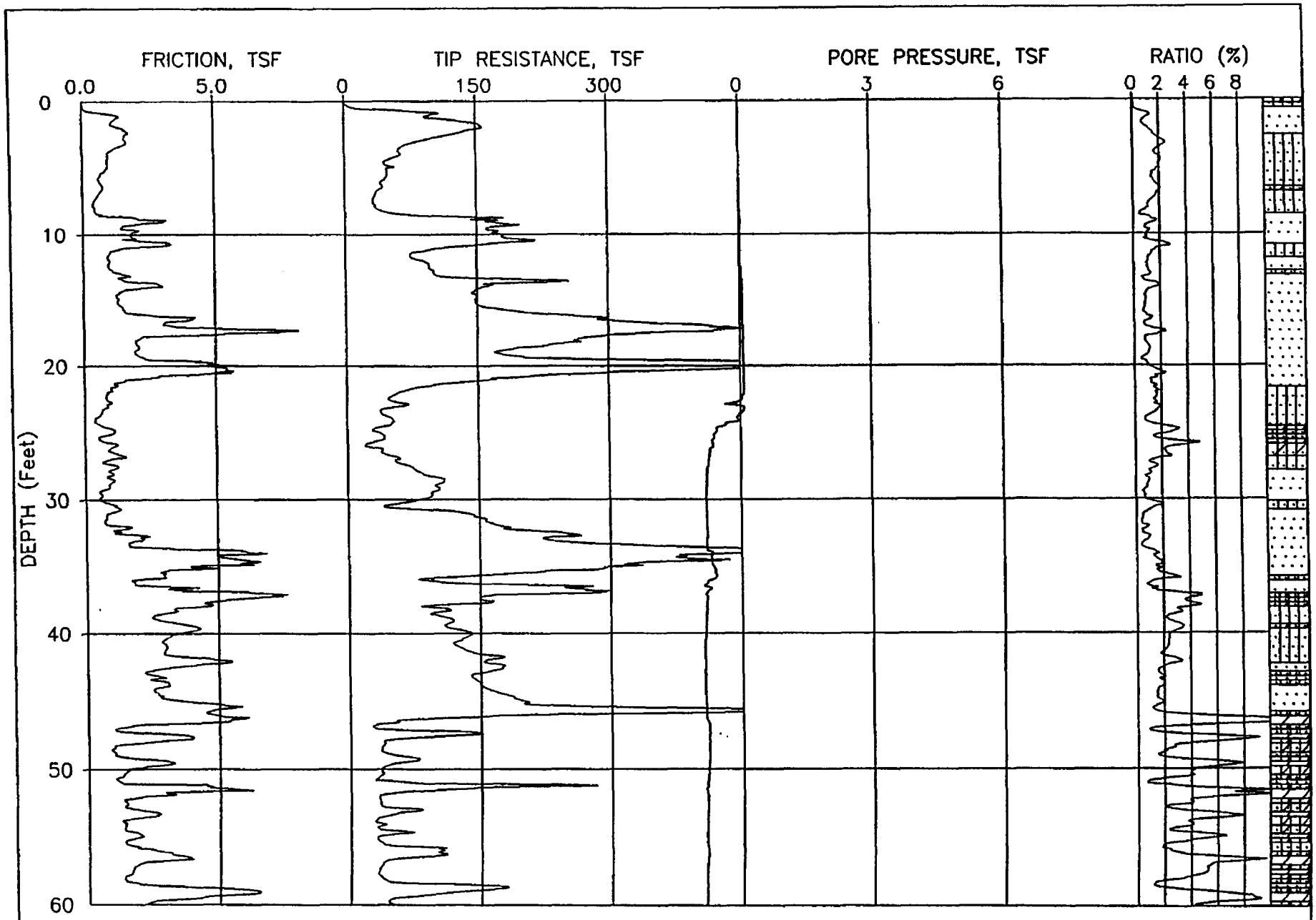
DEPTH: 75.2 FEET
DATE: 10-18-2002

FUGRO GEOSCIENCES, INC.


WAVEFORM TRAVEL DISTANCE VS. AVERAGE ARRIVAL TIME
Average Arrival Time (sec)
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
Waveform Travel Distance (ft)
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
50.00
55.00
60.00
65.00
70.00
75.00
80.00

SCPT-7A


SHEAR WAVE INTERVAL VELOCITY (VERTICAL COMPONENT) VS. ACTUAL DEPTH
Vertical Component Shear Wave Interval Velocity (fps)
0
200
400
600
800
1000
1200
1400
1600
Actual 'Vertical' Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80



JOB NUMBER: 0303-0731

CPT NUMBER: CPT8A

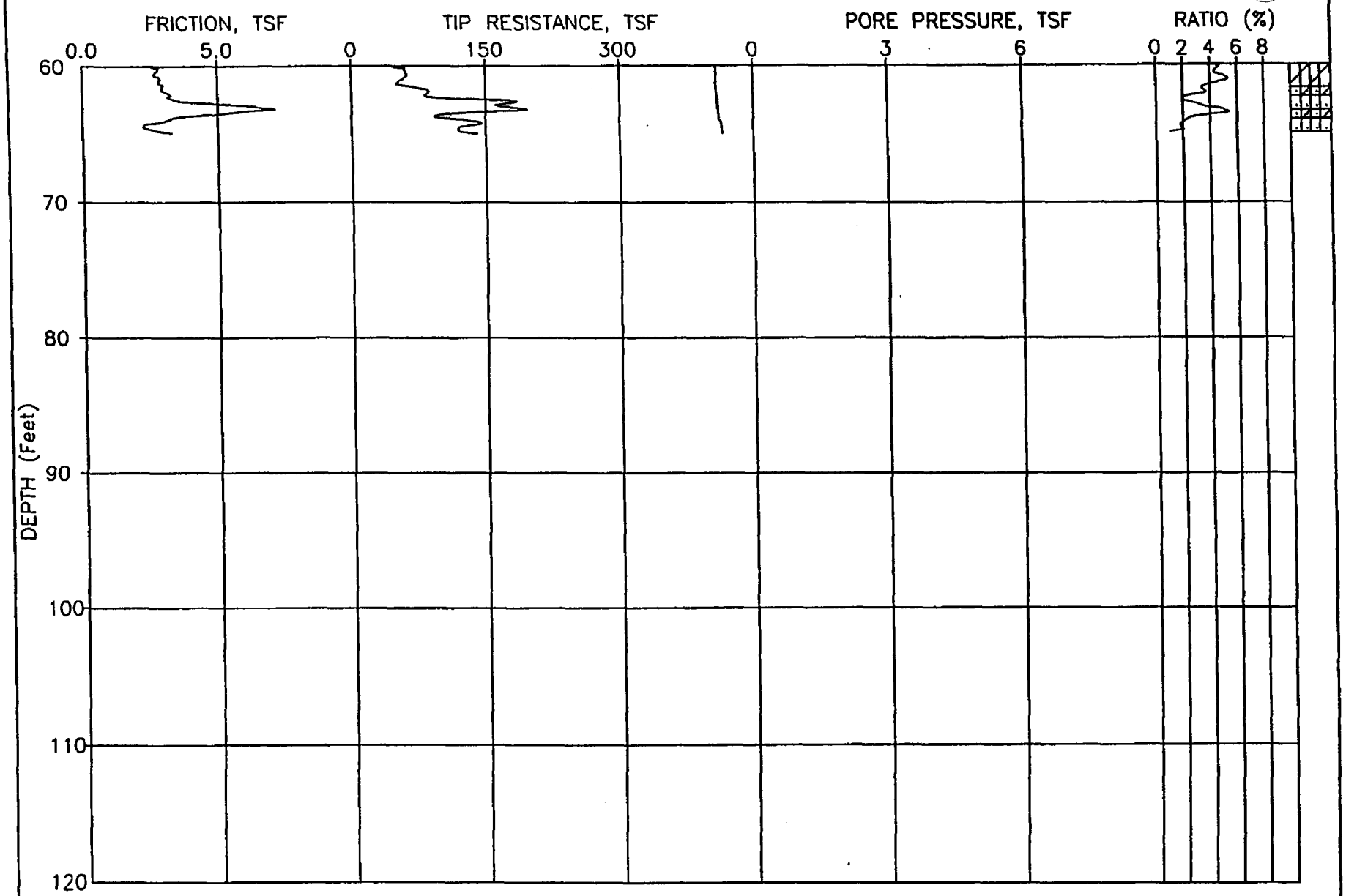
DATE: 10-17-2002

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1254

PLATE: 1 OF 2

FUGRO GEOSCIENCES,INC



JOB NUMBER: 0303-0731

CPT NUMBER: CPT8A

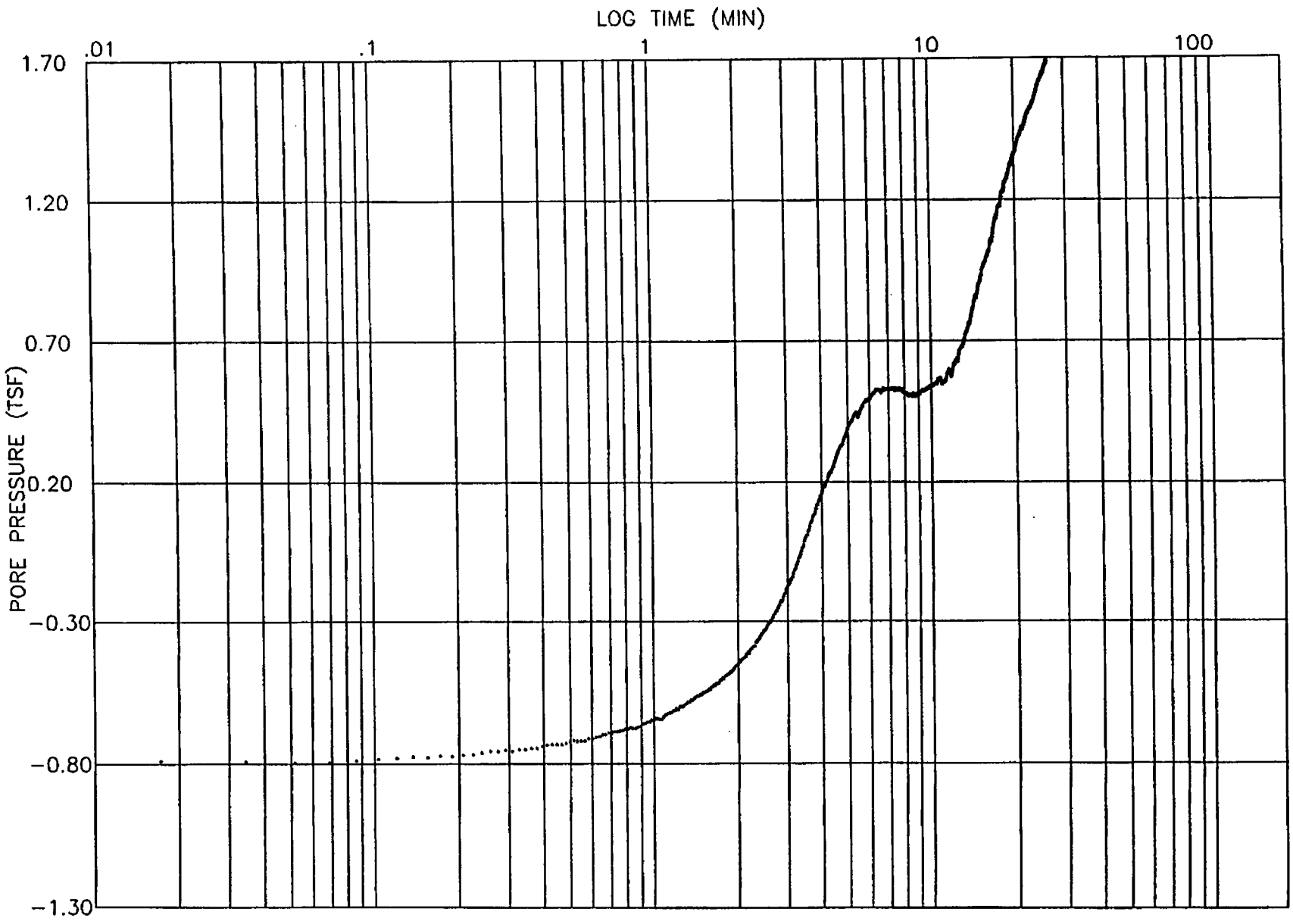
DATE: 10-17-2002

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1254

PLATE: 2 OF 2

FUGRO GEOSCIENCES,INC

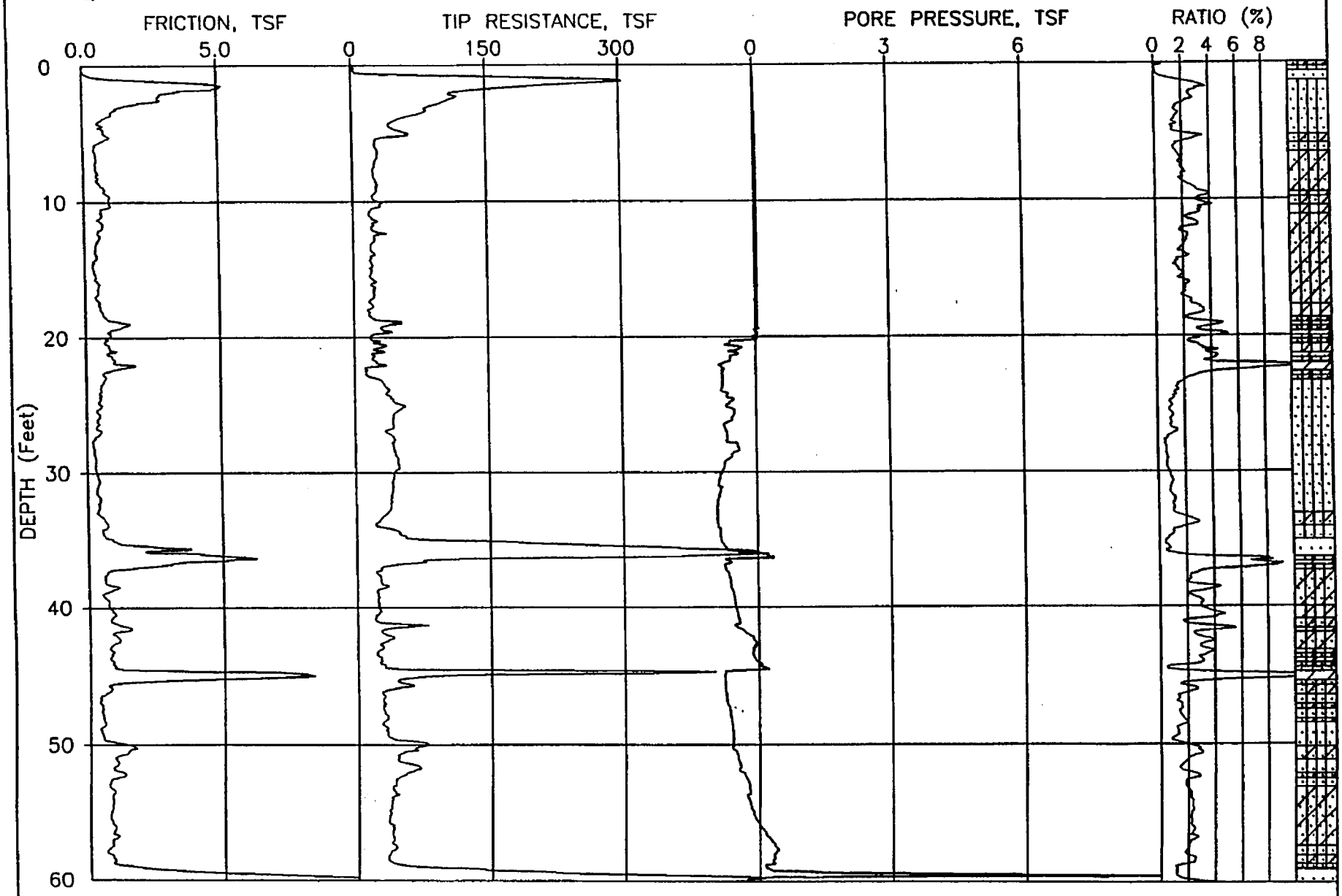


CPT NUMBER: CPT8A
JOB NUMBER: 0303-0731

DISSIPATION TEST

DEPTH: 65.4 FEET
DATE: 10-17-2002

FUGRO-GEOSCIENCES, INC.



JOB NUMBER: 0303-0731

CPT NUMBER: CPT9

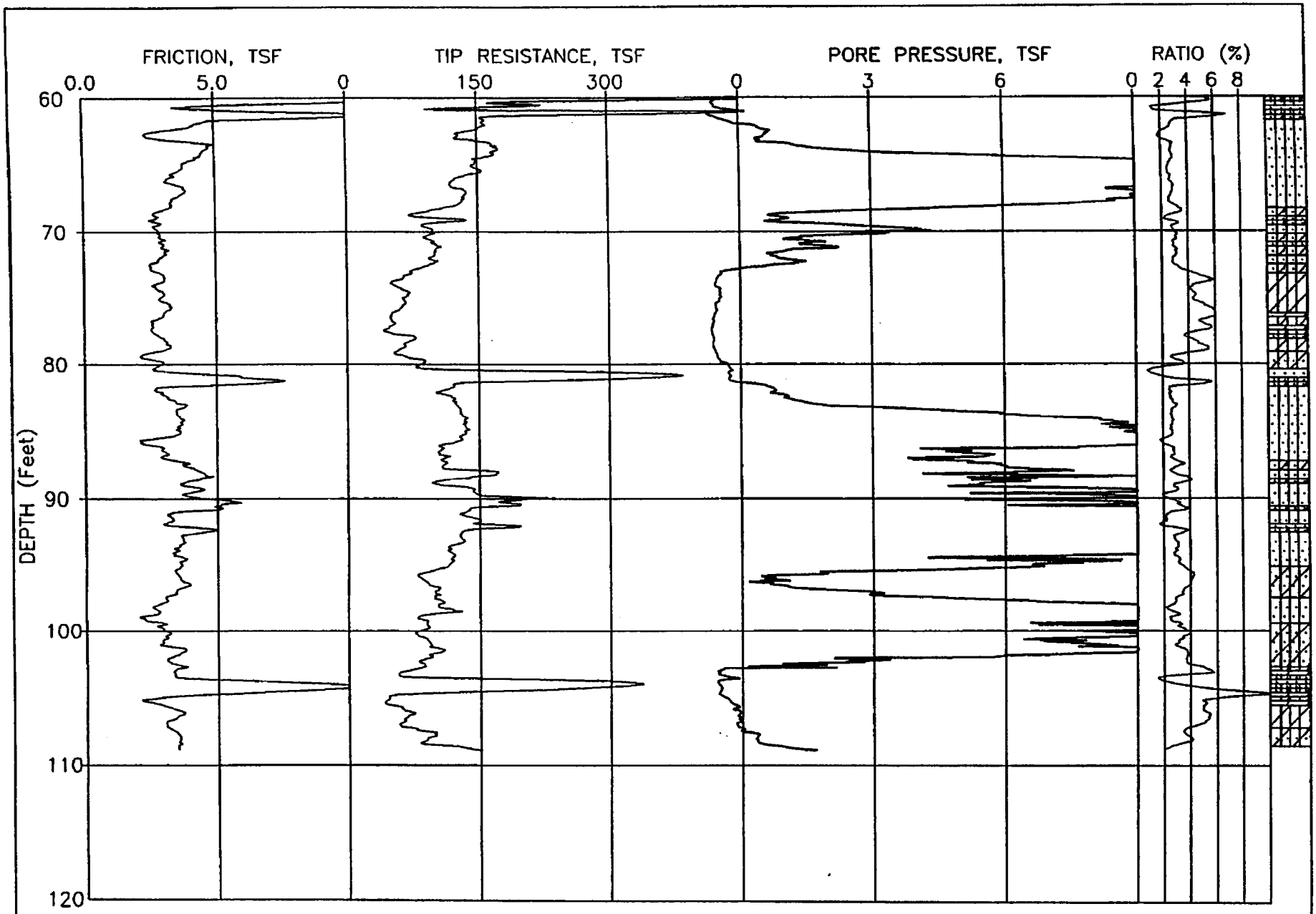
DATE: 10-17-2002

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1254

PLATE: 1 OF 2

FUGRO GEOSCIENCES,INC



JOB NUMBER: 0303-0731

CPT NUMBER: CPT9

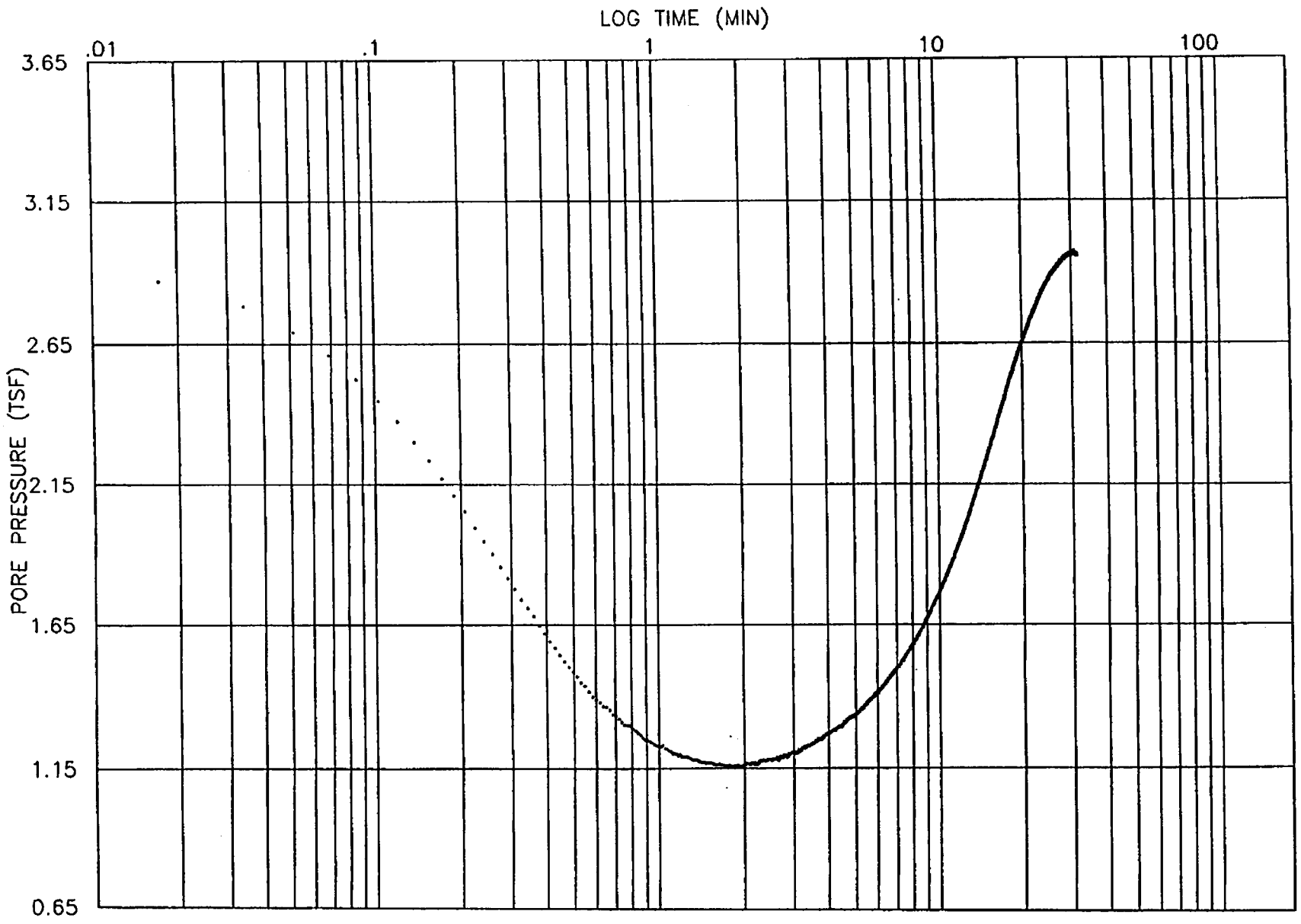
DATE: 10-17-2002

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1254

PLATE: 2 OF 2

FUGRO GEOSCIENCES,INC

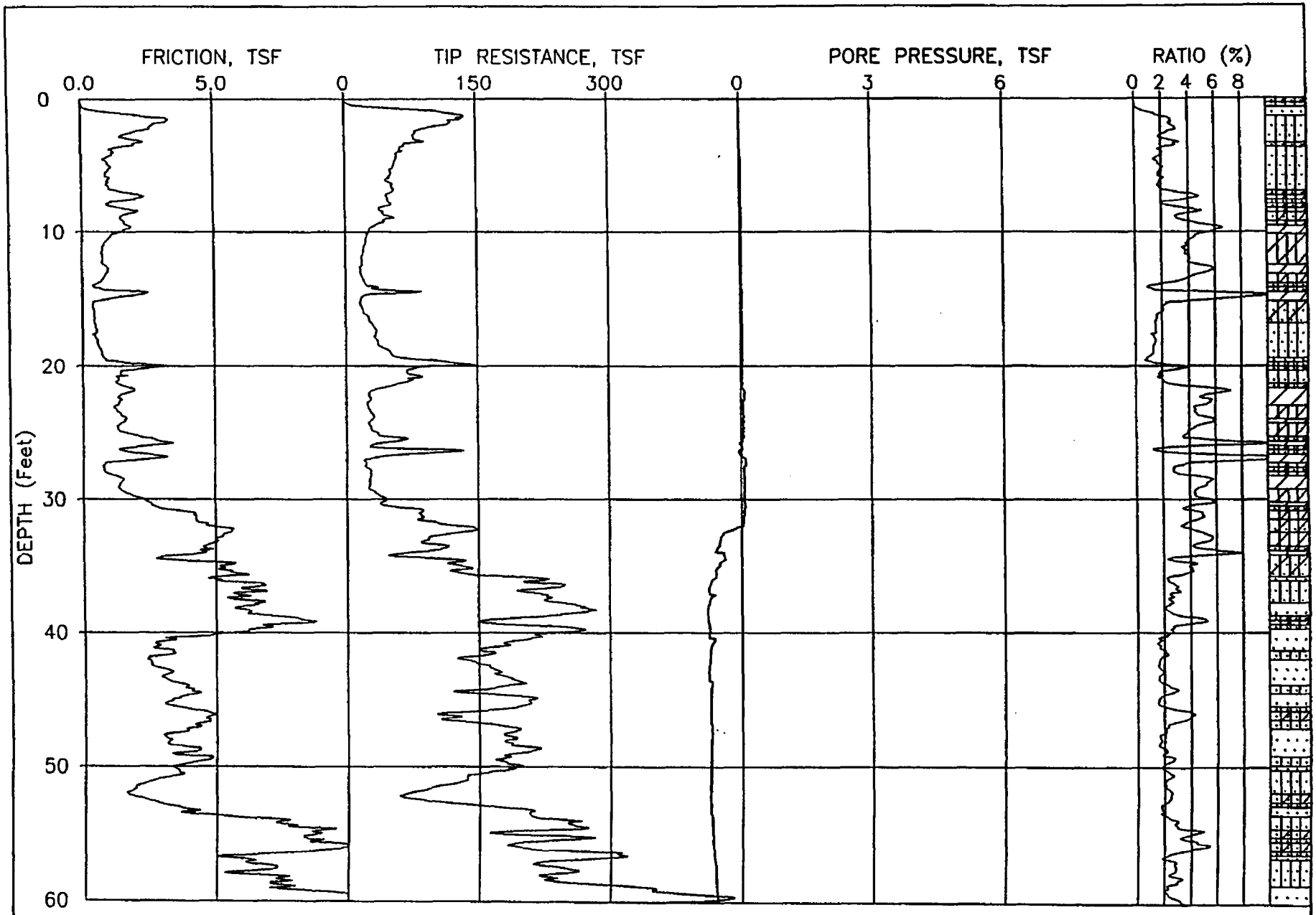


CPT NUMBER: CPT9
JOB NUMBER: 0303-0731

DISSIPATION TEST

DEPTH: 109.5 FEET
DATE: 10-17-2002

FUGRO GEOSCIENCES, INC.



JOB NUMBER: 0303-0731

CPT NUMBER: CPT10

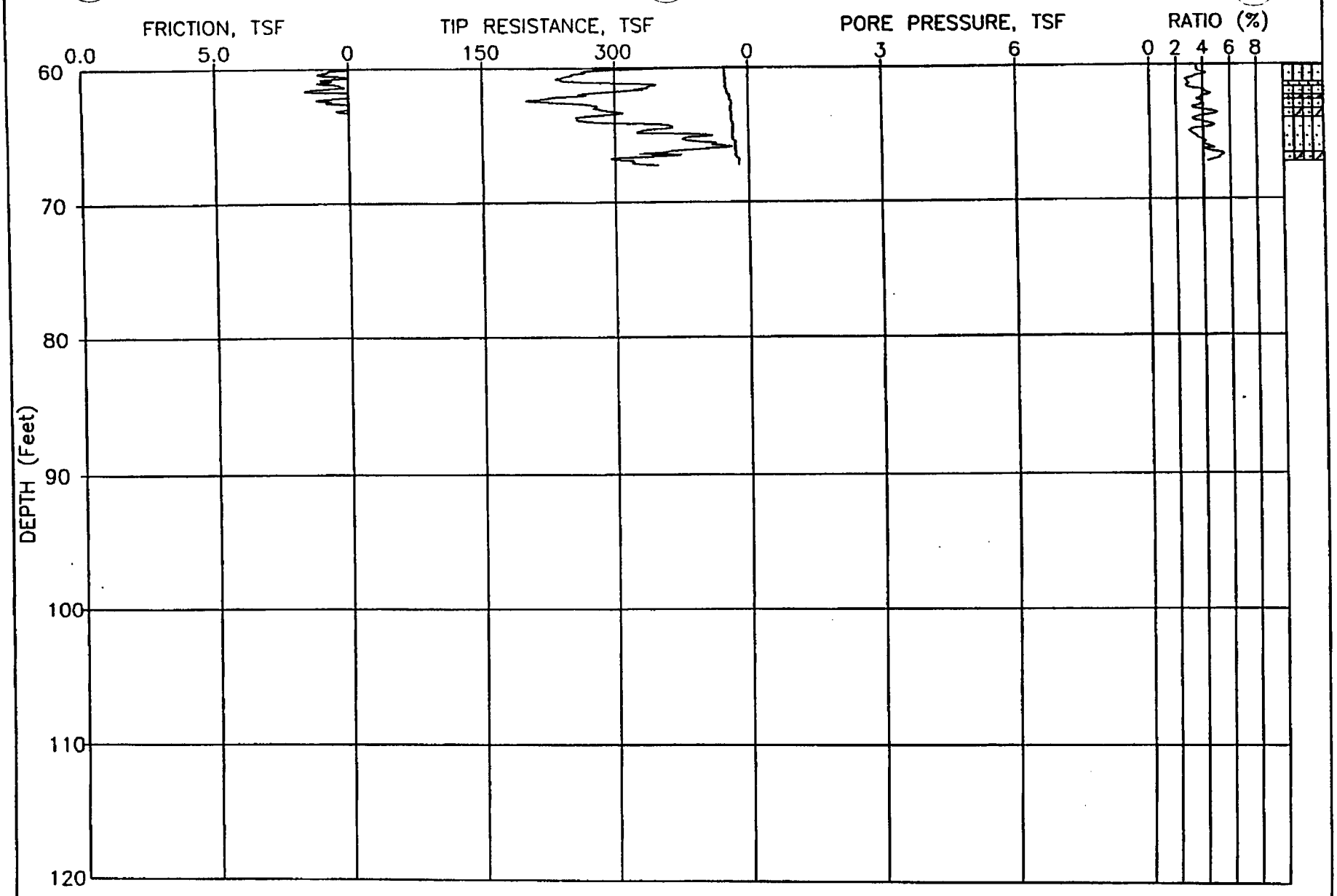
DATE: 10-17-2002

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1254

PLATE: 1 OF 2

FUGRO GEOSCIENCES,INC



JOB NUMBER: 0303-0731

ELEVATION: 0.00

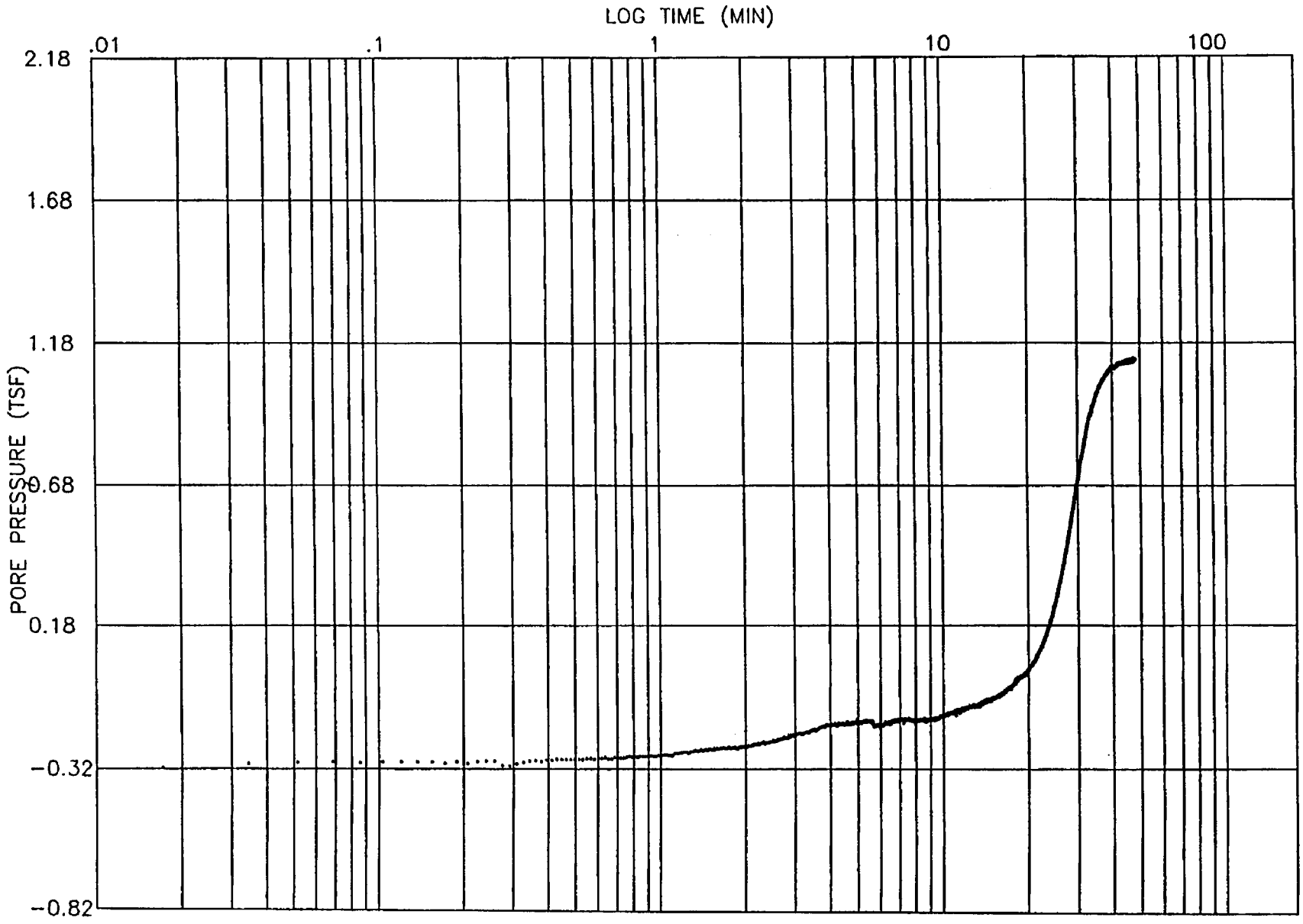
CPT NUMBER: CPT10

CONE NUMBER: F7.5CKEW1254

DATE: 10-17-2002

PLATE: 2 OF 2

FUGRO GEOSCIENCES,INC



CPT NUMBER: CPT10
JOB NUMBER: 0303-0731

DISSIPATION TEST

DEPTH: 67.8 FEET
DATE: 10-17-2002

FUGRO GEOSCIENCES, INC.

M60050_004321
MCAS EL TORO
SSIC NO. 5090.3.A

FOLDER 2 OF 5

Appendix D
Data Validation Reports

APPENDIX D – DATA VALIDATION REPORTS

RAW ANALYTICAL DATA IS NOT REQUIRED TO BE PHYSICALLY LOCATED AT OR NEAR THE INSTALLATION AND INFORMATION REPOSITORY.

FOR ADDITIONAL INFORMATION, CONTACT:

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SAN DIEGO, CA 92132

TELEPHONE: (619) 556-1280
E-MAIL: diane.silva@navy.mil

M60050_004321
MCAS EL TORO

FOLDER 3 OF 5

APPENDIX D – DATA VALIDATION REPORTS

RAW ANALYTICAL DATA IS NOT REQUIRED TO BE PHYSICALLY LOCATED AT OR NEAR THE INSTALLATION AND INFORMATION REPOSITORY.

FOR ADDITIONAL INFORMATION, CONTACT:

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1220 PACIFIC HIGHWAY
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TELEPHONE: (619) 556-1280
E-MAIL: diane.silva@navy.mil

M60050_004321
MCAS EL TORO

FOLDER 4 OF 5

APPENDIX D – DATA VALIDATION REPORTS

RAW ANALYTICAL DATA IS NOT REQUIRED TO BE PHYSICALLY LOCATED AT OR NEAR THE INSTALLATION AND INFORMATION REPOSITORY.

FOR ADDITIONAL INFORMATION, CONTACT:

DIANE C. SILVA, RECORDS MANAGER
NAVAL FACILITIES ENGINEERING COMMAND, SOUTHWEST
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132

TELEPHONE: (619) 556-1280
E-MAIL: diane.silva@navy.mil

M60050_004321
MCAS EL TORO
SSIC NO. 5090.3.A

FOLDER 5 OF 5

Appendix E
Risk Assessments

Appendix E1
Screening Risk Assessment – Human Health

Table E1-1: Quantification of BaP Equivalent Concentrations (Method 8270 SIM) for Maximum Detections in Surface Soil (0 - 1 ft bgs) Samples at Anomaly Area 3 Using California OEHHA Relative Potency Factors

PAHs[a]	RPF[b]	Maximum Detection (mg/kg)	Maximum Reporting Limit	BaP Equivalent Concentration (mg/kg)
Benz(a)anthracene	0.1	0.73	32	7.30E-02
Benzo(a)pyrene	1.0	1.03	32	1.03E+00
Benzo(b)fluoranthene	0.1	1.79	32	1.79E-01
Benzo(k)fluoranthene	0.1	0.51	32	5.10E-02
Chrysene	0.01	0.87	32	8.70E-03
Dibenz(a,h)anthracene	0.34	0.097	32	3.30E-02
Indeno(1,2,3-cd)pyrene	0.1	0.46	32	4.60E-02
Total BaP Equivalent Concentration[c]				**1.42E+00**

Notes:

PAHs = polyaromatic hydrocarbons

mg/kg = milligrams per kilogram

BaP = benzo(a)pyrene

OEHHA = Califiornia Office of Environmental Health Hazard Assessment

[a]These PAHs are the seven carcinogenic PAHs as defined in EPA 1993.

[b]RPF - relative potency factor; RPF taken from OEHHA 2002 as amended (http://www.oehha.ca.gov/risk/ChemicalDB/cancerpotency.asp)

[c]The total BAP equivalent concentration is the sum of the individual PAH BaP equivalent concentrations.

Reference:

California OEHHA, 2002. Air Toxics Hot Spot Program Risk Assessment Guidelines Part II: Technical Support Document for Describing Available Cancer Potency Factors. December.

Table E1-2: Quantification of BaP Equivalent Concentrations (Method 8270C) for Maximum Detections in Subsurface Soil (0 - 10 ft bgs) Samples at Anomaly Area 3 Using California OEHHA Relative Potency Factors

PAHs[a]	RPF[b]	Maximum Detection (mg/kg)	Maximum Reporting Limit	BaP Equivalent Concentration (mg/kg)
Benz(a)anthracene	0.1	0.27	32	2.70E-02
Benzo(a)pyrene	1.0	0.23	32	2.30E-01
Benzo(b)fluoranthene	0.1	0.44	32	4.40E-02
Benzo(k)fluoranthene	0.1	--	32	--
Chrysene	0.01	0.25	32	2.50E-03
Dibenz(a,h)anthracene	0.34	--	32	--
Indeno(1,2,3-cd)pyrene	0.1	0.081	32	8.10E-03
Total BaP Equivalent Concentration[c]				**3.12E-01**

Notes:

PAHs = polyaromatic hydrocarbons

mg/kg = milligrams per kilogram

BaP = benzo(a)pyrene

OEHHA = Califiornia Office of Environmental Health Hazard Assessment

"--" = not detected

[a]These PAHs are the seven carcinogenic PAHs as defined in EPA 1993.

[b]RPF - relative potency factor; RPF taken from OEHHA 2002 as amended (http://www.oehha.ca.gov/risk/ChemicalDB/cancerpotency.asp)

[c]The total BAP equivalent concentration is the sum of the individual PAH BaP equivalent concentrations.

Reference:

California OEHHA, 2002. Air Toxics Hot Spot Program Risk Assessment Guidelines Part II: Technical Support Document for

Table E1-3: Quantification of BaP Equivalent Concentrations (Method 8270 SIM) for Maximum Detections in Subsurface Soil (0 - 10 ft bgs) Samples at Anomaly Area 3 Using California OEHHA Relative Potency Factors

PAHs[a]	RPF[b]	Maximum Detection (mg/kg)	Maximum Reporting Limit	BaP Equivalent Concentration (mg/kg)
Benz(a)anthracene	0.1	0.73	32	7.30E-02
Benzo(a)pyrene	1.0	1.03	32	1.03E+00
Benzo(b)fluoranthene	0.1	1.79	32	1.79E-01
Benzo(k)fluoranthene	0.1	0.51	32	5.10E-02
Chrysene	0.01	0.87	32	8.70E-03
Dibenz(a,h)anthracene	0.34	0.097	32	3.30E-02
Indeno(1,2,3-cd)pyrene	0.1	0.46	32	4.60E-02
Total BaP Equivalent Concentration[c]				**1.42E+00**

Notes:

PAHs = polyaromatic hydrocarbons

mg/kg = milligrams per kilogram

BaP = benzo(a)pyrene

OEHHA = Califiornia Office of Environmental Health Hazard Assessment

[a]These PAHs are the seven carcinogenic PAHs as defined in EPA 1993.

[b]RPF - relative potency factor; RPF taken from OEHHA 2002 as amended (http://www.oehha.ca.gov/risk/ChemicalDB/cancerpotency.asp)

[c]The total BAP equivalent concentration is the sum of the individual PAH BaP equivalent concentrations.

Reference:

California OEHHA, 2002. Air Toxics Hot Spot Program Risk Assessment Guidelines Part II: Technical Support Document for

Table E1-4: Quantification of BaP Equivalent Concentrations (Method 8270C-SIM) for Maximum Detections in Groundwater Samples at Anomaly Area 3 Using California OEHHA Relative Potency Factors

PAHs[a]	RPF[b]	Maximum Detection (ug/L)	Maximum Reporting Limit	BaP Equivalent Concentration (ug/L)
Benz(a)anthracene	0.1	0.04	0.5	4.00E-03
Benzo(a)pyrene	1.0	0.46	0.2	4.60E-01
Benzo(b)fluoranthene	0.1	0.6	0.5	6.00E-02
Benzo(k)fluoranthene	0.1	--	0.5	--
Chrysene	0.01	0.04	0.5	4.00E-04
Dibenz(a,h)anthracene	0.34	0.1	0.5	3.40E-02
Indeno(1,2,3-cd)pyrene	0.1	0.4	0.5	4.00E-02
Total BaP Equivalent Concentration[c]				**5.98E-01**

Notes:

PAHs - polyaromatic hydrocarbons

mg/kg = milligrams per kilogram

BaP - benzo(a)pyrene

OEHHA - California Office of Environmental Health Hazard Assessment

"--" - not detected

[a]These PAHs are the seven carcinogenic PAHs as defined in EPA 1993.

[b]RPF - relative potency factor; RPF taken from OEHHA 2002 as amended (http://www.oehha.ca.gov/risk/ChemicalDB/cancerpotency.asp)

[c]The total BAP equivalent concentration is the sum of the individual PAH BaP equivalent concentrations.

Reference:

California OEHHA, 2002. Air Toxics Hot Spot Program Risk Assessment Guidelines Part II: Technical Support Document for Describing Available Cancer Potency Factors. December.

Table E1-5: Risk-Based Screening Evaluation of Subsurface Soil (0 - 1 ft bgs) for (Current/Future) Residential Receptor Using Cal-EPA Toxicity Information

Chemical	Number of Detects	Sample Size[a]	FOD	Maximum EPC[b]	95% UCL	EPC[c]	Background Concentration	Site Metal Exceed Background?	Preliminary Remediation Goals: Region 9 PRGs (RME): Carcinogenic PRG[d]	Preliminary Remediation Goals: Region 9 PRGs (RME): Noncarcinogenic PRG[d]	Preliminary Remediation Goals: CTE PRGs: Carcinogenic PRG[d]	Preliminary Remediation Goals: CTE PRGs: Noncarcinogenic PRG[d]	SSL DAF 1[e]	Maximum Detect Evaulation: >SSL	Maximum Detect Evaulation: Carcinogenic >PRG (ca)	Maximum Detect Evaulation: Noncarcinogenic >PRG (nc)	RME Evaluation: Carcinogenic >PRG (ca)	RME Evaluation: Carcinogenic Excess Cancer Risk[f]	RME Evaluation: Carcinogenic % Contribution Risk	RME Evaluation: Noncarcinogenic >PRG (nc)	RME Evaluation: Noncarcinogenic HQ[g]	RME Evaluation: Noncarcinogenic % Contribution HI	CTE Evaluation: Carcinogenic >PRG (ca)	CTE Evaluation: Carcinogenic Excess Cancer Risk[f]	CTE Evaluation: Carcinogenic % Contribution Risk	CTE Evaluation: Noncarcinogenic >PRG (nc)	CTE Evaluation: Noncarcinogenic HQ[g]	CTE Evaluation: Noncarcinogenic % Contribution HI
Metals (6010B & 7471A) (mg/kg)																												
Aluminum	33	33	100%	15800	9.98E+03	9.98E+03	1.48E+04	Yes	--	7.61E+04	--	1E+05 max	--	--	--	No	--	--	--	No	1.31E-01	9%	--	--	--	No	--[d]	--
Antimony	1	33	3%	2.1	--	2.10E+00	3.06E+00	No	--	3.13E+01	--	1.74E+02	3.00E-01	Yes	--	No	--	--	--	No	6.71E-02	5%	--	--	--	No	1.21E-08	0%
Arsenic	33	33	100%	4.6	3.16E+00	3.16E+00	6.86E+00	No	**6.16E-02**	2.16E+01	**4.77E-01**	1.22E+02	1.00E+00	Yes	Yes	No	Yes	5.13E-05	58%	No	1.46E-01	10%	Yes	6.62E-06	57%	No	2.59E-08	0%
Barium	33	33	100%	187	1.07E+02	1.07E+02	1.73E+02	Yes	--	5.37E+03	--	7.77E+04	8.20E+01	Yes	--	No	--	--	--	No	1.99E-02	1%	--	--	--	No	1.38E-09	0%
Berylium	10	33	30%	0.31	--	3.10E-01	6.69E-01	No	1.05E+03	1.51E+02	5.94E+03	8.01E+02	3.00E+00	No	No	No	No	2.94E-10	0%	No	2.06E-03	0%	No	5.21E-11	0%	No	3.87E-10	0%
Cadmium	33	33	100%	1	6.71E-01	6.71E-01	2.35E+00	No	7.00E+02	3.89E+01	3.33E+03	2.15E+02	4.00E-01	Yes	No	No	No	9.59E-10	0%	No	1.73E-02	1%	No	2.02E-10	0%	No	3.12E-09	0%
Calcium	33	33	100%	25200	8.55E+03	8.55E+03	4.60E+04	No	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium (total)	33	33	100%	15.8	1.09E+01	1.09E+01	2.69E+01	No	2.11E+02	--	1.19E+03	--	2.00E+00	Yes	No	--	No	5.17E-08	0%	--	--	--	No	9.17E-09	0%	--	--	--
Cobalt	33	33	100%	7.6	5.06E+00	5.06E+00	6.98E+00	Yes	9.03E+02	1.38E+03	5.10E+03	6.69E+03	--	--	No	No	No	5.60E-09	0%	No	3.67E-03	0%	No	9.92E-10	0%	No	7.56E-04	1%
Copper	33	33	100%	10.8	6.71E+00	6.71E+00	6.41E+00	Yes	--	3.13E+03	--	1.74E+04	--	--	--	No	--	--	--	No	2.14E-03	0%	--	--	--	No	3.86E-04	0%
Iron	33	33	100%	19400	1.25E+04	1.25E+04	1.84E+04	Yes	--	2.35E+04	--	1E+05 max	--	--	--	No	--	--	--	No	5.33E-01	38%	--	--	--	No	--[d]	--
Lead	33	33	100%	20.7	8.50E+00	8.50E+00	1.51E+01	Yes	--	1.50E+02	--	--	--	--	--	No	--	--	--	No	--[h]	--	--	--	--	No	--[h]	--
Magnesium	33	33	100%	6900	4.37E+03	4.37E+03	8.37E+03	No	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	33	33	100%	289	1.97E+02	1.97E+02	2.91E+02	No	--	1.85E+03	--	1.01E+04	--	--	--	No	--	--	--	No	1.07E-01	8%	--	--	--	No	1.96E-02	22%
Mercury	33	33	100%	0.069	3.06E-02	3.06E-02	2.20E-01	No	--	2.35E+01	--	1.30E+02	--	--	--	No	--	--	--	No	1.30E-03	0%	--	--	--	No	2.35E-04	0%
Nickel	33	33	100%	12.1	7.72E+00	7.72E+00	1.53E+01	No	1.15E+04	1.48E+03	5.49E+04	7.77E+03	7.00E+00	Yes	No	No	No	6.69E-10	0%	No	5.20E-03	0%	No	1.41E-10	0%	No	9.94E-04	1%
Potassium	33	33	100%	3970	2.64E+03	2.64E+03	4.89E+03	No	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	20	33	61%	1.1	6.62E-01	6.62E-01	3.20E-01	Yes	--	3.91E+02	--	2.17E+03	3.00E-01	Yes	--	No	--	--	--	No	1.69E-03	0%	--	--	--	No	3.05E-04	0%
Silver	1	33	3%	2	--	2.00E+00	5.39E-01	Yes	--	3.91E+02	--	2.17E+03	2.00E+00	No	--	No	--	--	--	No	5.11E-03	0%	--	--	--	No	9.22E-04	1%
Vanadium	33	33	100%	44.1	2.81E+01	2.81E+01	7.18E+01	No	--	7.82E+01	--	4.25E+02	3.00E+02	No	--	No	--	--	--	No	3.59E-01	26%	--	--	--	No	6.61E-02	74%
Zinc	33	33	100%	57.1	3.74E+01	3.74E+01	7.79E+01	No	--	2.35E+04	--	1E+05 max	6.20E+02	No	--	No	--	--	--	No	1.59E-03	0%	--	--	--	No	--[d]	--
Extractable Hydrocarbons (8015B) (mg/kg)																							--	--	--	--	--	--
PHC as Diesel Fuel	14	33	42%	15	3.95E+01	1.50E+01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHC as Motor Oil	20	33	61%	160	4.39E+01	4.39E+01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Purgeable Hydrocarbons (8015B) (mg/kg)																							--	--	--	--	--	--
PHC as Gasoline	26	33	79%	2.77	9.99E+00	2.77E+00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Semivolatile Organics (8270C) (mg/kg)																												
bis(2-Ethylhexyl) Phthalate	3	33	9%	0.07	--	7.00E-02	--	--	1.76E+02	1.20E+03	1.31E+03	7.10E+03	--	--	No	No	No	3.98E-10	0%	No	5.83E-05	0%	No	5.34E-11	0%	No	9.86E-06	0%
Diethylphthalate	1	33	3%	0.225	--	2.25E-01	--	--	--	4.89E+04	--	1.00E+05 max		--	--	No	--	--	--	No	4.60E-06	0%	--	--	--	No	--[d]	--
Phenol	12	33	36%	0.936	7.16E-01	7.16E-01	--	--	--	1.83E+04	--	1.00E+05 max	5.00E+00	No	--	No	--	--	--	No	3.91E-05	0%	--	--	--	No	--[d]	--
Semivolatile Organics (8270C-SIM) (mg/kg)																												
Anthracene	1	33	3%	0.044	--	4.40E-02	--	--	--	2.19E+04	--	1.00E+05 max	5.90E+02	No	--	No	--	--	--	No	2.01E-06	0%	--	--	--	No	--[d]	--
Benzo(g,h,i)Perylene	4	33	12%	0.44	--	4.40E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	5	33	15%	1	--	1.00E+00	--	--	--	2.29E+03	--	1.35E+04	2.10E+02	No	--	No	--	--	--	No	4.36E-04	0%	--	--	--	No	7.43E-05	0%
Phenanthrene	2	33	6%	0.29	--	2.90E-01	--	--	--	--	--	--		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	5	33	15%	0.96	--	9.60E-01	--	--	--	2.32E+03	--	1.30E+04	2.10E+02	No	--	No	--	--	--	No	4.15E-04	0%	--	--	--	No	7.36E-05	0%
Benzo(a)pyrene Equivalent	7	33	21%	1.42	--	1.42E+00	--	--	**4.11E-02**	--	**3.10E-01**	--	4.00E-01	Yes	Yes	--	Yes	3.46E-05	39%	--	--	--	Yes	4.58E-06	40%	--	--	--
Dioxins and Furans (8290) (mg/kg)																												
2,3,7,8-TCDD TEQ	9	9	100%	0.0000125	--	1.25E-05	--	--	**4.86E-06**	**2.33E+01**	**3.47E-05**	**5.82E+01**	--	--	Yes	No	Yes	2.58E-06	3%	No	5.39E-07	0.0%	No	3.62E-07	3%	No	2.15E-13	0%
Incremental Lifetime Cancer Risk/Hazard Index Including Background:																		**9E-05**			**1E+00**			**1E-05**			**9E-02**	
Incremental Lifetime Cancer Risk/Hazard Index Excluding Background:																		**4E-05**			**7E-01**			**5E-06**			**3E-03**	

NOTES:

-- = no data or not applicable
% = percent
ca = carcinogenic
HI = hazard index
mg/kg = milligrams per kilogram
nc = noncarcinogenic
PRG = preliminary remediation goals
SSL = soil screening levels
EPC = exposure point concentration
HI = hazard index
HQ = hazard quotient
RME = reasonable maximum exposure
FOD = frequency of detection
CTE = central tendency exposure
UCL = upper confidence limit
bgs = below ground surface
ft = foot
PHC = petroleum hydrocarbon
DAF = dilution attenuation factor
> = greater than
TCDD = tetrachlorodibenzo-dioxin

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Maximum concentration is the maximum detected concentration of an analyte.
[c] EPC is the minimum of either the 95% UCL or the max EPC. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region IX PRG table (EPA Region IX 2004). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.
[f] Excess cancer risk = 1E-06 x (EPC / Carcinogenic PRG)
[g] HQ = EPC / Noncarcinogenic PRG
[h] An HQ for lead could not be determined because the PRGs for lead were developed using blood-lead levels and a reference dose is not available.

Shading identifies chemicals with concentrations exceeding EPA Region IX PRGs (EPA Region IX 2004).

Table E1-6: Risk-Based Screening Evaluation of Subsurface Soil (0 - 10 feet bgs) for (Current/Future) Residential Receptor Using Cal-EPA Toxicity Information

Chemical	Number of Detects	Sample Size[a]	FOD	Maximum EPC[b]	95% UCL	EPC[c]	Background Concentration	Site Metal Exceed Background?	Preliminary Remediation Goals: Region 9 PRGs (RME) Carcinogenic PRG[d]	Preliminary Remediation Goals: Region 9 PRGs (RME) Noncarcinogenic PRG[d]	Preliminary Remediation Goals: CTE PRGs Carcinogenic PRG[d]	Preliminary Remediation Goals: CTE PRGs Noncarcinogenic PRG[d]	SSL DAF 1[e]	Maximum Detect Evaluation: >SSL	Maximum Detect Evaluation: Carcinogenic >PRG (ca)	Maximum Detect Evaluation: Noncarcinogenic >PRG (nc)	RME Comparisons: Carcinogenic >PRG (ca)	RME Comparisons: Carcinogenic Excess Cancer Risk[f]	RME Comparisons: Carcinogenic % Contribution to Risk	RME Comparisons: Noncarcinogenic >PRG (nc)	RME Comparisons: Noncarcinogenic HQ[g]	RME Comparisons: Noncarcinogenic % Contribution to HI	CTE Comparisons: Carcinogenic >PRG (ca)	CTE Comparisons: Carcinogenic Excess Cancer Risk[f]	CTE Comparisons: Carcinogenic % Contribution to Risk	CTE Comparisons: Noncarcinogenic >PRG (nc)	CTE Comparisons: Noncarcinogenic HQ[g]	CTE Comparisons: Noncarcinogenic % Contribution to HI
Metals (6010B & 7471A) (mg/kg)																												
Aluminum	33	33	100%	1.58E+04	9.98E+03	9.98E+03	1.48E+04	Yes	--	7.61E+04	--	1E+05 max	--	--	--	No	--	--	--	No	1.31E-01	9%	--	--	--	No	--[d]	--
Antimony	1	42	2%	2.10E+00	--	2.10E+00	3.06E+00	No	--	3.13E+01	--	1.74E+02	3.00E-01	Yes	--	No	--	--	--	No	6.71E-02	5%	--	--	--	No	1.21E-02	9%
Arsenic	42	42	100%	4.63E+00	3.20E+00	3.20E+00	6.86E+00	No	6.16E-02	2.16E+01	4.77E-01	1.22E+02	1.00E+00	Yes	Yes	No	Yes	5.19E-05	58%	No	1.48E-01	10%	Yes	6.70E-06	57%	No	2.62E-02	20%
Barium	42	42	100%	1.87E+02	1.04E+02	1.04E+02	1.73E+02	Yes	--	5.37E+03	--	7.77E+04	8.20E+01	Yes	--	No	--	--	--	No	1.94E-02	1%	--	--	--	No	1.34E-03	1%
Beryllium	10	42	24%	3.10E-01	--	3.10E-01	6.69E-01	No	1.05E+03	1.51E+02	5.94E+03	8.01E+02	3.00E+00	No	No	No	No	2.94E-10	0%	No	2.06E-03	0%	No	5.21E-11	0%	No	3.87E-04	0%
Cadmium	33	42	79%	1.00E+00	7.74E-01	7.74E-01	2.35E+00	No	7.00E+02	3.89E+01	3.33E+03	2.15E+02	4.00E-01	Yes	No	No	No	1.11E-09	0%	No	1.99E-02	1%	No	2.33E-10	0%	No	3.60E-03	3%
Calcium	33	33	100%	2.52E+04	8.55E+03	8.55E+03	4.60E+04	No	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	42	42	100%	1.64E+01	1.09E+01	1.09E+01	2.69E+01	No	2.11E+02	--	1.19E+03	--	2.00E+00	Yes	No	--	No	5.19E-08	0%	--	--	--	No	9.20E-09	0%	--	--	--
Cobalt	42	42	100%	7.60E+00	4.88E+00	4.88E+00	6.98E+00	Yes	9.03E+02	1.38E+03	5.10E+03	6.69E+03	--	--	No	No	No	5.40E-09	0%	No	3.53E-03	0%	No	9.56E-10	0%	No	7.29E-04	1%
Copper	42	42	100%	1.27E+01	7.02E+00	7.02E+00	6.41E+00	Yes	--	3.13E+03	--	1.74E+04	--	--	--	No	--	--	--	No	2.25E-03	0%	--	--	--	No	4.04E-04	0%
Iron	33	33	100%	1.94E+04	1.25E+04	1.25E+04	1.84E+04	Yes	--	2.35E+04	--	1E+05 max	--	--	--	No	--	--	--	No	5.32E-01	38%	--	--	--	No	--[d]	--
Lead	42	42	100%	2.07E+01	8.40E+00	8.40E+00	1.51E+01	Yes	--	1.50E+02	--	--	--	--	--	No	--	--	--	No	--[h]	--	--	--	--	No	--[h]	--
Magnesium	33	33	100%	6.90E+03	4.37E+03	4.37E+03	8.37E+03	No	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	42	42	100%	2.89E+02	1.96E+02	1.96E+02	2.91E+02	No	--	1.85E+03	--	1.01E+04	--	--	--	No	--	--	--	No	1.06E-01	8%	--	--	--	No	1.94E-02	15%
Mercury	33	42	79%	6.90E-02	6.67E-02	6.67E-02	2.20E-01	No	--	2.35E+01	--	1.30E+02	--	--	--	No	--	--	--	No	2.84E-03	0%	--	--	--	No	5.12E-04	0%
Nickel	41	42	98%	1.37E+01	7.86E+00	7.86E+00	1.53E+01	No	1.15E+04	1.48E+03	5.49E+04	7.77E+03	7.00E+00	Yes	No	No	No	6.82E-10	0%	No	5.29E-03	0%	No	1.43E-10	0%	No	1.01E-03	1%
Potassium	33	33	100%	3.97E+03	2.64E+03	2.64E+03	4.89E+03	No	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	20	42	48%	1.10E+00	7.77E-01	7.77E-01	3.20E-01	Yes	--	3.91E+02	--	2.17E+03	3.00E-01	Yes	--	No	--	--	--	No	1.99E-03	0%	--	--	--	No	3.58E-04	0%
Silver	1	42	2%	2.00E+00	--	2.00E+00	5.39E-01	Yes	--	3.91E+02	--	2.17E+03	2.00E+00	No	--	No	--	--	--	No	5.11E-03	0%	--	--	--	No	9.22E-04	1%
Vanadium	42	42	100%	4.41E+01	2.79E+01	2.79E+01	7.18E+01	No	--	7.82E+01	--	4.25E+02	3.00E+02	No	--	No	--	--	--	No	3.56E-01	25%	--	--	--	No	6.56E-02	49%
Zinc	42	42	100%	5.71E+01	3.77E+01	3.77E+01	7.79E+01	No	--	2.35E+04	--	1E+05 max	6.20E+02	No	--	No	--	--	--	No	1.61E-03	0%	--	--	--	No	--[d]	--
Extractable Hydrocarbons (8015B) (mg/kg)																												
PHC as Diesel Fuel	19	42	45%	5.60E+03	1.48E+03	1.48E+03	--		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHC as Motor Oil	20	33	61%	1.60E+02	4.39E+01	4.39E+01	--		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Purgeable Hydrocarbons (8015B) (mg/kg)																												
PHC as Gasoline	26	42	62%	2.78E+00	1.84E+01	2.78E+00	--		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Volatile Organics (8260B) (mg/kg)																												
Acetone	5	42	12%	1.00E-01	--	1.00E-01	--		--	1.40E+04	--	6.27E+04	8.00E-01	No	--	No	--	--	--	No	7.14E-06	0%	--	--	--	No	1.60E-06	0%
Benzene	1	42	2%	2.40E-03	--	2.40E-03	--		2.09E-01	5.84E+01	1.10E+00	1.77E+02	2.00E-03	Yes	No	No	No	1.15E-08	0%	No	4.11E-05	0%	No	2.18E-09	0%	No	1.35E-05	0%
Methylene Chloride	1	9	11%	9.20E-03	--	9.20E-03	--		6.58E+00	5.24E+02	3.27E+01	1.40E+03	1.00E-03	Yes	No	No	No	1.40E-09	0%	No	1.76E-05	0%	No	2.81E-10	0%	No	6.59E-06	0%
Semivolitile Organics (8270C) (mg/kg)																												
bis(2-Ethylhexyl) Phthalate	3	33	9%	7.00E-02	--	7.00E-02	--		1.76E+02	1.20E+03	1.31E+03	7.10E+03	--	--	No	No	No	3.98E-10	0%	No	5.83E-05	0%	No	5.34E-11	0%	No	9.86E-06	0%
Diethylphthalate	3	42	7%	2.60E-01	--	2.60E-01	--		--	4.89E+04	--	1E+05 max	--	--	--	No	--	--	--	No	5.32E-06	0%	--	--	--	No	--[d]	--
Hexachlorbenzene	1	9	11%	1.50E-01	--	1.50E-01	--		2.93E-01	4.90E+01	2.18E+00	2.84E+02	1.00E-01	Yes	No	No	No	5.12E-07	1%	No	3.06E-03	0%	No	6.87E-08	1%	No	5.28E-04	0%
Phenol	12	33	36%	9.36E-01	3.29E+00	9.36E-01	--		--	1.83E+04	--	1E+05 max	5.00E+00	No	--	No	--	--	--	No	5.11E-05	0%	--	--	--	No	--[d]	--
Fluoranthene	1	9	11%	6.00E-01	--	6.00E-01	--		--	2.29E+03	--	1.35E+04	2.10E+02	No	--	No	--	--	--	No	2.62E-04	--[i]	--	--	--	No	4.46E-05	--[i]
Phenanthrene	1	9	11%	1.40E-01	--	1.40E-01	--		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	1	9	11%	4.60E-01	--	4.60E-01	--		--	2.32E+03	--	1.30E+04	2.10E+02	No	--	No	--	--	--	No	1.99E-04	--[i]	--	--	--	No	3.53E-05	--[i]
Benzo(a)pyrene Equivalent	1	9	11%	3.12E-01	--	3.12E-01	--		4.11E-02	--	3.10E-01	--	4.00E-01	No	Yes	--	Yes	7.59E-06	--	--	--	--	Yes	1.00E-06	--	--	--	--
Semivolatile Organics (8270C-SIM) (mg/kg)																												
Anthracene	1	33	3%	4.40E-02	--	4.40E-02	--		--	2.19E+04	--	1E+05 max	5.90E+02	No	--	No	--	--	--	No	2.01E-06	0%	--	--	--	No	--[d]	--
Benzo(G,H,I)Perylene	4	33	12%	4.40E-01	--	4.40E-01	--		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	5	33	15%	1.00E+00	--	1.00E+00	--		--	2.29E+03	--	1.35E+04	2.10E+02	No	--	No	--	--	--	No	4.36E-04	0%	--	--	--	No	7.43E-05	0%
Phenanthrene	2	33	6%	2.90E-01	--	2.90E-01	--		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	5	33	15%	9.60E-01	--	9.60E-01	--		--	2.32E+03	--	1.30E+04	2.10E+02	No	--	No	--	--	--	No	4.15E-04	0%	--	--	--	No	7.36E-05	0%
Benzo(a)pyrene Equivalent	7	33	21%	1.42E+00	--	1.42E+00	--		4.11E-02	--	3.10E-01	--	4.00E-01	Yes	Yes	--	Yes	3.46E-05	39%	--	--	--	Yes	4.58E-06	39%	--	--	--
Dioxins and Furans (8290) (mg/kg)																												
2,3,7,8-TCDD TEQ	11	11	100%	1.29E-05	--[j]	1.29E-05	--		4.86E-06	2.33E+01	3.47E-05	5.82E+01	--	--	Yes	No	Yes	2.65E-06	3%	No	5.54E-07	0%	No	3.72E-07	3%	No	2.22E-07	0%
Incremental Lifetime Cancer Risk/Hazard Index Including Background:																		**9E-05**			**1E+00**			**1E-05**			**1E-01**	
Incremental Lifetime Cancer Risk/Hazard Index Excluding Background:																		**4E-05**			**7E-01**			**5E-06**			**4E-03**	

NOTES:

-- = no data or not applicable
% = percent
ca = carcinogenic
HI = hazard index
mg/kg = milligrams per kilogram
nc = noncarcinogenic
PRG = preliminary remediation goals
SSL = soil screening levels
EPC = exposure point concentration
HI = hazard index
HQ = hazard quotient
RME = reasonable maximum exposure
FOD = frequency of detection
CTE = central tendency exposure
UCL = upper confidence limit
bgs = below ground surface
ft = foot
PHC = petroleum hydrocarbon
DAF = dilution attenuation factor
> = greater than
TCDD = tetrachlorodibenzo-dioxin

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Maximum concentration is the maximum detected concentration of an analyte.
[c] EPC is the minimum of either the 95% UCL or the max EPC. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region 9 PRG table (EPA Region 9 2004). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.
[f] Excess cancer risk = 1E-06 x (EPC / Carcinogenic PRG)
[g] HQ = EPC / Noncarcinogenic PRG
[h] An HQ for lead could not be determined because the PRGs for lead were developed using blood-lead levels and a reference dose is not available.
[i] Only the higher concentration using the 8270C-SIM method is included in the quantitative risk estimate(s).
[j] A 95UCL was not calculated as only 5 of the 25 detected congeners had 11 detections, and none of the 5 congeners contributed significantly to the TCDD TEQ.
Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (EPA Region 9 2004).

Table E1-7: Risk-Based Screening of Indoor Air from Soil for (Current/Future) Residential Receptor Using Cal-EPA Toxicity Information

							Preliminary Remedial Goals						RME Evaluation						CTE Evaluation					
							RME PRGs		CTE PRGs		Region 9 PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect in Soil (mg/kg)[a]	Soil EPC[b]	Estimated Indoor Air Concentration (mg/m^3)	Carcinogenic PRG	Non-carcinogenic PRG	Carcinogenic PRG	Non-carcinogenic PRG	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[c]	% Contribution to Risk	>PRG (nc)	HQ[d]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI
Acetone	5	42	12%	1.00E-01	1.00E-01	2.02E-03	--	3.29E+00	--	6.08E+00	--	No	--	--	--	No	6.14E-04	10%	--	--	--	No	3.32E-04	10%
Benzene	1	42	2%	2.40E-03	2.40E-03	6.37E-06	6.72E-05	6.24E-02	2.53E-04	1.16E-01	No	No	No	9.47E-08	2%	No	1.02E-04	2%	No	2.51E-08	2%	No	5.51E-05	2%
Hexachlorobenzene	1	9	11%	1.50E-01	1.50E-01	1.47E-05	**3.74E-06**	**2.92E-03**	**1.41E-05**	**5.41E-03**	Yes	No	Yes	3.93E-06	95%	No	5.03E-03	81%	Yes	1.04E-06	95%	No	2.71E-03	81%
Methylene Chloride	1	9	11%	9.20E-03	9.20E-03	1.86E-04	1.92E-03	4.16E-01	7.24E-03	7.71E-01	No	No	No	9.66E-08	2%	No	4.46E-04	7%	No	2.56E-08	2%	No	2.41E-04	7%
Pyrene	1	9	11%	9.60E-01	9.60E-01	2.18E-07	--	1.10E-01	--	2.03E-01	--	No	--	--	--	No	1.99E-06	0%	--	--	--	No	1.08E-06	0%
Cumulative Incremental Lifetime Cancer Risk/Hazard Index:														4E-06			6E-03			1E-06			3E-03	

NOTES:
-- = no data or not applicable
% = percent
ca = carcinogenic
CTE = central tendency exposure
nc = noncarcinogenic
mg/m^3 = milligrams per kilogram
HI = hazard index
PRG = preliminary remediation goal
RME = reasonable maximum exposure
ug/kg = micrograms per kilogram

[a] Maximum detect is the maximum detected concentration of an analyte in the medium.
[b] EPC is the maximum detected concentration since there are too few number of detections (less than 11) to estimate a UCL of a mean concentration using ProUCL.
[c] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)
[d] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG
[e] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)
[f] HQ = EPC / CTE Noncarcinogic PRG

Shading identifies COPCs with indoor air concentrations above PRGs.

Table E1-8: Risk-Based Screening Evaluation of Surface Soil (0 - 1 ft bgs) for (Current/Future) Industrial Receptor Using Cal-EPA Toxicity Information

Chemical	Number of Detects	Sample Size[a]	FOD	Maximum EPC[b]	95% UCL	EPC[c]	Background Concentration	Site Metal Exceed Background?	Preliminary Remediation Goals: Region 9 PRGs (RME) Carcinogenic PRG[d]	Preliminary Remediation Goals: Region 9 PRGs (RME) Noncarcinogenic PRG[d]	Preliminary Remediation Goals: CTE PRGs Carcinogenic PRG[d]	Preliminary Remediation Goals: CTE PRGs Noncarcinogenic PRG[d]	SSL DAF 1[e]	Maximum Detect Evaluation: >SSL	Maximum Detect Evaluation: Carcinogenic >PRG (ca)	Maximum Detect Evaluation: Noncarcinogenic >PRG (nc)	RME Evaluation: Carcinogenic >PRG (ca)	RME Evaluation: Carcinogenic Incremental Cancer Risk[f]	RME Evaluation: Carcinogenic % Contribution to Risk	RME Evaluation: Noncarcinogenic >PRG (nc)	RME Evaluation: Noncarcinogenic HQ[g]	RME Evaluation: Noncarcinogenic % Contribution to HI	CTE Evaluation: Carcinogenic >PRG (ca)	CTE Evaluation: Carcinogenic Incremental Cancer Risk[f]	CTE Evaluation: Carcinogenic % Contribution to Risk	CTE Evaluation: Noncarcinoienic >PRi (nc)	CTE Evaluation: Noncarcinoienic HQ[g]	CTE Evaluation: Noncarcinoienic % Contribution to HI
Metals (6010B & 7471A) (mg/kg)																												
Aluminum	33	33	100%	1.58E+04	9.98E+03	9.98E+03	1.48E+04	Yes	--	1.00E+05 max	--	1E+05 max	--	--	--	--	--	--	--	--	--[d]	--	--	--	--	No	--[d]	--
Antimony	1	33	3%	2.10E+00	--	2.10E+00	3.06E+00	No	--	4.09E+02	--	1.87E+03	3.00E-01	Yes	--	No	--	--	--	No	5.14E-03	9%	--	--	--	No	1.13E-03	11%
Arsenic	33	33	100%	4.60E+00	3.16E+00	3.16E+00	6.86E+00	No	2.53E-01	2.55E+02	4.85E+00	1.29E+03	1.00E+00	Yes	Yes	No	Yes	1.25E-05	51%	No	1.24E-02	21%	No	6.51E-07	57%	No	2.44E-03	24%
Barium	33	33	100%	1.87E+02	1.07E+02	1.07E+02	1.73E+02	Yes	--	6.66E+04	--	1E+05 max	8.20E+01	Yes	--	No	--	--	--	No	1.61E-03	3%	--	--	--	No	--[d]	--
Berylium	10	33	30%	3.10E-01	--	3.10E-01	6.69E-01	No	2.20E+03	1.78E+03	7.69E+04	8.67E+03	3.00E+00	No	No	No	No	1.41E-10	0%	No	1.75E-04	0%	No	4.03E-12	0%	No	3.58E-05	0%
Cadmium	33	33	100%	1.00E+00	6.71E-01	6.71E-01	2.35E+00	No	1.26E+03	5.01E+02	2.31E+03	4.31E+04	4.00E-01	Yes	No	No	No	5.32E-10	0%	No	1.34E-03	2%	No	2.90E-10	0%	No	1.56E-05	0%
Calcium	33	33	100%	2.52E+04	8.55E+03	8.55E+03	4.60E+04	No	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium (total)	33	33	100%	1.58E+01	1.09E+01	1.09E+01	2.69E+01	No	4.48E+02	--	1.54E+04	--	2.00E+00	Yes	No	--	No	2.43E-08	0%	--	--	--	No	7.08E-10	0%	--	--	--
Cobalt	33	33	100%	7.60E+00	5.06E+00	5.06E+00	6.98E+00	Yes	1.92E+03	1.30E+04	6.59E+04	7.36E+04	--	--	No	No	No	2.63E-09	0%	No	3.89E-04	1%	No	7.67E-11	0%	No	6.88E-05	1%
Copper	33	33	100%	1.08E+01	6.71E+00	6.71E+00	6.41E+00	Yes	--	4.09E+04	--	1E+05 max	--	--	--	No	--	--	--	No	1.64E-04	0%	--	--	--	No	--[d]	--
Iron	33	33	100%	1.94E+04	1.25E+04	1.25E+04	1.84E+04	Yes	--	1.00E+05 max	--	1E+05 max	--	--	--	--	--	--	--	--	--[d]	--	--	--	--	No	--[d]	--
Lead	33	33	100%	2.07E+01	8.50E+00	8.50E+00	1.51E+01	Yes	--	8.00E+02	--	--	--	--	--	No	--	--	--	No	--[h]	--	--	--	--	No	--[h]	--
Magnesium	33	33	100%	6.90E+03	4.37E+03	4.37E+03	8.37E+03	No	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	33	33	100%	2.89E+02	1.97E+02	1.97E+02	2.91E+02	No	--	2.31E+04	--	1E+05 max	--	--	--	No	--	--	--	No	8.54E-03	14%	--	--	--	No	--[d]	--
Mercury	33	33	100%	6.90E-02	3.06E-02	3.06E-02	2.20E-01	No	--	3.06E+02	--	1.40E+03	--	--	--	No	--	--	--	No	1.00E-04	0%	--	--	--	No	2.19E-05	0%
Nickel	33	33	100%	1.21E+01	7.72E+00	7.72E+00	1.53E+01	No	2.08E+04	1.69E+04	1E+05 max	8.43E+04	7.00E+00	Yes	No	No	No	3.72E-10	0%	No	4.58E-04	1%	No	--[d]	--	No	9.16E-05	1%
Potassium	33	33	100%	3.97E+03	2.64E+03	2.64E+03	4.89E+03	No	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	20	33	61%	1.10E+00	6.62E-01	6.62E-01	3.20E-01	Yes	--	5.11E+03	--	2.33E+04	3.00E-01	Yes	--	No	--	--	--	No	1.30E-04	0%	--	--	--	No	2.84E-05	0%
Silver	1	33	3%	2.00E+00	--	2.00E+00	5.39E-01	Yes	--	5.11E+03	--	2.33E+04	2.00E+00	No	--	No	--	--	--	No	3.91E-04	1%	--	--	--	No	8.58E-05	1%
Vanadium	33	33	100%	4.41E+01	2.81E+01	2.81E+01	7.18E+01	No	--	1.00E+03	--	4.55E+03	3.00E+02	No	--	No	--	--	--	No	2.81E-02	48%	--	--	--	No	6.18E-03	61%
Zinc	33	33	100%	5.71E+01	3.74E+01	3.74E+01	7.79E+01	No	--	1.00E+05 max	--	1.00E+05 max	6.20E+02	No	--	--	--	--	--	--	--[d]	--	--	--	--	No	--[d]	--
Extractable Hydrocarbons (8015B) (mg/kg)																												
PHC as Diesel Fuel	14	33	42%	1.50E+01	3.95E+01	1.50E+01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHC as Motor Oil	20	33	61%	1.60E+02	4.39E+01	4.39E+01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Purgeable Hydrocarbons (8015B) (mg/kg)																												
PHC as Gasoline	26	33	79%	2.77E+00	9.99E+00	2.77E+00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Semivolitile Organics (8270C) (mg/kg)																												
bis(2-Ethylhexyl) Phthalate	3	33	9%	7.00E-02	--	7.00E-02	--	--	5.74E+02	1.20E+04	1.31E+04	7.38E+04	--	--	No	No	No	1.22E-10	0%	No	5.83E-06	0%	No	5.36E-12	0%	No	9.48E-07	0%
Diethylphthalate	1	33	3%	2.25E-01	--	2.25E-01	--	--	--	1.0E+05 max	--	1.0E+05 max	--	--	--	--	--	--	--	--	--[d]	--	--	--	--	No	--[d]	--
Phenol	12	33	36%	9.36E-01	7.16E-01	7.16E-01	--	--	--	1.0E+05 max	--	1.0E+05 max	5.00E+00	No	--	--	--	--	--	--	--[d]	--	--	--	--	No	--[d]	--
Semivolitile Organics (8270C-SIM) (mg/kg)																												
Anthracene	1	33	3%	4.40E-02	--	4.40E-02	--	--	--	1.0E+05 max	--	1.0E+05 max	5.90E+02	No	--	--	--	--	--	--	--[d]	--	--	--	--	No	--[d]	--
Benzo(g,h,I)Perylene	4	33	12%	4.40E-01	--	4.40E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	5	33	15%	1.00E+00	--	1.00E+00	--	--	--	2.20E+04	--	1.0E+05 max	2.10E+02	No	--	No	--	--	--	No	4.55E-05	0%	--	--	--	No	--[d]	--
Phenanthrene	2	33	6%	2.90E-01	--	2.90E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	5	33	15%	9.60E-01	--	9.60E-01	--	--	--	2.91E+04	--	1.0E+05 max	2.10E+02	No	--	No	--	--	--	No	3.30E-05	0%	--	--	--	No	--[d]	--
Benzo(a)pyrene Equivalent	7	33	21%	1.42	--	1.42E+00		--	1.28E-01	--	3.07E+00	--	4.00E-01	Yes	Yes	--	Yes	1.11E-05	46%	--	--	--	No	4.63E-07	40%	--	--	--
Dioxins and Furans (8290) (mg/kg)																												
2,3,7,8-TCDD TEQ	9	9	100%	1.25E-05	--	1.25E-05	--	--	1.84E-05	7.70E+01	3.53E-04	6.95E+02	--	--	No	No	No	6.82E-07	3%	No	1.63E-07	0%	No	3.55E-08	3%	No	--	--
Incremental Lifetime Cancer Risk/Hazard Index Including Background:																		**2E-05**			**6E-02**			**1E-06**			**1E-02**	
Incremental Lifetime Cancer Risk/Hazard Index Excluding Background:																		**1E-05**			**3E-03**			**5E-07**			**2E-04**	

NOTES:

-- = no data or not applicable
% = percent
ca = carcinogenic
HI = hazard index
mg/kg = milligrams per kilogram
nc = noncarcinogenic
PRG = preliminary remediation goals
SSL = soil screening levels
EPC = exposure point concentration
HI = hazard index
HQ = hazard quotient
RME = reasonable maximum exposure
FOD = frequency of detection
CTE = central tendency exposure
UCL = upper confidence limit
bgs = below ground surface
ft = foot
PHC = petroleum hydrocarbon
DAF = dilution attenuation factor
> = greater than
TCDD = tetrachlorodibenzo-dioxin

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Max EPC is the maximum detected concentration of an analyte.
[c] EPC is the minimum of either the 95% UCL or the max EPC. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region 9 PRG table (EPA Region 9 2004). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.
[f] Excess cancer risk = 1E-06 x (EPC / Carcinogenic PRG)
[g] HQ = EPC / Noncarcinogenic PRG
[h] An HQ for lead could not be determined because the PRGs for lead were developed using blood-lead levels and a reference dose is not available.

Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (EPA Region 9 2004).

Table E1-9: Risk-Based Screening Evaluation of Subsurface Soil (0 - 10 ft bgs) for (Current/Future) Industrial Receptor Using Cal-EPA Toxicity Information

Chemical	Number of Detects	Sample Size [a]	FOD	Maximum EPC[b]	95% UCL	EPC[c]	Background Concentration	Site Metal Exceed Background?	Preliminary Remediation Goals: Region 9 PRGs (RME) Carcinogenic PRG[d]	Region 9 PRGs (RME) Noncarcinogenic PRG[d]	CTE PRGs Carcinogenic PRG[d]	CTE PRGs Noncarcinogenic PRG[d]	SSL DAF 1[e]	Maximum Detect Evaluation >SSL	Maximum Detect Evaluation Carcinogenic >PRG (ca)	Maximum Detect Evaluation Noncarcinogenic >PRG (nc)	RME Evaluation Carcinogenic >PRG (ca)	RME Carcinogenic Excess Cancer Risk[f]	RME Carcinogenic % Contribution to Risk	RME Noncarcinogenic >PRG (nc)	RME Noncarcinogenic HQ[g]	RME Noncarcinogenic % Contribution to HI	CTE Evaluation Carcinogenic >PRG (ca)	CTE Carcinogenic Excess Cancer Risk[f]	CTE Carcinogenic % Contribution to Risk	CTE Noncarcinogenic >PRG (nc)	CTE Noncarcinogenic HQ[g]	CTE Noncarcinogenic % Contribution to HI
Metals (6010B & 7471A) (mg/kg)																												
Aluminum	33	33	100%	1.58E+04	9.98E+03	9.98E+03	1.48E+04	Yes	--	1.00E+05 max	--	1E+05 max	--	--	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Antimony	1	42	2%	2.10E+00	--	2.10E+00	3.06E+00	No	--	4.09E+02	--	1.87E+03	3.00E-01	Yes	--	No	--	--	--	No	5.14E-03	9%	--	--	--	No	1.13E-03	11%
Arsenic	42	42	100%	4.63E+00	3.20E+00	3.20E+00	6.86E+00	No	2.53E-01	2.55E+02	4.85E+00	1.29E+03	1.00E+00	Yes	Yes	No	Yes	1.26E-05	51%	No	1.25E-02	21%	No	6.58E-07	56%	No	2.47E-03	24%
Barium	42	42	100%	1.87E+02	1.04E+02	1.04E+02	1.73E+02	Yes	--	6.66E+04	--	1E+05 max	8.20E+01	Yes	--	No	--	--	--	No	1.56E-03	3%	--	--	--	No	--[d]	--
Beryllium	10	42	24%	3.10E-01	--	3.10E-01	6.69E-01	No	2.20E+03	1.78E+03	7.69E+04	8.67E+03	3.00E+00	No	No	No	No	1.41E-10	0%	No	1.75E-04	0%	No	4.03E-12	0%	No	3.58E-05	0%
Cadmium	33	42	79%	1.00E+00	7.74E-01	7.74E-01	2.35E+00	No	1.26E+03	5.01E+02	2.31E+03	4.31E+04	4.00E-01	Yes	No	No	No	6.14E-10	0%	No	1.55E-03	3%	No	3.35E-10	0%	No	1.80E-05	0%
Calcium	33	33	100%	2.52E+04	8.55E+03	8.55E+03	4.60E+04	No	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium (total)	42	42	100%	1.64E+01	1.09E+01	1.09E+01	2.69E+01	No	4.48E+02	--	1.54E+04	--	2.00E+00	Yes	No	--	No	2.44E-08	0%	--	--	--	No	7.11E-10	0%	--	--	--
Cobalt	42	42	100%	7.60E+00	4.88E+00	4.88E+00	6.98E+00	Yes	1.92E+03	1.30E+04	6.59E+04	7.36E+04	--	--	No	No	No	2.54E-09	0%	No	3.75E-04	1%	No	7.40E-11	0%	No	6.63E-05	1%
Copper	42	42	100%	1.27E+01	7.02E+00	7.02E+00	6.41E+00	Yes	--	4.09E+04	--	1E+05 max	--	--	--	No	--	--	--	No	1.72E-04	0%	--	--	--	No	--[d]	--
Iron	33	33	100%	1.94E+04	1.25E+04	1.25E+04	1.84E+04	Yes	--	1.00E+05 max	--	1E+05 max	--	--	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Lead	42	42	100%	2.07E+01	8.40E+00	8.40E+00	1.51E+01	Yes	--	8.00E+02	--	--	--	--	--	No	--	--	--	No	--[h]	--[h]	--	--	--	No	--[h]	--
Magnesium	33	33	100%	6.90E+03	4.37E+03	4.37E+03	8.37E+03	No	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	42	42	100%	2.89E+02	1.96E+02	1.96E+02	2.91E+02	No	--	2.31E+04	--	1E+05 max	--	--	--	No	--	--	--	No	8.48E-03	14%	--	--	--	No	--[d]	--
Mercury	33	42	79%	6.90E-02	6.67E-02	6.67E-02	2.20E-01	No	--	3.06E+02	--	1.40E+03	--	--	--	No	--	--	--	No	2.18E-04	0%	--	--	--	No	4.77E-05	0%
Nickel	41	42	98%	1.37E+01	7.86E+00	7.86E+00	1.53E+01	No	2.08E+04	1.69E+04	1E+05 max	8.43E+04	7.00E+00	Yes	No	No	No	3.78E-10	0%	No	4.66E-04	1%	--	--[d]	--	No	9.32E-05	1%
Potassium	33	33	100%	3.97E+03	2.64E+03	2.64E+03	4.89E+03	No	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	20	42	48%	1.10E+00	7.77E-01	7.77E-01	3.20E-01	Yes	--	5.11E+03	--	2.33E+04	3.00E-01	Yes	--	No	--	--	--	No	1.52E-04	0%	--	--	--	No	3.33E-05	0%
Silver	1	42	2%	2.00E+00	--	2.00E+00	5.39E-01	Yes	--	5.11E+03	--	2.33E+04	2.00E+00	No	--	No	--	--	--	No	3.91E-04	1%	--	--	--	No	8.58E-05	1%
Vanadium	42	42	100%	4.41E+01	2.79E+01	2.79E+01	7.18E+01	No	--	1.00E+03	--	4.55E+03	3.00E+02	No	--	No	--	--	--	No	2.79E-02	47%	--	--	--	No	6.13E-03	60%
Zinc	42	42	100%	5.71E+01	3.77E+01	3.77E+01	7.79E+01	No	--	1.00E+05 max	--	1.00E+05 max	6.20E+02	No	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Extractable Hydrocarbons (8015B) (mg/kg)																												
PHC as Diesel Fuel	19	42	45%	5.60E+03	1.48E+03	1.48E+03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHC as Motor Oil	20	33	61%	1.60E+02	4.39E+01	4.39E+01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Purgeable Hydrocarbons (8015B) (mg/kg)																												
PHC as Gasoline	26	42	62%	2.78E+00	1.84E+01	2.78E+00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Volatile Organics (8260B) (mg/kg)																												
Acetone	5	42	12%	1.00E-01	--	1.00E-01	--	--	--	5.40E+04	--	1.00E+05 max	8.00E-01	No	--	No	--	--	--	No	1.85E-06	0%	--	--	--	No	--[d]	--
Benzene	1	42	2%	2.40E-03	--	2.40E-03	--	--	3.84E-01	2.24E+02	1.42E+01	2.09E+03	2.00E-03	Yes	No	No	No	6.25E-09	0%	No	1.07E-05	0%	No	1.69E-10	0%	No	1.15E-06	0%
Methylene Chloride	1	9	11%	9.20E-03	--	9.20E-03	--	--	1.28E+01	1.89E+03	4.13E+02	1.66E+04	1.00E-03	Yes	No	No	No	7.17E-10	0%	No	4.87E-06	0%	No	2.23E-11	0%	No	5.56E-13	0%
Semivolitile Organics (8270C) (mg/kg)																												
bis(2-Ethylhexyl) Phthalate	3	33	9%	7.00E-02	--	7.00E-02	--	--	5.74E+02	1.20E+04	1.31E+04	7.38E+04	--	--	No	No	No	1.22E-10	0%	No	5.83E-06	0%	No	5.36E-12	0%	No	9.48E-07	0%
Diethylphthalate	3	42	7%	2.60E-01	--	2.60E-01	--	--	--	1.00E+05 max	--	1.00E+05 max	--	--	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Hexachlorobenzene	1	9	11%	1.50E-01	--	1.50E-01	--	--	9.58E-01	4.90E+02	2.18E+01	2.95E+03	1.00E-01	Yes	No	No	No	1.57E-07	1%	No	3.06E-04	1%	No	6.90E-09	1%	No	5.08E-05	1%
Phenol	12	33	36%	9.36E-01	3.29E+00	9.36E-01	--	--	--	1.00E+05 max	--	1.00E+05 max	5.00E+00	No	--	No	--	--	--	No	--[d]	--	--	--	--	No	--[d]	--
Fluoranthene	1	9	11%	6.00E-01	--	6.00E-01	--	--	--	2.20E+04	--	1.00E+05 max	2.10E+02	No	--	No	--	--	--	No	2.73E-05	--[i]	--	--	--	No	--[d]	--
Phenanthrene	1	9	11%	1.40E-01	--	1.40E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	1	9	11%	4.60E-01	--	4.60E-01	--	--	--	2.91E+04	--	1.00E+05 max	2.10E+02	No	--	No	--	--	--	No	1.58E-05	--[i]	--	--	--	No	--[d]	--
Benzo(a)pyrene Equivalent	1	9	11%	3.12E-01	--	3.12E-01	--	--	1.28E-01	--	3.07E+00	--	4.00E-01	No	Yes	--	Yes	2.43E-06	--[i]	--	--	--	No	1.01E-07	--[i]	--	--	--
Semivolitile Organics (8270C-SIM) (mg/kg)																												
Anthracene	1	33	3%	4.40E-02	--	4.40E-02	--	--	--	2.40E+05	--	1.00E+05 max	5.90E+02	No	--	No	--	--	--	No	1.83E-07	0%	--	--	--	No	--[d]	--
Benzo(G,H,I)Perylene	4	33	12%	4.40E-01	--	4.40E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	5	33	15%	1.00E+00	--	1.00E+00	--	--	--	2.20E+04	--	1.00E+05 max	2.10E+02	No	--	No	--	--	--	No	4.55E-05	0%	--	--	--	No	--[d]	--
Phenanthrene	2	33	6%	2.90E-01	--	2.90E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	5	33	15%	9.60E-01	--	9.60E-01	--	--	--	2.91E+04	--	1.00E+05 max	2.10E+02	No	--	No	--	--	--	No	3.30E-05	0%	--	--	--	No	--[d]	--
Benzo(a)pyrene Equivalent	7	33	21%	1.42E+00	--	1.42E+00	--	--	1.28E-01	--	3.07E+00	--	4.00E-01	Yes	Yes	--	Yes	1.11E-05	45%	--	--	--	No	4.63E-07	40%	--	--	--
Dioxins and Furans (8290) (mg/kg)																												
2,3,7,8-TCDD TEQ	11	11	100%	1.29E-05	--[j]	1.29E-05	--	--	1.84E-05	7.70E+01	3.53E-04	6.95E+02	--	--	No	No	No	7.02E-07	3%	No	1.68E-07	0%	No	3.66E-08	3%	No	1.86E-14	0%
Incremental Lifetime Cancer Risk/Hazard Index Including Background:																		**2E-05**			**6E-02**			**1E-06**			**1E-02**	
Incremental Lifetime Cancer Risk/Hazard Index Excluding Background:																		**1E-05**			**5E-03**			**5E-07**			**3E-04**	

NOTES:

-- = no data or not applicable
% = percent
ca = carcinogenic
HI = hazard index
mg/kg = milligrams per kilogram
nc = noncarcinogenic
PRG = preliminary remediation goals
SSL = soil screening levels
EPC = exposure point concentration
HI = hazard index
HQ = hazard quotient
RME = reasonable maximum exposure
FOD = frequency of detection
CTE = central tendency exposure
UCL = upper confidence limit
bgs = below ground surface
ft = foot
PHC = petroleum hydrocarbon
DAF = dilution attenuation factor
> = greater than
TCDD = tetrachlorodibenzo-dioxin

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Max EPC is the maximum detected concentration of an analyte.
[c] EPC is the minimum of either the 95% UCL or the max EPC. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region 9 PRG table (EPA Region 9 2004). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachate concentration.
[f] Excess cancer risk = 1E-06 x (EPC / Carcinogenic PRG)
[g] HQ = EPC / Noncarcinogenic PRG
[h] An HQ for lead could not be determined because the PRGs for lead were developed using blood-lead levels and a reference dose is not available.
[i] Only the higher concentration using the 8270C-SIM method is included in the quantitative risk estimate(s).
[j] A 95UCL was not calculated as only 5 of the 25 detected congeners had 11 detections, and none of the 5 congeners contributed significantly to the TCDD TEQ.
Shading identifies chemicals with concentrations exceeding EPA Region 9 PRGs (EPA Region 9 2004).

Table E1-10: Risk-Based Screening of Indoor Air from Soil for (Current/Future) Industrial Receptor Using Cal-EPA Toxicity Information

							Preliminary Remedial Goals						RME Evaluation						CTE Evaluation					
							RME PRGs		CTE PRGs		Region 9 PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detect in Soil (mg/kg)[a]	Soil EPC[b]	Estimated Indoor Air Concentration (mg/m^3)	Carcinogenic PRG	Non-carcinogenic PRG	Carcinogenic PRG	Non-carcinogenic PRG	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[c]	% Contribution to Risk	>PRG (nc)	HQ[d]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI
Acetone	5	42	12%	1.00E-01	1.00E-01	1.21E-03	--	4.60E+00	--	7.23E+00	--	No	--	--	--	No	2.63E-04	12%	--	--	--	No	1.67E-04	12%
Benzene	1	42	2%	2.40E-03	2.40E-03	3.18E-06	1.43E-04	8.74E-02	8.52E-04	1.37E-01	No	No	No	2.23E-08	2%	No	3.64E-05	2%	No	3.74E-09	2%	No	2.32E-05	2%
Hexachlorobenzene	1	9	11%	1.50E-01	1.50E-01	7.34E-06	**7.95E-06**	4.09E-03	**4.73E-05**	6.43E-03	No	No	No	9.23E-07	95%	No	1.79E-03	79%	No	1.55E-07	95%	No	1.14E-03	79%
Methylene Chloride	1	9	11%	9.20E-03	9.20E-03	1.11E-04	4.09E-03	5.83E-01	2.43E-02	9.16E-01	No	No	No	2.72E-08	3%	No	1.91E-04	8%	No	4.57E-09	3%	No	1.22E-04	8%
Pyrene	1	9	11%	9.60E-01	9.60E-01	1.09E-07	--	1.53E-01	--	2.41E-01	--	No	--	--	--	No	7.12E-07	0%	--	--	--	No	4.53E-07	0%
						Cumulative Incremental Lifetime Cancer Risk/Hazard Index:								1E-06			2E-03			2E-07			1E-03	

NOTES:
-- = no data or not applicable
% = percent
ca = carcinogenic
CTE = central tendency exposure
nc = noncarcinogenic
mg/m3 = milligrams per kilogram
HI = hazard index
'PRG = preliminary remediation goal
RME = reasonable maximum exposure
ug/kg = micrograms per kilogram

[a] Maximum detect is the maximum detected concentration of an analyte in the medium.
[b] EPC is the maximum detected concentration since there are too few number of detections (less than 11) to estimate a UCL of a mean concentration using ProUCL.
[c] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)
[d] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG
[e] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)
[f] HQ = EPC / CTE Noncarcinogic PRG
Shading identifies COPCs with indoor air concentrations above PRGs.

Table E1-11: Risk-Based Screening Evaluation of Groundwater for Future Residential Receptor Using Cal-EPA Toxicity Information

Chemical	Number of Detects	Sample Size [a]	FOD	Maximum Detection[b]	95% UCL	EPC[c]	Preliminary Remediation Goals: Region 9 PRGs (RME) Carcinogenic PRG[d]	Preliminary Remediation Goals: Region 9 PRGs (RME) Noncarcinogenic PRG[d]	Preliminary Remediation Goals: CTE PRGs Carcinogenic PRG[d]	Preliminary Remediation Goals: CTE PRGs Noncarcinogenic PRG[d]	Maximum Detect Evaluation: Carcinogenic >PRG (ca)	Maximum Detect Evaluation: Noncarcinogenic >PRG (nc)	RME Evaluation: Carcinogenic >PRG (ca)	RME Evaluation: Carcinogenic Excess Cancer Risk[e]	RME Evaluation: Carcinogenic % Contribution to Risk	RME Evaluation: Noncarcinogenic >PRG (nc)	RME Evaluation: Noncarcinogenic HQ[f]	RME Evaluation: Noncarcinogenic % Contribution to HI	CTE Evaulation: Carcinogenic >PRG (ca)	CTE Evaulation: Carcinogenic Excess Cancer Risk[g]	CTE Evaulation: Carcinogenic % Contribution to Risk	CTE Evaulation: Noncarcinogenic >PRG (nc)	CTE Evaulation: Noncarcinogenic HQ[h]	CTE Evaulation: Noncarcinogenic % Contribution to HI
Total Petroleum Hydrocarbons (mg/L) by Method 8015B DRO																								
Motor Oils	15	91	16%	3.70E-01	6.41E-02	6.41E-02	---	---	---	---	---[i]	---[i]	---	---[i]	---[i]	---	---[i]	---[i]	---	---[i]	---[i]	---	---[i]	---[i]
PHC as Diesel Fuel	20	111	18%	1.30E+00	1.95E-01	1.95E-01	---	---	---	---	---[i]	---[i]	---	---[i]	---[i]	---	---[i]	---[i]	---	---[i]	---[i]	---	---[i]	---[i]
PHC as Gasoline	22	111	20%	5.00E-02	1.53E-01	5.00E-02	---	---	---	---	---[i]	---[i]	---	---[i]	---[i]	---	---[i]	---[i]	---	---[i]	---[i]	---	---[i]	---[i]
Volatile Organic Chemicals (ug/L) by Method 8260B																								
4-Methyl-2-Pentanone	3	111	3%	1.35E+01	--	1.35E+01	---	2.00E+03	---	3.46E+03	---	No	---	---	---	No	6.75E-03	0%	---	---	---	No	3.90E-03	0%
Chloroform	2	111	2%	9.50E-01	--	9.50E-01	2.49E+00	1.55E+02	1.30E+01	4.32E+02	No	No	No	3.82E-07	0%	No	6.12E-03	0%	No	7.29E-08	0%	No	2.20E-03	0%
Methyl ethyl ketone	1	111	1%	1.00E+00	--	1.00E+00	---	7.00E+03	---	2.54E+04	---	No	---	---	---	No	1.43E-04	0%	---	---	---	No	3.93E-05	0%
Methyl Tert-Butyl Ether	1	111	1%	2.55E+00	--	2.55E+00	6.23E+00	5.21E+03	2.51E+01	3.96E+03	No	No	No	4.10E-07	0%	No	4.89E-04	0%	No	1.02E-07	0%	No	6.44E-04	0%
Methylene chloride	2	111	2%	6.60E-01	--	6.60E-01	5.62E+00	9.06E+02	2.94E+01	2.53E+03	No	No	No	1.17E-07	0%	No	7.29E-04	0%	No	2.24E-08	0%	No	2.61E-04	0%
Semivolatile Organic Chemicals (ug/L) by Method 8270C																								
4-Methylphenol	1	103	1%	6.00E+00	--	6.00E+00	---	1.80E+02	---	2.17E+02	---	No	---	---	---	No	3.33E-02	0%	---	---	---	No	2.76E-02	0%
Bis(2-chloroethoxy)Methane	1	103	1%	2.00E+00	--	2.00E+00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Bis(2-Ethylhexyl)Phthalate	4	103	4%	3.90E+00	--	3.90E+00	2.66E+01	3.13E+02	1.39E+02	8.69E+02	No	No	No	1.47E-07	0%	No	1.25E-02	0%	No	2.80E-08	0%	No	4.49E-03	0%
Butyl Benzyl Phthalate	1	103	1%	7.00E-01	--	7.00E-01	---	7.30E+03	---	8.69E+03	---	No	---	---	---	No	9.59E-05	0%	---	---	---	No	8.05E-05	0%
Diethyl Phthalate	2	103	2%	2.00E+00	--	2.00E+00	---	2.90E+04	---	3.48E+04	---	No	---	---	---	No	6.90E-05	0%	---	---	---	No	5.75E-05	0%
Phenol	1	103	1%	1.20E+01	--	1.20E+01	---	4.69E+03	---	1.30E+04	---	No	---	---	---	No	2.56E-03	0%	---	---	---	No	9.21E-04	0%
Semivolatile Organics (8270C-SIM) (ug/L)																								
Acenaphthene	3	103	3%	1.55E+00	--	1.55E+00	---	3.65E+02	---	2.61E+03	---	No	---	---	---	No	4.25E-03	0%	---	---	---	No	5.95E-04	0%
Anthracene	2	103	2%	8.50E-02	--	8.50E-02	---	1.83E+03	---	1.30E+04	---	No	---	---	---	No	4.66E-05	0%	---	---	---	No	6.52E-06	0%
Benzo(g,h,I)Perylene	1	103	1%	4.00E-01	--	4.00E-01	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Fluoranthene	2	103	2%	8.50E-02	--	8.50E-02	---	1.46E+03	---	1.74E+03	---	No	---	---	---	No	5.82E-05	0%	---	---	---	No	4.89E-05	0%
Fluorene	1	103	1%	1.00E-01	--	1.00E-01	---	2.43E+02	---	1.74E+03	---	No	---	---	---	No	4.12E-04	0%	---	---	---	No	5.75E-05	0%
Naphthalene	1	103	1%	3.50E-02	--	3.50E-02	6.28E-01	2.04E+02	3.30E+00	6.00E+02	No	No	No	5.57E-08	0%	No	1.72E-04	0%	No	1.06E-08	0%	No	5.84E-05	0%
Phenanthrene	2	102	2%	1.00E-01	--	1.00E-01	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pyrene	1	103	1%	6.00E-02	--	6.00E-02	---	1.83E+02	---	1.30E+03	---	No	---	---	---	No	3.29E-04	0%	---	---	---	No	4.60E-05	0%
Benzo(a)pyrene Equivalent[m]	1	91	1%	5.98E-01	--	5.98E-01	6.65E-03	---	3.48E-02	---	Yes	---	Yes	8.99E-05	6%	---	---	---	Yes	1.72E-05	6%	---	---	---
Metals (ug/L) by Method 6010B																								
Aluminum	63	106	59%	1.70E+03	2.16E+02	2.16E+02	---	3.65E+04	---	4.35E+04	---	No	---	---	---	No	5.92E-03	0%	---	---	---	No	4.97E-03	0%
Antimony	17	114	15%	2.09E+01	1.24E+01	1.24E+01	---	1.46E+01	---	1.74E+01	---	Yes	---	---	---	No	8.49E-01	8%	---	---	---	No	7.13E-01	12%
Arsenic	46	114	40%	6.03E+01	1.10E+01	1.10E+01	8.45E-03	4.69E+00	4.42E-02	1.30E+01	Yes	Yes	Yes	1.30E-03	93%	Yes	2.34E+00	23%	Yes	2.49E-04	93%	No	8.44E-01	14%
Barium	104	114	91%	3.33E+02	6.17E+01	6.17E+01	---	2.55E+03	---	8.69E+03	---	No	---	---	---	No	2.41E-02	0%	---	---	---	No	7.10E-03	0%
Cadmium	4	114	4%	2.10E+00	--	2.10E+00	---	7.82E+00	---	2.17E+01	---	No	---	---	---	No	2.68E-01	3%	---	---	---	No	9.67E-02	2%
Chromium	73	114	64%	3.57E+02	4.04E+01	4.04E+01	---	4.69E+01	---	1.30E+02	---	Yes	---	---	---	No	8.61E-01	8%	---	---	---	No	3.10E-01	5%
Cobalt	8	114	7%	1.29E+01	--	1.29E+01	---	7.30E+02	---	8.69E+02	---	No	---	---	---	No	1.77E-02	0%	---	---	---	No	1.49E-02	0%
Copper	64	114	56%	4.72E+01	1.28E+01	1.28E+01	---	1.46E+03	---	1.74E+03	---	No	---	---	---	No	8.77E-03	0%	---	---	---	No	7.36E-03	0%
Iron	80	106	75%	6.95E+03	1.06E+03	1.06E+03	---	1.09E+04	---	1.30E+04	---	No	---	---	---	No	9.68E-02	1%	---	---	---	No	8.13E-02	1%
Lead	16	114	14%	7.75E+00	2.18E+00	2.18E+00	1.09E+01	---	5.65E+01	---	No	---	No	1.99E-07	0%	---	---	---	No	3.86E-08	0%	---	---	---
Manganese	96	114	84%	1.95E+03	3.72E+02	3.72E+02	---	3.75E+02	---	1.04E+03	---	Yes	---	---	---	No	9.91E-01	10%	---	---	---	No	3.57E-01	6%
Nickel	65	114	57%	1.05E+02	3.24E+01	3.24E+01	---	3.13E+02	---	8.69E+02	---	No	---	---	---	No	1.04E-01	1%	---	---	---	No	3.73E-02	1%
Selenium	67	114	59%	1.65E+02	2.90E+01	2.90E+01	---	1.82E+02	---	2.17E+02	---	No	---	---	---	No	1.59E-01	2%	---	---	---	No	1.33E-01	2%
Silver	17	114	15%	1.81E+01	5.41E+00	5.41E+00	---	1.82E+02	---	2.17E+02	---	No	---	---	---	No	2.96E-02	0%	---	---	---	No	2.49E-02	0%
Thallium	9	114	8%	7.80E+00	--	7.80E+00	---	2.41E+00	---	2.87E+00	---	Yes	---	---	---	Yes	3.24E+00	32%	---	---	---	Yes	2.72E+00	44%
Vanadium	92	114	81%	5.75E+01	2.81E+01	2.81E+01	---	3.60E+01	---	4.35E+01	---	Yes	---	---	---	No	7.81E-01	8%	---	---	---	No	6.47E-01	10%
Zinc	72	114	63%	2.05E+02	2.33E+01	2.33E+01	---	1.09E+04	---	1.30E+04			---	---	---	No	2.13E-03	0%	---	---	---	No	1.79E-03	0%
Hexavalent Chromium (ug/L) by Method 7199																						--	--	--
Hexavalent Chromium	6	13	46%	1.40E+01	--	1.40E+01	---	4.69E+01	---	1.30E+02	---	No	---	---	---	No	2.98E-01	3%	---	---	---	No	1.07E-01	2%
Mercury (ug/L) by Method 7470A																								
Mercury[k]	90	114	79%	1.20E+00	2.90E-01	2.90E-01	---	4.69E+00	---	1.30E+01	---	No	---	---	---	No	6.18E-02	1%	---	---	---	No	2.22E-02	0%
Other Inorganics (mg/L) by Method 300.0																								
Nitrate as N (Method 300.0)[L]	15	16	94%	9.91E+00	4.71E+00	4.71E+00	---	1.00E+01	---	6.95E+01	---	No	---	---	---	---	---	---	---	---	---	No	6.77E-08	0%
												Incremental Lifetime Cancer Risk/Hazard Index Including Background:		1E-03			1E+01			3E-04			6E+00	

NOTES:

--- = no data or not applicable
% = percent
ug/L = microgram per liter
mg/L = milligram per liter

ca = carcinogenic
nc = noncarcinogenic
HI = hazard index
PHC = petroleum hydrocarbon

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Maximum detection is the maximum detected concentration of an analyte in the medium.
[c] Reasonable maximum exposure (RME) EPC is the minimum of either the 95% upper confidence limit (UCL) of the arithmetic mean or the maximum EPC. The 95 UCL is determined using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects. CTE PRGs are calculated using CTE exposure factors in Region 9 PRG equations.
[e] Excess cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)
[f] Hazard quotient (HQ) = EPC / RME Noncarcinogenic PRG
[g] Excess cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)
[h] HQ = EPC / CTE Noncarcinogenic PRG
[i] According to the California Regional Water Quality Control Board (RWQCB 1996), the American Society for Testing and Materials (ASTM) standard for Risk Based Corrective Action (RBCA), ASTM E-1739-95 is recommended to perform a risk analysis at petroleum release sites. The ASTM methodology provides screening levels for PHC indicator chemicals. Therefore, the health risk for PHCs is assessed based on indicator chemicals (i.e., benzene, ethylbenzene, toluene, xylene, and polycyclic aromatic hydrocarbons).
[j] No tap water PRG is available for inorganic lead.
[k] PRG is for mercury chloride
[L] RME PRG for nitrate is provided for comparison purposes only and not included in risk calculations since the tap water PRG, taken from IRIS and equal to the maximum contaminant level of 10 mg/L, is based on exposure as an infant and not an adult like other noncarcinogenic tap water PRGs.
[m] The Benzo(a)pyrene equivalent concentration taken from Table E1-4.
Shading identifies COPCs with maximum EPCs above PRGs.

Table E1-12: Risk-Based Screening of Indoor Air from Groundwater for (Current/Future) Residential Receptor Using Cal-EPA Toxicity Information

							Preliminary Remedial Goals						RME Evaluation						CTE Evaluation					
							RME PRGs		CTE PRGs		Region 9 PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size	FOD	Maximum Detect in Groundwater (ug/L)[a]	Groundwater EPC (ug/L)[b]	Estimated Indoor Air Concentration (mg/m^3)	Carcinogenic PRG (mg/m^3)	Non-carcinogenic PRG (mg/m^3)	Carcinogenic PRG (mg/m^3)	Non-carcinogenic PRG (mg/m^3)	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[c]	% Contribution to Risk	>PRG (nc)	HQ[d]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI
Volatile Organic Chemicals (ug/L) by Method 8260B																								
4-Methyl-2-pentanone	3	111	3%	1.35E+01	1.35E+01	1.31E-05	--	3.14E+00	--	5.81E+00	--	No	--	--	--	No	4.18E-06	3%	--	--	--	No	2.26E-06	3%
Chloroform	2	111	2%	9.50E-01	9.50E-01	3.20E-05	3.54E-04	3.13E-01	1.33E-03	5.79E-01	No	No	No	9.05E-08	88%	No	1.02E-04	65%	No	2.40E-08	88%	No	5.53E-05	65%
Methyl ethyl ketone	1	111	1%	1.00E+00	1.00E+00	4.65E-07	--	5.11E+00	--	9.46E+00	--	No	--	--	--	No	9.10E-08	0%	--	--	--	No	4.91E-08	0%
Methyl tert-butyl ether	1	111	1%	2.55E+00	2.55E+00	1.47E-05	3.74E-03	3.13E+00	1.41E-02	5.79E+00	No	No	No	3.94E-09	4%	No	4.70E-06	3%	No	1.05E-09	4%	No	2.54E-06	3%
Methylene chloride	2	111	2%	6.60E-01	6.60E-01	1.31E-05	1.92E-03	4.16E-01	7.24E-03	7.71E-01	No	No	No	6.82E-09	7%	No	3.15E-05	20%	No	1.81E-09	7%	No	1.70E-05	20%
Semivolatile Organics (8270C-SIM) (ug/L)																								
Acenaphthene	3	103	3%	1.55E+00	1.55E+00	9.28E-07	--	2.19E-01	--	4.06E-01	--	No	--	--	--	No	4.24E-06	3%	--	--	--	No	2.29E-06	3%
Fluorene	1	103	1%	1.00E-01	1.00E-01	2.36E-08	--	1.46E-01	--	2.70E-01	--	No	--	--	--	No	1.62E-07	0%	--	--	--	No	8.72E-08	0%
Naphthalene	1	103	1%	3.50E-02	3.50E-02	8.73E-08	5.60E-05	9.38E-03	2.11E-04	1.74E-02	No	No	No	1.56E-09	2%	No	9.31E-06	6%	No	4.14E-10	2%	No	5.03E-06	6%
Pyrene	1	9	11%	9.60E-01	9.60E-01	2.03E-09	--	1.10E-01	--	2.03E-01	--	No	--	--	--	No	1.85E-08	0%	--	--	--	No	1.00E-08	0%
Cumulative Incremental Lifetime Cancer Risk/Hazard Index:														1E-07			2E-04			3E-08			8E-05	

Notes:
-- = no data or not applicable
% = percent
ca = carcinogenic
CTE = central tendency exposure
nc = noncarcinogenic
mg/m^3 = milligrams per kilogram
HI = hazard index
PRG = preliminary remediation goal
RME = reasonable maximum exposure
ug/kg = micrograms per kilogram

[a] Maximum detect is the maximum detected concentration of an analyte in the medium.
[b] EPC is the maximum detected concentration since there are too few number of detections (less than 11) to estimate a UCL of a mean concentration using ProUCL.
[c] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)
[d] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG
[e] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)
[f] HQ = EPC / CTE Noncarcinogic PRG

Table E1-13: Risk-Based Screening of Indoor Air from Groundwater for (Current/Future) Industrial Receptor Using Cal-EPA Toxicity Information

							Preliminary Remedial Goals						RME Evaluation						CTE Evaluation					
							RME PRGs		CTE PRGs		Region 9 PRGs		Carcinogenic			Noncarcinogenic			Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size	FOD	Maximum Detect in Groundwater (ug/L)[a]	Groundwater EPC (ug/L)[b]	Estimated Indoor Air Concentration (mg/m^3)	Carcinogenic PRG (mg/m^3)	Non-carcinogenic PRG (mg/m^3)	Carcinogenic PRG (mg/m^3)	Non-carcinogenic PRG (mg/m^3)	>PRG (ca)	>PRG (nc)	>PRG (ca)	Incremental Cancer Risk[c]	% Contribution to Risk	>PRG (nc)	HQ[d]	% Contribution to HI	>PRG (ca)	Incremental Cancer Risk[e]	% Contribution to Risk	>PRG (nc)	HQ[f]	% Contribution to HI
Volatile Organic Chemicals (ug/L) by Method 8260B																								
4-Methyl-2-pentanone	3	111	3%	1.35E+01	1.35E+01	6.56E-06	--	4.39E+00	--	6.91E+00	--	No	--	--	--	No	1.49E-06	3%	--	--	--	No	9.50E-07	3%
Chloroform	2	111	2%	9.50E-01	9.50E-01	1.60E-05	7.53E-04	4.38E-01	4.49E-03	6.89E-01	No	No	No	2.12E-08	88%	No	3.65E-05	65%	No	3.57E-09	88%	No	2.32E-05	65%
Methyl ethyl ketone	1	111	1%	1.00E+00	1.00E+00	2.33E-07	--	7.15E+00	--	1.12E+01	--	No	--	--	--	No	3.25E-08	0%	--	--	--	No	2.07E-08	0%
Methyl tert-butyl ether	1	111	1%	2.55E+00	2.55E+00	7.35E-06	7.95E-03	4.38E+00	4.73E-02	6.89E+00	No	No	No	9.25E-10	4%	No	1.68E-06	3%	No	1.55E-10	4%	No	1.07E-06	3%
Methylene chloride	2	111	2%	6.60E-01	6.60E-01	6.55E-06	4.09E-03	5.83E-01	2.43E-02	9.16E-01	No	No	No	1.60E-09	7%	No	1.12E-05	20%	No	2.69E-10	7%	No	7.15E-06	20%
Semivolatile Organics (8270C-SIM) (ug/L)																								
Acenaphthene	3	103	3%	1.55E+00	1.55E+00	4.64E-07	--	3.07E-01	--	4.82E-01	--	No	--	--	--	No	1.51E-06	3%	--	--	--	No	9.62E-07	3%
Fluorene	1	103	1%	1.00E-01	1.00E-01	1.18E-08	--	2.04E-01	--	3.21E-01	--	No	--	--	--	No	5.77E-08	0%	--	--	--	No	3.67E-08	0%
Naphthalene	1	103	1%	3.50E-02	3.50E-02	4.37E-08	1.19E-04	1.31E-02	7.10E-04	2.06E-02	No	No	No	3.66E-10	2%	No	3.32E-06	6%	No	6.15E-11	2%	No	2.11E-06	6%
Pyrene	1	9	11%	9.60E-01	9.60E-01	1.01E-09	--	1.53E-01	--	2.41E-01	--	No	--	--	--	No	6.62E-09	0%	--	--	--	No	4.21E-09	0%
Cumulative Incremental Lifetime Cancer Risk/Hazard Index:														2E-08			6E-05			4E-09			4E-05	

Notes:
-- = no data or not applicable
% = percent
ca = carcinogenic
CTE = central tendency exposure
nc = noncarcinogenic
mg/m^3 = milligrams per kilogram
HI = hazard index
PRG = preliminary remediation goal
RME = reasonable maximum exposure
ug/kg = micrograms per kilogram

[a] Maximum detect is the maximum detected concentration of an analyte in the medium.
[b] EPC is the maximum detected concentration since there are too few number of detections (less than 11) to estimate a UCL of a mean concentration using ProUCL.
[c] Incremental cancer risk = 1E-06 x (EPC / RME Carcinogenic PRG)
[d] Hazard Quotient (HQ) = EPC / RME Noncarcinogenic PRG
[e] Incremental cancer risk = 1E-06 x (EPC / CTE Carcinogenic PRG)
[f] HQ = EPC / CTE Noncarcinogic PRG

Table E1-14: Toxicity Values Used in Estimating Site-Specific PRGs Using Cal-EPA Toxicity Information

Chemical	SFo (mg/kg-d)	RfDo (1/(mg/kg-d))	SFi (mg/kg-d)	RfDi (1/(mg/kg-d))
Arsenic	9.45E+00	3.00E-04	1.20E+01	8.57E-06
Benzo(a)pyrene Equivalent	1.20E+01	--	3.90E+00	--
2,3,7,8-TCDD TEQ	1.30E+05	--	1.30E+05	1.14E-08

NOTES:

Source: Highlighted values are from the California Office of Environmental Health Hazard Assessment. Otherwise, value is from PA Region 9 Preliminary Remediation Goals (PRG) Tables dated October 2004.

SFo = Oral slope factor

mg/kg-d = milligrams per kilograms per day

RfDo = Oral reference dose

SFi = Inhalation slope factor

RfDi = Inhalation reference dose

-- = Toxicity value not available

Table E1-15. Site-Specific Preliminary Remediation Goals Under the RME and CTE Scenarios Using Cal-EPA Toxicity Information

Reasonable Maximum Exposure (RME)

Chemical	Escorted Visitor			Construction/Utility Worker		Agricultural Worker		Recreational Visitor		
	RME PRGs			RME PRGs		RME PRGs		RME PRGs		
	Noncarcinogenic PRGs		Age-Adjusted Carcinogenic PRG	Noncarcinogen PRG	Carcinogenic PRG	Noncarcinoge PRG	Carcinogenic PRG	Noncarcinogenic PRGs		Age-Adjusted Carcinogenic PRG
	adult	juvenile						adult	juvenile	
Metals by Method 6010B (mg/kg)										
Arsenic	1.37E+03	6.99E+02	1.14E+00	8.51E+01	7.02E-01	1.35E+02	1.34E-01	4.46E+02	2.22E+02	4.09E-01
Semivolitile Organics (PAH-SIM) (mg/kg)										
Benzo(a)pyrene Equivalent	---	---	5.80E-01	---	4.33E-01	--	4.95E-02	---	---	2.39E-01
Dioxins and Furans (8290) (mg/kg)										
2,3,7,8-TCDD TEQ	1.28E+03	7.26E+02	8.32E-05	7.67E+01	5.10E-05	1.02E+02	9.71E-06	7.99E+02	7.65E+02	2.97E-05

Central Tendency Exposure (CTE)

Chemical	Escorted Visitor			Construction/Utility Worker		Agricultural Worker		Recreational Visitor		
	CTE PRGs			CTE PRGs		CTE PRGs		CTE PRGs		
	Noncarcinogenic PRGs		Age-Adjusted Carcinogenic PRG	Noncarcinogen PRG	Carcinogenic PRG	Noncarcinoge PRG	Carcinogenic PRG	Noncarcinogenic PRGs		Age-Adjusted Carcinogenic PRG
	adult	juvenile						adult	juvenile	
Metals by Method 6010B (mg/kg)										
Arsenic	2.39E+04	1.21E+04	3.33E+01	3.17E+02	1.57E+01	9.93E+02	3.72E+00	5.66E+03	2.93E+03	9.03E+00
Semivolitile Organics (PAH-SIM) (mg/kg)										
Benzo(a)pyrene Equivalent	---	---	1.70E+01	---	8.36E+00	--	1.80E+00	---	---	6.01E+00
Dioxins and Furans (8290) (mg/kg)										
2,3,7,8-TCDD TEQ	1.28E+04	1.04E+04	2.42E-03	1.47E+02	1.14E-03	4.65E+02	2.71E-04	9.58E+03	7.26E+03	6.57E-04

Notes:
CTE = central tendency exposure
RME = reasonable maximum exposure
PRG = preliminary remediation goal
-- = PRG not available
CAS = Chemical Abstract Service
mg/kg = milligrams per kilogram
2,3,7,8-TCDD TEQ = dioxin toxicity equivalent quotient based on the toxicity of 2,3,7,8-tetrachlorodibeno-p-dioxin

Table E1-16: Site-Specific Risk-Based Evaluation of Surface Soil (0 - 1 ft bgs) for (Current/Future) Visitor (Adult/Juvenile) Receptor Using Cal-EPA Toxicity Information

								Preliminary Remediation Goals				Maximum Detect Evaluation		RME Evaluation						Background Comparison	CTE Evaluation					
								RME		CTE PRGs		Carcinogenic	Noncarcinogenic	Carcinogenic			Noncarcinogenic				Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect in Soil (mg/kg)[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG (mg/kg)[d]	Noncarcinogenic PRG (mg/kg)[d]	Carcinogenic PRG (mg/kg)[d]	Noncarcinogenic PRG (mg/kg)[d]	>PRG (ca)	>PRG (nc)	>PRG (ca)	Excess Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI	Max > Background?	>PRG (ca)	Excess Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI
Arsenic	33	33	100%	4.60E+00	3.16E+00	3.16E+00	6.86E+00	1.14E+00	6.99E+02	3.33E+01	1.21E+04	Yes	No	Yes	2.76E-06	51%	No	4.52E-03	100%	No	No	9.48E-08	51%	No	2.60E-04	100%
Benzo(a)pyrene Equivalent	7	33	21%	1.42E+00	--	1.48E+00	--	5.80E-01	--	1.70E+01	--	Yes	--	Yes	2.55E-06	47%	--	--	--	--	No	8.71E-08	47%	--	--	--
2,3,7,8-TCDD TEQ	9	9	100%	1.25E-05	--	1.25E-05	--	8.32E-05	7.26E+02	2.42E-03	1.04E+04	No	No	No	1.51E-07	3%	No	1.73E-08	0%	--	No	5.17E-09	3%	No	1.20E-09	0%
Cumulative Excess Cancer Risk/Hazard Index Including Background:															**5E-06**			**5E-03**				**2E-07**			**3E-04**	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:															**3E-06**			**2E-08**				**9E-08**			**1E-09**	

NOTES:

-- = no data or not applicable
% = percent
ca = carcinogenic
HI = hazard index
mg/kg = milligrams per kilogram
nc = noncarcinogenic
PRG = preliminary remediation goals
SSL = soil screening levels
EPC = exposure point concentration
HI = hazard index
HQ = hazard quotient
RME = reasonable maximum exposure

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Maximum EPC is the maximum detected concentration of an analyte.
[c] RME EPC is the minimum of either the 95% UCL of the arithmetic mean or the maximum EPC. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region 9 PRG table (EPA Region 9 2004). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachat
[f] Excess cancer risk = 1E-06 x (EPC / Carcinogenic PRG)
[g] HQ = EPC / Noncarcinogenic PRG
[h] The BaP equivalent concentration is from Table E1-1.

Shaded PRGs are based on toxicity values from the California Office of Environmental Health Hazard Assessment.
Bolded chemicals have maximum detected concentrations exceeding site-specific PRGs.

Table E1-17: Site-Specific Risk-Based Evaluation of Surface Soil (0 - 1 ft bgs) for (Future) Construction Worker Receptor Using Cal-EPA Toxicity Information

								Preliminary Remediation Goals				Maximum Detect Evaluation		RME Evaluation							CTE Evaulation					
								RME		CTE PRGs		Carcinogenic	Noncarcinogenic	Carcinogenic			Noncarcinogenic			Background Comparison	Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect in Soil (mg/kg)[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG (mg/kg)[d]	Noncarcinogenic PRG (mg/kg)[d]	Carcinogenic PRG (mg/kg)[d]	Noncarcinogenic PRG (mg/kg)[d]	>PRG (ca)	>PRG (nc)	>PRG (ca)	Excess Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI	Max > Background?	>PRG (ca)	Excess Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI
Arsenic	33	33	100%	4.60E+00	3.16E+00	3.16E+00	6.86E+00	7.02E-01	8.51E+01	1.57E+01	3.17E+02	Yes	No	Yes	4.50E-06	55%	No	3.71E-02	100%	No	No	2.01E-07	52%	No	9.96E-03	100%
Benzo(a)pyrene Equivalent	7	33	21%	1.42E+00	--	1.48E+00	--	4.33E-01	--	8.36E+00	--	Yes	--	Yes	3.42E-06	42%	--	--	--	--	No	1.77E-07	45%	--	--	--
2,3,7,8-TCDD TEQ	9	9	100%	1.25E-05	--	1.25E-05		5.10E-05	7.67E+01	1.14E-03	1.47E+02	No	No	No	2.46E-07	3%	No	1.64E-07	0%	--	No	1.10E-08	3%	No	8.50E-08	0%
Cumulative Excess Cancer Risk/Hazard Index Including Background:															**8E-06**			**4E-02**				**4E-07**			**1E-02**	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:															**4E-06**			**2E-07**				**2E-07**			**9E-08**	

NOTES:

-- = no data or not applicable
% = percent
ca = carcinogenic
HI = hazard index
mg/kg = milligrams per kilogram
nc = noncarcinogenic
PRG = preliminary remediation goals
SSL = soil screening levels
EPC = exposure point concentration
HI = hazard index
HQ = hazard quotient
RME = reasonable maximum exposure

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Maximum EPC is the maximum detected concentration of an analyte.
[c] RME EPC is the minimum of either the 95% UCL of the arithmetic mean or the maximum EPC. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region IX PRG table (EPA Region IX 2004). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachat
[f] Excess cancer risk = 1E-06 x (EPC / Carcinogenic PRG)
[g] HQ = EPC / Noncarcinogenic PRG
The BaP equivalent concentration is from Table E1-1.

Shaded PRGs are based on toxicity values from the California Office of Environmental Health Hazard Assessment.
Bolded chemicals have maximum detected concentrations exceeding site-specific PRGs.

Table E1-18: Site-Specific Risk-Based Evaluation of Subsurface Soil (0 - 10 ft bgs) for (Future) Construction Worker Receptor Using Cal-EPA Toxicity Information

								Preliminary Remediation Goals				Maximum Detect Evaluation		RME Evaluation						Background Comparison	CTE Evaluation					
								RME		CTE PRGs		Carcinogenic	Noncarcinogenic	Carcinogenic			Noncarcinogenic				Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect in Soil (mg/kg)[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG (mg/kg)[d]	Noncarcinogenic PRG (mg/kg)[d]	Carcinogenic PRG (mg/kg)[d]	Noncarcinogenic PRG (mg/kg)[d]	>PRG (ca)	>PRG (nc)	>PRG (ca)	Excess Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI	Max > Background?	>PRG (ca)	Excess Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI
Arsenic	42	42	100%	4.63E+00	3.20E+00	3.20E+00	6.86	7.02E-01	8.51E+01	1.57E+01	3.17E+02	Yes	No	Yes	4.56E-06	53%	No	3.75E-02	100%	No	No	2.03E-07	50%	No	1.01E-02	100%
Benzo(a)pyrene Equivalent	7	33	21%	1.42E+00	--	1.58E+00	--	4.33E-01	--	8.36E+00	--	Yes	--	Yes	3.65E-06	43%	--	--	--	--	No	1.89E-07	46%	--	--	--
2,3,7,8-TCDD TEQ	11	11	100%	1.29E-05	--[h]	1.87E-05	--	5.10E-05	7.67E+01	1.14E-03	1.47E+02	No	No	No	3.67E-07	4%	No	2.44E-07	0%	--	No	1.64E-08	4%	No	1.27E-07	0%
Cumulative Excess Cancer Risk/Hazard Index Including Background:															**9E-06**			**4E-02**				**4E-07**			**1E-02**	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:															**4E-06**			**2E-07**				**2E-07**			**1E-07**	

NOTES:

-- = no data or not applicable
% = percent
ca = carcinogenic
HI = hazard index
mg/kg = milligrams per kilogram
nc = noncarcinogenic
PRG = preliminary remediation goals
SSL = soil screening levels
EPC = exposure point concentration
HI = hazard index
HQ = hazard quotient
RME = reasonable maximum exposure

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Maximum EPC is the maximum detected concentration of an analyte.
[c] RME EPC is the minimum of either the 95% UCL of the arithmetic mean or the maximum EPC. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region IX PRG table (EPA Region IX 2004). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachat
[f] Excess cancer risk = 1E-06 x (EPC / Carcinogenic PRG)
[g] HQ = EPC / Noncarcinogenic PRG
[h] A 95UCL was not calculated as only 5 of the 25 detected congeners had 11 detections, and none of the 5 congeners contributed significantly to the TCDD TEQ.

Shaded PRGs are based on toxicity values from the California Office of Environmental Health Hazard Assessment.

Table E1-19: Site-Specific Risk-Based Evaluation of Surface Soil (0 - 1 ft bgs) for Future Agricultural Worker Receptor Using Cal-EPA Toxicity Information

								Preliminary Remediation Goals				Maximum Detect Evaluation		RME Evaluation						Background Comparison	CTE Evaluation					
								RME		CTE PRGs		Carcinogenic	Noncarcinogenic	Carcinogenic			Noncarcinogenic				Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect in Soil (mg/kg)[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG (mg/kg)[d]	Noncarcinogenic PRG (mg/kg)[d]	Carcinogenic PRG (mg/kg)[d]	Noncarcinogenic PRG (mg/kg)[d]	>PRG (ca)	>PRG (nc)	>PRG (ca)	Excess Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI	Max > Background?	>PRG (ca)	Excess Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI
Arsenic	33	33	100%	4.60E+00	3.16E+00	3.16E+00	6.86	1.34E-01	1.35E+02	3.72E+00	9.93E+02	Yes	No	Yes	2.36E-05	43%	No	2.34E-02	100%	No	No	8.48E-07	49%	No	3.18E-03	100%
Benzo(a)pyrene Equivalent	7	33	21%	1.42E+00	--	1.48E+00	--	4.95E-02	--	1.80E+00	--	Yes	--	Yes	2.99E-05	55%	--	--	--	--	No	8.21E-07	48%	--	--	--
2,3,7,8-TCDD TEQ	9	9	100%	1.25E-05	--	1.25E-05	--	9.71E-06	1.02E+02	2.71E-04	4.65E+02	Yes	No	Yes	1.29E-06	2%	No	1.23E-07	0%	--	No	4.63E-08	3%	No	2.70E-08	0%
Cumulative Excess Cancer Risk/Hazard Index Including Background:															**5E-05**			**2E-02**				**2E-06**			**3E-03**	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:															**3E-05**			**1E-07**				**9E-07**			**3E-08**	

NOTES:

-- = no data or not applicable
% = percent
ca = carcinogenic
HI = hazard index
mg/kg = milligrams per kilogram
nc = noncarcinogenic
PRG = preliminary remediation goals
EPC = exposure point concentration
HI = hazard index
HQ = hazard quotient
RME = reasonable maximum exposure

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Maximum EPC is the maximum detected concentration of an analyte.
[c] RME EPC is the minimum of either the 95% UCL of the arithmetic mean or the maximum EPC. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region IX PRG table (EPA Region IX 2004). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachat
[f] Excess cancer risk = 1E-06 x (EPC / Carcinogenic PRG)
[g] HQ = EPC / Noncarcinogenic PRG
[h] The BaP equivalent concentration is from Table E1-1.

Shaded PRGs are based on toxicity values from the California Office of Environmental Health Hazard Assessment.
Bolded chemicals have maximum detected concentrations exceeding site-specific PRGs.

Table E1-20: Site-Specific Risk-Based Evaluation of Subsurface Soil (0 - 10 ft bgs) for (Future) Agricultural Worker Receptor Using Cal-EPA Toxicity Information

								Preliminary Remediation Goals				Maximum Detect Evaluation		RME Evaluation						Background Comparison	CTE Evaluation					
								RME		CTE PRGs		Carcinogenic	Noncarcinogenic	Carcinogenic			Noncarcinogenic				Carcinogenic			Noncarcinogenic		
Chemical	Number of Detects	Sample Size[a]	FOD	Maximum Detect in Soil (mg/kg)[b]	95% UCL	EPC[c]	Background Concentration	Carcinogenic PRG (mg/kg)[d]	Noncarcinogenic PRG (mg/kg)[d]	Carcinogenic PRG (mg/kg)[d]	Noncarcinogenic PRG (mg/kg)[d]	>PRG (ca)	>PRG (nc)	>PRG (ca)	Excess Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI	Max > Background?	>PRG (ca)	Excess Cancer Risk[f]	% Contribution to Risk	>PRG (nc)	HQ[g]	% Contribution to HI
Arsenic	42	42	100%	4.63E+00	3.20E+00	3.20E+00	6.86	1.34E-01	1.35E+02	3.72E+00	9.93E+02	Yes	No	Yes	2.39E-05	41%	No	2.37E-02	100%	No	No	8.58E-07	48%	No	3.22E-03	100%
Benzo(a)pyrene Equivalent	7	33	21%	1.42E+00	--	1.58E+00	--	4.95E-02	--	1.80E+00	--	Yes	--	Yes	3.19E-05	55%	--	--	--	--	No	8.76E-07	49%	--	--	--
2,3,7,8-TCDD TEQ	11	11	100%	1.29E-05	--[h]	1.87E-05	--	9.71E-06	1.02E+02	2.71E-04	4.65E+02	Yes	No	Yes	1.93E-06	3%	No	1.83E-07	0%	--	No	6.91E-08	4%	No	4.02E-08	0%
Cumulative Excess Cancer Risk/Hazard Index Including Background:															**6E-05**			**2E-02**				**2E-06**			**3E-03**	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:															**3E-05**			**2E-07**				**9E-07**			**4E-08**	

NOTES:

-- = no data or not applicable
% = percent
ca = carcinogenic
HI = hazard index
mg/kg = milligrams per kilogram
nc = noncarcinogenic
PRG = preliminary remediation goals
SSL = soil screening levels
EPC = exposure point concentration
HI = hazard index
HQ = hazard quotient
RME = reasonable maximum exposure

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Maximum EPC is the maximum detected concentration of an analyte.
[c] RME EPC is the minimum of either the 95% UCL of the arithmetic mean or the maximum EPC. The 95% UCL is calculated using ProUCL.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region IX PRG table (EPA Region IX 2004). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachat
[f] Excess cancer risk = 1E-06 x (EPC / Carcinogenic PRG)
[g] HQ = EPC / Noncarcinogenic PRG
[h] A 95UCL was not calculated as only 5 of the 25 detected congeners had 11 detections, and none of the 5 congeners contributed significantly to the TCDD TEQ.

Shaded PRGs are based on toxicity values from the California Office of Environmental Health Hazard Assessment.
Bolded chemicals have maximum detected concentrations exceeding site-specific PRGs.

Table E1-21: Site-Specific Risk-Based Evaluation of Surface Soil (0 - 1 ft bgs) for (Future) Adult/Juvenile Recreational Receptor Using Cal-EPA Toxicity Information

Chemical	Number of Detects	Sample Size[a]	Frequency of Detection	Maximum Detect in Soil (mg/kg)[b]	95% UCL of Arithmetic Mean (mg/kg)	EPC (mg/kg)[c]	Background Concentration (mg/kg)	Preliminary Remediation Goals: RME Carcinogenic PRG (mg/kg)[d]	Preliminary Remediation Goals: RME Noncarcinogenic PRG (mg/kg)[d]	Preliminary Remediation Goals: CTE PRGs Carcinogenic PRG (mg/kg)[d]	Preliminary Remediation Goals: CTE PRGs Noncarcinogenic PRG (mg/kg)[d]	Maximum Detect Evaluation: Carcinogenic >PRG (ca)	Maximum Detect Evaluation: Noncarcinogenic >PRG (nc)	RME Evaluation: Carcinogenic >PRG (ca)	RME Evaluation: Carcinogenic Excess Cancer Risk[f]	RME Evaluation: Carcinogenic % Contribution to Risk	RME Evaluation: Noncarcinogenic >PRG (nc)	RME Evaluation: Noncarcinogenic HQ[g]	RME Evaluation: Noncarcinogenic % Contribution to HI	Background Comparison: Max > Background?	CTE Evaluation: Carcinogenic >PRG (ca)	CTE Evaluation: Carcinogenic Excess Cancer Risk[f]	CTE Evaluation: Carcinogenic % Contribution to Risk	CTE Evaluation: Noncarcinogenic >PRG (nc)	CTE Evaluation: Noncarcinogenic HQ[g]	CTE Evaluation: Noncarcinogenic % Contribution to HI
Arsenic	33	33	100%	4.60E+00	3.16E+00	3.16E+00	6.86	4.09E-01	2.22E+02	9.03E+00	2.93E+03	Yes	No	Yes	7.72E-06	54%	No	1.42E-02	100%	No	No	3.50E-07	57%	No	1.08E-03	100%
Benzo(a)pyrene Equivalent	7	33	21%	1.42E+00	--	1.48E+00	--	2.39E-01	--	6.01E+00	--	Yes	--	Yes	6.20E-06	43%	--	--	--	--	No	2.46E-07	40%	--	--	--
2,3,7,8-TCDD TEQ	9	9	100%	1.25E-05	--	1.25E-05	--	2.97E-05	7.65E+02	6.57E-04	7.26E+03	No	No	No	4.21E-07	3%	No	1.64E-08	0%	--	No	1.91E-08	3%	No	1.73E-09	0%
Cumulative Excess Cancer Risk/Hazard Index Including Background:															**1E-05**			**1E-02**				**6E-07**			**1E-03**	
Cumulative Excess Cancer Risk/Hazard Index Excluding Background:															**7E-06**			**2E-08**				**3E-07**			**2E-09**	

NOTES:

-- = no data or not applicable
% = percent
ca = carcinogenic
HI = hazard index
mg/kg = milligrams per kilogram
nc = noncarcinogenic
PRG = preliminary remediation goals
SSL = soil screening levels
EPC = exposure point concentration
HI = hazard index
HQ = hazard quotient
RME = reasonable maximum exposure

[a] Sample size does not include field or laboratory quality control samples; field duplicate result is averaged with original sample result.
[b] Maximum EPC is the maximum detected concentration of an analyte.
[c] RME EPC is the minimum of either the 95% UCL of the arithmetic mean or the maximum EPC.
[d] PRGs are based on cancer risk or noncarcinogenic health effects, unless qualified with a "sat" (soil saturation concentration) or "max" (ceiling limit concentration). Excess cancer risks or HQs are not calculated for chemicals of potential concern with non-risk-based PRGs (sat or max), which are discussed qualitatively in the Uncertainty Section of the text.
[e] Soil screening levels (SSLs) for the protection of groundwater from EPA Region IX PRG table (EPA Region IX 2002). A dilution attenuation factor (DAF) of 1 assumes that no dilution occurs and the concentration in the receptor well equals the soil leachat
[f] Excess cancer risk = 1E-06 x (EPC / Carcinogenic PRG)
[g] HQ = EPC / Noncarcinogenic PRG
The BaP equivalent concentration is from Table E1-1.

Shaded PRGs are based on toxicity values from the California Office of Environmental Health Hazard Assessment.
Bolded chemicals have maximum detected concentrations exceeding site-specific PRGs.

Attachment E1-1 Summary

Medium	Chemical	Indoor Air Concentration (mg/m3)	
		residential	industrial
soil	acetone	2.02E-03	1.21E-03
	benzene	6.37E-06	3.18E-06
	hexachlorobenzene	1.47E-05	7.34E-06
	methylene chloride	1.86E-04	1.11E-04
	pyrene	2.18E-07	1.09E-07
groundwater	4-Methyl-2-pentanone	1.31E-05	6.56E-06
	Chloroform	3.20E-05	1.60E-05
	Methyl ethyl ketone	4.65E-07	2.33E-07
	Methyl tert-butyl ether	1.47E-05	7.35E-06
	Methylene chloride	1.31E-05	6.55E-06
	Acenaphthene	9.28E-07	4.64E-07
	Fluorene	2.36E-08	1.18E-08
	Naphthalene	8.73E-08	4.37E-08
	Pyrene	2.03E-09	1.01E-09

Attachment E1-1a. Johnson & Ettinger Residential Evaluation of Acetone in Soil

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
67641	1.00E+02	Acetone

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Totals must add up to value of L_t (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
22	15	121.92	701.04	121.92			S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
S	1.58	0.375	0.054	0.005										

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1

Used to calculate risk-based soil concentration.

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	106.92	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	4,000	1.00E+02	5.08E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	7.410	3.41E-05	1.41E-03	1.79E-04	2.00E-02	0.00E+00	0.00E+00	2.00E-02	106.92	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
2.88E-03	3.77E+03	0.10	9.95E+01	2.00E-02	4.00E+02	7.95E+53	NA	NA	3.00E+00	4.18E-08	7.39E+08	YES

Finite source indoor attenuation coefficient, <α> (unitless)	Mass limit bldg. conc., $C_{building}$ (µg/m^3)	Finite source bldg. conc., $C_{building}$ (µg/m^3)	Final finite source bldg. conc., $C_{building}$ (µg/m^3)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	2.02E+00	NA	2.02E+00	NA	3.5E-01

END

Attachment E1-1b. Johnson & Ettinger Residential Evaluation of Benzene in Soil

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES: x

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
71432	2.40E+00	Benzene

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Totals must add up to value of L_t (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
22	15	228.6	304.8	228.6			S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
S	1.58	0.375	0.054	0.005										

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1

Used to calculate risk-based soil concentration.

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	213.6	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	4.000	2.40E+00	5.08E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	7.998	4.83E-03	1.99E-01	1.79E-04	1.42E-02	0.00E+00	0.00E+00	1.42E-02	213.6	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, t_D (sec)	Exposure duration > time for source depletion (YES/NO)
2.95E-01	1.30E+03	0.10	9.99E+01	1.42E-02	4.00E+02	9.20E+75	NA	NA	1.71E+00	1.07E-07	6.32E+06	YES

Finite source indoor attenuation coefficient, α_{ss} (unitless)	Mass limit, bldg. conc., $C_{building}$ (µg/m^3)	Finite source bldg. conc., $C_{building}$ (µg/m^3)	Final finite source bldg. conc., $C_{building}$ (µg/m^3)	Unit risk factor, URF (µg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
NA	6.37E-03	NA	6.37E-03	7.8E-06	3.0E-02

END

Attachment E1-1c. Johnson & Ettinger Residential Evaluation of Hexachlorobenzene in Soil

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_B (µg/kg)	Chemical
118741	1.50E+02	Hexachlorobenzene

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Totals must add up to value of L_t (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (Enter value or 0) (cm)	ENTER Thickness of soil stratum C, h_C (Enter value or 0) (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
22	15	182.88	701.04	182.88			S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
S	1.58	0.375	0.054	0.005										

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1

Used to calculate risk-based soil concentration

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_B (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	167.88	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	4.000	1.50E+02	5.08E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	19.852	9.37E-04	3.87E-02	1.79E-04	8.76E-03	0.00E+00	0.00E+00	8.76E-03	167.88	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
2.75E+02	2.11E+01	0.10	9.95E+01	8.76E-03	4.00E+02	2.17E+123	NA	NA	1.56E+00	2.77E-11	3.46E+11	NO

Finite source indoor attenuation coefficient, α (unitless)	Mass limit bldg. conc., $C_{building}$ (µg/m^3)	Finite source bldg. conc., $C_{building}$ (µg/m^3)	Final finite source bldg. conc., $C_{building}$ (µg/m^3)	Unit risk factor, URF (µg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
6.99E-04	NA	1.47E-02	1.47E-02	4.6E-04	2.8E-03

END

Attachment E1-1d. Johnson & Ettinger Residential Evaluation of Methylene Chloride in Soil

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES: x

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_B (µg/kg)	Chemical
75092	9.20E+00	Methylene chloride

MORE

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination (enter value of 0 if value is unknown) L_b (cm)	ENTER Totals must add up to value of L_t (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
22	15	121.92	701.04	121.92			S		

MORE

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
S	1.58	0.375	0.054	0.005										

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1

Used to calculate risk-based soil concentration.

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm³/cm³)	Stratum B soil air-filled porosity, θ_a^B (cm³/cm³)	Stratum C soil air-filled porosity, θ_a^C (cm³/cm³)	Stratum A effective total fluid saturation, S_{te} (cm³/cm³)	Stratum A soil intrinsic permeability, k_i (cm²)	Stratum A soil relative air permeability, k_{rg} (cm²)	Stratum A soil effective vapor permeability, k_v (cm²)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_B (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm³/s)
9.46E+08	106.92	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	4.000	9.20E+00	5.08E+04

Area of enclosed space below grade, A_B (cm²)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m³/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm²/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm²/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm²/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm²/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	6.906	1.94E-03	8.01E-02	1.79E-04	1.63E-02	0.00E+00	0.00E+00	1.63E-02	106.92	15

Soil-water partition coefficient, K_d (cm³/g)	Source vapor conc., C_{source} (µg/m³)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm³/s)	Crack effective diffusion coefficient, D^{crack} (cm²/s)	Area of crack, A_{crack} (cm²)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m³)	Finite source β term (unitless)	Finite source ψ term (sec)$^{-1}$	Time for source depletion, τ_0 (sec)	Exposure duration > time for source depletion (YES/NO)
5.85E-02	6.77E+03	0.10	9.95E+01	1.63E-02	4.00E+02	1.54E+66	NA	NA	2.63E+00	6.65E-07	4.35E+07	YES

Finite source indoor attenuation coefficient, α_{ss} (unitless)	Mass limit bldg. conc., $C_{building}$ (µg/m³)	Finite source bldg. conc., $C_{building}$ (µg/m³)	Final finite source bldg. conc., $C_{building}$ (µg/m³)	Unit risk factor, URF (µg/m³)$^{-1}$	Reference conc., RfC (mg/m³)
NA	1.86E-01	NA	1.86E-01	4.7E-07	3.0E+00

END

Attachment E1-1e. Johnson & Ettinger Residential Evaluation of Pyrene in Soil

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [x]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
129000	9.60E+02	Pyrene

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Total's must add up to value of L_t (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (Enter value or 0) (cm)	ENTER Thickness of soil stratum C, h_C (Enter value or 0) (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
22	15	213.36	701.04	213.36			S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
S	1.58	0.375	0.054	0.005										

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1

Used to calculate risk-based soil concentration.

END

Exposure duration, τ (sec)	Source-building separation, LT (cm)	Stratum A soil air-filled porosity, $\theta_a A$ (cm3/cm3)	Stratum B soil air-filled porosity, $\theta_a B$ (cm3/cm3)	Stratum C soil air-filled porosity, $\theta_a X$ (cm3/cm3)	Stratum A effective total fluid saturation, Ste (cm3/cm3)	Stratum A soil intrinsic permeability, ki (cm2)	Stratum A soil relative air permeability, krg (cm2)	Stratum A soil effective vapor permeability, kv (cm2)	Floor-wall seam perimeter Xcrack (cm)	Initial soil concentration used, CR (mg/kg)	Bldg. ventilation rate, Qbuilding (cm3/s)
9.46E+08	198.36	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	4.000	9.60E+02	5.08E+04

Area of enclosed space below grade, AB (cm2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Zcrack (cm)	Enthalpy of vaporization at ave. soil temperature, ΔHvTΣ (cal/mol)	Henry's law constant at ave. soil temperature, HTS (atm-m3/mol)	Henry's law constant at ave. soil temperature, HTS (unitless)	Vapor viscosity at ave. soil temperature, µTΣ (g/cm-s)	Stratum A effective diffusion coefficient, DeffA (cm2/s)	Stratum B effective diffusion coefficient, DeffB (cm2/s)	Stratum C effective diffusion coefficient, DeffC (cm2/s)	Total overall effective diffusion coefficient, DeffT (cm2/s)	Diffusion path length, Ld (cm)	Convection path length, Lp (cm)
1.06E+06	3.77E-04	15	20.543	7.71E-05	3.18E-04	1.79E-04	4.41E-03	0.00E+00	0.00E+00	4.41E-03	198.36	15

Soil-water partition coefficient, Kd (cm3/g)	Source vapor conc., Csource (mg/m3)	Crack radius, rcrack (cm)	Average vapor flow rate into bldg., Qsoil (cm3/s)	Crack effective diffusion coefficient, Dcrack (cm2/s)	Area of crack, Acrack (cm2)	Exponent of equivalent foundation Peclet number, exp(Pef) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., Cbuilding (mg/m3)	Finite source β τ≤µ (unitless)	Finite source ψ τ≤µ (sec)-1	Time for source depletion, tλ (sec)	Exposure duration > time for source depletion (YES/NO)
5.25E+02	5.82E-01	0.10	9.95E+01	4.41E-03	4.00E+02	1.68E+245	NA	NA	1.24E+00	4.30E-14	1.41E+14	NO

Finite source indoor attenuation coefficient, <α> (unitless)	Mass limit bldg. conc., Cbuilding (mg/m3)	Finite source bldg. conc., Cbuilding (mg/m3)	Final finite source bldg. conc., Cbuilding (mg/m3)	Unit risk factor, URF (mg/m3)-1	Reference conc., RfC (mg/m3)
3.75E-04	NA	2.18E-04	2.18E-04	NA	1.1E-01

END

Attachment E1-1f. Johnson & Ettinger Industrial Evaluation of Acetone in Soil

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES x

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc. C_R (µg/kg)	Chemical
67641	1.00E+02	Acetone

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (cm)	ENTER Thickness of soil stratum C, h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
				Totals must add up to value of L_T (cell G28)					
22	15	121.92	701.04	121.92			S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
S	1.58	0.375	0.054	0.005							1.5	0.43		0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
				Used to calculate risk-based soil concentration							
7.88E+08	106.92	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	4.000	1.00E+02	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	7.410	3.41E-05	1.41E-03	1.79E-04	2.00E-02	0.00E+00	0.00E+00	2.00E-02	106.92	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
2.88E-03	3.77E+03	0.10	9.95E+01	2.00E-02	4.00E+02	7.95E+53	NA	NA	3.00E+00	4.18E-08	7.39E+08	YES

Finite source indoor attenuation coefficient, <α> (unitless)	Mass limit bldg. conc., $C_{building}$ (µg/m^3)	Finite source bldg. conc., $C_{building}$ (µg/m^3)	Final finite source bldg. conc., $C_{building}$ (µg/m^3)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.21E+00	NA	1.21E+00	NA	3.5E-01

END

Attachment E1-1g. Johnson & Ettinger Industrial Evaluation of Benzene in Soil

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES x

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_{sk} (µg/kg)	Chemical
71432	2.40E+00	Benzene

MORE

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination (enter value of 0 if value is unknown) L_b (cm)	ENTER Totals must add up to value of L_t (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
22	15	228.6	304.8	228.6			S		

MORE

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
S	1.58	0.375	0.054	0.005										

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1

END

Used to calculate risk-based soil concentration.

Exposure duration, τ (sec)	Source-building separation, LT (cm)	Stratum A soil air-filled porosity, $\theta_a A$ (cm3/cm3)	Stratum B soil air-filled porosity, $\theta_a B$ (cm3/cm3)	Stratum C soil air-filled porosity, $\theta_a X$ (cm3/cm3)	Stratum A effective total fluid saturation, Ste (cm3/cm3)	Stratum A soil intrinsic permeability, ki (cm2)	Stratum A soil relative air permeability, krg (cm2)	Stratum A soil effective vapor permeability, kv (cm2)	Floor-wall seam perimeter, Xcrack (cm)	Initial soil concentration used, CR (mg/kg)	Bldg. ventilation rate, Qbuilding (cm3/s)
9.46E+08	213.6	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	4.000	2.40E+00	1.02E+05

Area of enclosed space below grade, AB (cm2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Zcrack (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_v TS$ (cal/mol)	Henry's law constant at ave. soil temperature, HTS (atm-m3/mol)	Henry's law constant at ave. soil temperature, H'TS (unitless)	Vapor viscosity at ave. soil temperature, µTS (g/cm-s)	Stratum A effective diffusion coefficient, DeffA (cm2/s)	Stratum B effective diffusion coefficient, DeffB (cm2/s)	Stratum C effective diffusion coefficient, DeffC (cm2/s)	Total overall effective diffusion coefficient, DeffT (cm2/s)	Diffusion path length, Ld (cm)	Convection path length, Lp (cm)
1.06E+06	3.77E-04	15	7.998	4.83E-03	1.99E-01	1.79E-04	1.42E-02	0.00E+00	0.00E+00	1.42E-02	213.6	15

Soil-water partition coefficient, Kd (cm3/g)	Source vapor conc., Csource (mg/m3)	Crack radius, rcrack (cm)	Average vapor flow rate into bldg., Qsoil (cm3/s)	Crack effective diffusion coefficient, Dcrack (cm2/s)	Area of crack, Acrack (cm2)	Exponent of equivalent foundation Peclet number, exp(Pef) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., Cbuilding (mg/m3)	Finite source β τ_{exp} (unitless)	Finite source ψ τ_{exp} (sec)-1	Time for source depletion, τ_s (sec)	Exposure duration > time for source depletion (YES/NO)
2.95E-01	1.30E+03	0.10	9.95E+01	1.42E-02	4.00E+02	9.20E+75	NA	NA	1.71E+00	1.07E-07	6.32E+06	YES

Finite source indoor attenuation coefficient, <a> (unitless)	Mass limit bldg. conc., Cbuilding (mg/m3)	Finite source bldg. conc., Cbuilding (mg/m3)	Final finite source bldg. conc., Cbuilding (mg/m3)	Unit risk factor, URF (mg/m3)-1	Reference conc., RfC (mg/m3)
NA	3.18E-03	NA	3.18E-03	7.8E-06	3.0E-02

END

Attachment E1-1h. Johnson & Ettinger Industrial Evaluation of Hexachlorobenzene in Soil

SL-ADV
sion 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [x]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc. C_R (µg/kg)	Chemical
118741	1.50E+02	Hexachlorobenzene

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_1 (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_2 (cm)	ENTER Totals must add up to value of L_1 (cell G28) Thickness of soil stratum A h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
22	15	182.88	701.04	182.88			S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
S	1.58	0.375	0.054	0.005										

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1

Used to calculate risk-based soil concentration.

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	167.88	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	4.000	1.50E+02	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	19.852	9.37E-04	3.87E-02	1.79E-04	8.76E-03	0.00E+00	0.00E+00	8.76E-03	167.88	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)	Finite source β term (unitless)	Finite source ψ term (sec)$^{-1}$	Time for source depletion, τ_0 (sec)	Exposure duration > time for source depletion (YES/NO)
2.75E+02	2.11E+01	0.10	9.95E+01	8.76E-03	4.00E+02	2.17E+123	NA	NA	1.56E+00	2.77E-11	3.46E+11	NO

Finite source indoor attenuation coefficient, α_{ss} (unitless)	Mass limit bldg. conc., $C_{building}$ (µg/m^3)	Finite source bldg. conc., $C_{building}$ (µg/m^3)	Final finite source bldg. conc., $C_{building}$ (µg/m^3)	Unit risk factor, URF (µg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
3.48E-04	NA	7.34E-03	7.34E-03	4.6E-04	2.8E-03

END

Attachment E1-1i. Johnson & Ettinger Industrial Evaluation of Methylene Chloride in Soil

SL-ADV Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES X

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
75092	9.20E+00	Methylene chloride

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0, if value is unknown) L_b (cm)	ENTER Totals must add up to value of L_t (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
22	15	121.92	701.04	121.92			S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
S	1.58	0.375	0.054	0.005										

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1

Used to calculate risk-based soil concentration.

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm³/cm³)	Stratum B soil air-filled porosity, θ_a^B (cm³/cm³)	Stratum C soil air-filled porosity, θ_a^C (cm³/cm³)	Stratum A effective total fluid saturation, S_{te} (cm³/cm³)	Stratum A soil intrinsic permeability, k_i (cm²)	Stratum A soil relative air permeability, k_{rg} (cm²)	Stratum A soil effective vapor permeability, k_v (cm²)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg ventilation rate, $Q_{building}$ (cm³/s)
7.88E+08	106.92	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	4.000	9.20E+00	1.02E+05

Area of enclosed space below grade, A_B (cm²)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m³/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm²/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm²/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm²/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm²/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	6.906	1.94E-03	8.01E-02	1.79E-04	1.63E-02	0.00E+00	0.00E+00	1.63E-02	106.92	15

Soil-water partition coefficient, K_d (cm³/g)	Source vapor conc., C_{source} (µg/m³)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm³/s)	Crack effective diffusion coefficient, D^{crack} (cm²/s)	Area of crack, A_{crack} (cm²)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg conc., $C_{building}$ (µg/m³)	Finite source β term (unitless)	Finite source ψ term (sec)$^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
5.85E-02	6.77E+03	0.10	9.95E+01	1.63E-02	4.00E+02	1.54E+56	NA	NA	2.63E+00	6.65E-07	4.35E+07	YES

Finite source indoor attenuation coefficient, $\langle\alpha\rangle$ (unitless)	Mass limit bldg conc., $C_{building}$ (µg/m³)	Finite source bldg conc., $C_{building}$ (µg/m³)	Final finite source bldg conc., $C_{building}$ (µg/m³)	Unit risk factor, URF (µg/m³)$^{-1}$	Reference conc., RfC (mg/m³)
NA	1.11E-01	NA	1.11E-01	4.7E-07	3.0E+00

END

Attachment E1-1j. Johnson & Ettinger Industrial Evaluation of Pyrene in Soil

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [x]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_{si} (µg/kg)	Chemical
129000	9.60E+02	Pyrene

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Totals must add up to value of L_t (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (Enter value or 0) (cm)	ENTER Thickness of soil stratum C, h_C (Enter value or 0) (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
22	15	213.36	701.04	213.36			S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
S	1.58	0.375	0.054	0.005										

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1

END

Used to calculate risk-based soil concentration

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_w (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_{si} (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	198.36	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	4.000	9.60E+02	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	20.543	7.71E-05	3.18E-04	1.79E-04	4.41E-03	0.00E+00	0.00E+00	4.41E-03	198.36	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)	Finite source β term (unitless)	Finite source ψ term (sec^{-1})	Time for source depletion, τ_0 (sec)	Exposure duration > time for source depletion (YES/NO)
5.25E+02	5.82E-01	0.10	9.95E+01	4.41E-03	4.00E+02	1.68E+245	NA	NA	1.24E+00	4.30E-14	1.41E+14	NO

Finite source indoor attenuation coefficient, <α> (unitless)	Mass limit bldg. conc., $C_{building}$ (µg/m^3)	Finite source bldg. conc., $C_{building}$ (µg/m^3)	Final finite source bldg. conc., $C_{building}$ (µg/m^3)	Unit risk factor, URF (µg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
1.87E-04	NA	1.09E-04	1.09E-04	NA	1.1E-01

END

Attachment E1-1k. Johnson & Ettinger Residential Evaluation of Acenaphthylene in Groundwater

GW-ADV Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
83329	1.55E+00	Acenaphthene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
22	15	809.5	809.5	0	0	A	S	S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.58	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a\,cz}$ (cm^3/cm^3)
9.46E+08	794.5	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	17.05	0.375	0.122

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)
5.08E+04	1.06E+06	3.77E-04	15	15,976	1.18E-04	4.85E-03	1.79E-04	6.81E-03	0.00E+00	0.00E+00	3.86E-04

Convection path length, L_p (cm)	Source vapor conc., C_{source} (µg/m³)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m³)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m³)
15	7.52E+00	0.10	9.95E+01	6.81E-03	4.00E+02	5.87E+158	1.23E-04	9.28E-04	NA	2.1E-01

END

Attachment E1-1I. Johnson & Ettinger Residential Evaluation of Chloroform in Groundwater

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
67663	9.50E-01	Chloroform

MORE

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
22	15	809.5	809.5	0	0	A	S	S		

MORE

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.58	0.375	0.054								

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

MORE

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)
9.46E+08	794.5	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	17.05	0.375	0.122	0.253

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
5.08E+04	1.06E+06	3.77E-04	15	7,429	3.22E-03	1.33E-01	1.79E-04	1.68E-02	0.00E+00	0.00E+00	6.72E-04	1.11E-02

Convection path length, L_p (cm)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)	Unit risk factor, URF (µg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
15	1.26E+02	0.10	9.95E+01	1.68E-02	4.00E+02	1.89E+64	2.53E-04	3.20E-02	2.3E-05	NA

END

Attachment E1-1m. Johnson & Ettinger Residential Evaluation of Fluorene in Groundwater

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
86737	1.00E-01	Fluorene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (Enter value or 0) (cm)	ENTER Thickness of soil stratum C, h_C (Enter value or 0) (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
22	15	809.5	809.5	0	0	A	S	S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.58	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a\,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w\,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	794.5	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	17.05	0.375	0.122	0.253	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.08E+04	1.06E+06	3.77E-04	15	16,112	4.81E-05	1.99E-03	1.79E-04	5.87E-03	0.00E+00	0.00E+00	5.24E-04	4.82E-03	794.5

Convection path length, L_p (cm)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)	Unit risk factor, URF (µg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
15	1.99E-01	0.10	9.95E+01	5.87E-03	4.00E+02	1.26E+184	1.19E-04	2.36E-05	NA	1.4E-01

END

Attachment E1-1n. Johnson & Ettinger Residential Evaluation of MEK (2-butanone) in Groundwater

GW-ADV Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
78933	1.00E+00	Methylethylketone (2-butanone)

MORE

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
22	15	809.5	809.5	0	0	A	S	S		

MORE

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.58	0.375	0.054								

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

MORE

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1

Used to calculate risk-based groundwater concentration.

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	794.5	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	17.05	0.375	0.122	0.253	4.000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.08E+04	1.06E+06	3.77E-04	15	8.269	4.84E-05	2.00E-03	1.79E-04	1.31E-02	0.00E+00	0.00E+00	8.78E-04	1.01E-02	794.5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	2.00E+00	0.10	9.95E+01	1.31E-02	4.00E+02	5.25E+82	2.33E-04	4.65E-04	NA	5.0E+00

END

Attachment E1-1o. Johnson & Ettinger Residential Evaluation of Methylene Chloride in Groundwater

GW-ADV Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
75092	6.60E-01	Methylene chloride

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
			Totals must add up to value of L_{WT} (cell G28)							
22	15	809.5	809.5	0	0	A	S	S		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
S	1.58	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm³/cm³)	Stratum B soil air-filled porosity, θ_a^B (cm³/cm³)	Stratum C soil air-filled porosity, θ_a^C (cm³/cm³)	Stratum A effective total fluid saturation, S_{te} (cm³/cm³)	Stratum A soil intrinsic permeability, k_i (cm²)	Stratum A soil relative air permeability, k_{rg} (cm²)	Stratum A soil effective vapor permeability, k_v (cm²)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm³/cm³)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm³/cm³)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm³/cm³)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	794.5	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	17.05	0.375	0.122	0.253	4,000

Bldg. ventilation rate, $Q_{building}$ (cm³/s)	Area of enclosed space below grade, A_B (cm²)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m³/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm²/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm²/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm²/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm²/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm²/s)	Diffusion path length, L_d (cm)
5.08E+04	1.06E+06	3.77E-04	15	6,906	1.94E-03	8.01E-02	1.79E-04	1.63E-02	0.00E+00	0.00E+00	6.58E-04	1.08E-02	794.5

Convection path length, L_p (cm)	Source vapor conc., C_{source} (µg/m³)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm³/s)	Crack effective diffusion coefficient, D^{crack} (cm²/s)	Area of crack, A_{crack} (cm²)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m³)	Unit risk factor, URF (µg/m³)⁻¹	Reference conc., RfC (mg/m³)
15	5.29E+01	0.10	9.95E+01	1.63E-02	4.00E+02	1.54E+66	2.48E-04	1.31E-02	4.7E-07	3.0E+00

END

Attachment E1-1p. Johnson & Ettinger Residential Evaluation of MIBK (4-methyl-2-pentanone) in Groundwater

GW-ADV Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
108101	1.35E+01	Methylisobutylketone (4-methyl-2-pentanone)

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
22	15	809.5	809.5	0	0	A	S	S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.58	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a\,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w\,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	794.5	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	17.05	0.375	0.122	0.253	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.08E+04	1.06E+06	3.77E-04	15	9,700	1.17E-04	4.81E-03	1.79E-04	1.21E-02	0.00E+00	0.00E+00	5.99E-04	8.58E-03	794.5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	6.50E+01	0.10	9.95E+01	1.21E-02	4.00E+02	1.34E+89	2.02E-04	1.31E-02	NA	3.0E+00

END

Attachment E1-1q. Johnson & Ettinger Residential Evaluation of MTBE in Groundwater

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
1634044	2.55E+00	MTBE

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
22	15	809.5	809.5	0	0	A	S	S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.58	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	794.5	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	17.05	0.375	0.122	0.253	4.000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.08E+04	1.06E+06	3.77E-04	15	7,139	5.52E-04	2.28E-02	1.79E-04	1.66E-02	0.00E+00	0.00E+00	6.90E-04	1.11E-02	794.5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	5.81E+01	0.10	9.95E+01	1.66E-02	4.00E+02	1.91E+65	2.53E-04	1.47E-02	NA	3.0E+00

END

Attachment E1-1r. Johnson & Ettinger Residential Evaluation of Naphthalene in Groundwater

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_{W} (µg/L)	Chemical
91203	3.50E-02	Naphthalene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
22	15	809.5	809.5	0	0	A	S	S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.58	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	794.5	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	17.05	0.375	0.122	0.253	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.08E+04	1.06E+06	3.77E-04	15	12,789	3.87E-04	1.60E-02	1.79E-04	9.54E-03	0.00E+00	0.00E+00	4.12E-04	6.47E-03	794.5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	5.59E-01	0.10	9.95E+01	9.54E-03	4.00E+02	1.99E+113	1.56E-04	8.73E-05	NA	3.0E-03

END

Attachment E1-1s. Johnson & Ettinger Residential Evaluation of Pyrene in Groundwater

GW-ADV Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_{gw} (µg/L)	Chemical
129000	6.00E-02	Pyrene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
22	15	809.5	809.5	0	0	A	S	S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.58	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	794.5	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	17.05	0.375	0.122	0.253	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.08E+04	1.06E+06	3.77E-04	15	20,543	7.71E-06	3.18E-04	1.79E-04	4.41E-03	0.00E+00	0.00E+00	1.84E-03	4.28E-03	794.5

Convection path length, L_p (cm)	Source vapor conc., C_{source} (µg/m³)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m³)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m³)
15	1.91E-02	0.10	9.95E+01	4.41E-03	4.00E+02	1.68E+245	1.08E-04	2.03E-06	NA	1.1E-01

END

Attachment E1-1t. Johnson & Ettinger Industrial Evaluation of Acenaphthylene in Groundwater

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
83329	1.55E+00	Acenaphthene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
22	15	809.5	809.5	0	0	A	S	S		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
S	1.58	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\cdot s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, St_e (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	794.5	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	17.05	0.375	0.122	0.253	4.000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.02E+05	1.06E+06	3.77E-04	15	15,976	1.18E-04	4.85E-03	1.79E-04	6.81E-03	0.00E+00	0.00E+00	3.86E-04	5.02E-03	794.5

Convection path length, L_p (cm)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)	Unit risk factor, URF (µg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
15	7.52E+00	0.10	9.95E+01	6.81E-03	4.00E+02	5.87E+158	6.17E-05	4.64E-04	NA	2.1E-01

END

Attachment E1-1u. Johnson & Ettinger Industrial Evaluation of Chloroform in Groundwater

GW-ADV Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., $C_{w,i}$ (µg/L)	Chemical
67663	9.50E-01	Chloroform

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
			Totals must add up to value of L_{WT} (cell G28)							
22	15	809.5	809.5	0	0	A	S	S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
S	1.58	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm³/cm³)	Stratum B soil air-filled porosity, θ_a^B (cm³/cm³)	Stratum C soil air-filled porosity, θ_a^C (cm³/cm³)	Stratum A effective total fluid saturation, S_{te} (cm³/cm³)	Stratum A soil intrinsic permeability, k_i (cm²)	Stratum A soil relative air permeability, k_{rg} (cm²)	Stratum A soil effective vapor permeability, k_v (cm²)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm³/cm³)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm³/cm³)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm³/cm³)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	794.5	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	17.05	0.375	0.122	0.253	4.000

Bldg. ventilation rate, $Q_{building}$ (cm³/s)	Area of enclosed space below grade, A_B (cm²)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m³/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm²/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm²/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm²/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm²/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm²/s)	Diffusion path length, L_d (cm)
1.02E+05	1.06E+06	3.77E-04	15	7,429	3.22E-03	1.33E-01	1.79E-04	1.68E-02	0.00E+00	0.00E+00	6.72E-04	1.11E-02	794.5

Convection path length, L_p (cm)	Source vapor conc., C_{source} (µg/m³)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm³/s)	Crack effective diffusion coefficient, D^{crack} (cm²/s)	Area of crack, A_{crack} (cm²)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m³)	Unit risk factor, URF (µg/m³)⁻¹	Reference conc., RfC (mg/m³)
15	1.26E+02	0.10	9.95E+01	1.68E-02	4.00E+02	1.89E+64	1.27E-04	1.60E-02	2.3E-05	NA

END

Attachment E1-1v. Johnson & Ettinger Industrial Evaluation of Fluorene in Groundwater

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
86737	1.00E-01	Fluorene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
22	15	809.5	809.5	0	0	A	S	S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.58	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1

Used to calculate risk-based groundwater concentration.

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a\,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w\,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	794.5	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	17.05	0.375	0.122	0.253	4.000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.02E+05	1.06E+06	3.77E-04	15	16.112	4.81E-05	1.99E-03	1.79E-04	5.87E-03	0.00E+00	0.00E+00	5.24E-04	4.82E-03	794.5

Convection path length, L_p (cm)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)	Unit risk factor, URF (µg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
15	1.99E-01	0.10	9.95E+01	5.87E-03	4.00E+02	1.26E+184	5.94E-05	1.18E-05	NA	1.4E-01

END

Attachment E1-1w. Johnson & Ettinger Industrial Evaluation of MEK in Groundwater

GW-ADV Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
78933	1.00E+00	Methylethylketone (2-butanone)

MORE

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (Enter value or 0) (cm)	ENTER Thickness of soil stratum C, h_C (Enter value or 0) (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
22	15	809.5	809.5	0	0	A	S	S		

MORE

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.58	0.375	0.054								

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

MORE

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1

Used to calculate risk-based groundwater concentration.

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	794.5	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	17.05	0.375	0.122	0.253	4.000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.02E+05	1.06E+06	3.77E-04	15	8.269	4.84E-05	2.00E-03	1.79E-04	1.31E-02	0.00E+00	0.00E+00	8.78E-04	1.01E-02	794.5

Convection path length, L_p (cm)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)	Unit risk factor, URF (µg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
15	2.00E+00	0.10	9.95E+01	1.31E-02	4.00E+02	5.25E+82	1.16E-04	2.33E-04	NA	5.0E+00

END

Attachment E1-1x. Johnson & Ettinger Industrial Evaluation of Methylene Chloride in Groundwater

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
75092	6.60E-01	Methylene chloride

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
22	15	809.5	809.5	0	0	A	S	S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.58	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	794.5	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	17.05	0.375	0.122	0.253	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.02E+05	1.06E+06	3.77E-04	15	6,906	1.94E-03	8.01E-02	1.79E-04	1.63E-02	0.00E+00	0.00E+00	6.58E-04	1.08E-02	794.5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	5.29E+01	0.10	9.95E+01	1.63E-02	4.00E+02	1.54E+66	1.24E-04	6.55E-03	4.7E-07	3.0E+00

END

Attachment E1-1y. Johnson & Ettinger Industrial Evaluation of MIBK in Groundwater

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
108101	1.35E+01	Methylisobutylketone (4-methyl-2-pentanone)

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
22	15	809.5	809.5	0	0	A	S	S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.58	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	794.5	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	17.05	0.375	0.122	0.253	4.000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.02E+05	1.06E+06	3.77E-04	15	9,700	1.17E-04	4.81E-03	1.79E-04	1.21E-02	0.00E+00	0.00E+00	5.99E-04	8.58E-03	794.5

Convection path length, L_p (cm)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)	Unit risk factor, URF (µg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
15	6.50E+01	0.10	9.95E+01	1.21E-02	4.00E+02	1.34E+89	1.01E-04	6.56E-03	NA	3.0E+00

END

Attachment E1-1z. Johnson & Ettinger Industrial Evaluation of MTBE in Groundwater

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_{gw} (µg/L)	Chemical
1634044	2.55E+00	MTBE

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
22	15	809.5	809.5	0	0	A	S	S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.58	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a\,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w\,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	794.5	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	17.05	0.375	0.122	0.253	4.000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.02E+05	1.06E+06	3.77E-04	15	7,139	5.52E-04	2.28E-02	1.79E-04	1.66E-02	0.00E+00	0.00E+00	6.90E-04	1.11E-02	794.5

Convection path length, L_p (cm)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)	Unit risk factor, URF (µg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
15	5.81E+01	0.10	9.95E+01	1.66E-02	4.00E+02	1.91E+65	1.27E-04	7.35E-03	NA	3.0E+00

END

Attachment E1-1aa. Johnson & Ettinger Industrial Evaluation of Naphthalene in Groundwater

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
91203	3.50E-02	Naphthalene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
			Totals must add up to value of L_{WT} (cell G28)							
22	15	809.5	809.5	0	0	A	S	S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
S	1.58	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	1	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm³/cm³)	Stratum B soil air-filled porosity, θ_a^B (cm³/cm³)	Stratum C soil air-filled porosity, θ_a^C (cm³/cm³)	Stratum A effective total fluid saturation, S_{te} (cm³/cm³)	Stratum A soil intrinsic permeability, k_i (cm²)	Stratum A soil relative air permeability, k_{rg} (cm²)	Stratum A soil effective vapor permeability, k_v (cm²)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm³/cm³)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm³/cm³)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm³/cm³)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	794.5	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	17.05	0.375	0.122	0.253	4,000

Bldg. ventilation rate, $Q_{building}$ (cm³/s)	Area of enclosed space below grade, A_B (cm²)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m³/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_a (cm²/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm²/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm²/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm²/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm²/s)	Diffusion path length, L_d (cm)
1.02E+05	1.06E+06	3.77E-04	15	12,789	3.87E-04	1.60E-02	1.79E-04	9.54E-03	0.00E+00	0.00E+00	4.12E-04	6.47E-03	794.5

Convection path length, L_p (cm)	Source vapor conc., C_{source} (µg/m³)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm³/s)	Crack effective diffusion coefficient, D^{crack} (cm²/s)	Area of crack, A_{crack} (cm²)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m³)	Unit risk factor, URF (µg/m³)⁻¹	Reference conc., RfC (mg/m³)
15	5.59E-01	0.10	9.95E+01	9.54E-03	4.00E+02	1.99E+113	7.81E-05	4.37E-05	NA	3.0E-03

END

Attachment E1-1bb. Johnson & Ettinger Industrial Evaluation of Pyrene in Groundwater

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
129000	6.00E-02	Pyrene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
22	15	809.5	809.5	0	0	A	S	S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.58	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.5	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	794.5	0.321	ERROR	ERROR	0.003	1.01E-07	0.998	1.01E-07	17.05	0.375	0.122	0.253	4.000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.02E+05	1.06E+06	3.77E-04	15	20,543	7.71E-06	3.18E-04	1.79E-04	4.41E-03	0.00E+00	0.00E+00	1.84E-03	4.28E-03	794.5

Convection path length, L_p (cm)	Source vapor conc., C_{source} (µg/m³)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m³)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.91E-02	0.10	9.95E+01	4.41E-03	4.00E+02	1.68E+245	5.31E-05	1.01E-06	NA	1.1E-01

END

Attachment E1-2. Development of Ambient Air PRGs for Industrial Receptor and for CTE Assumption

		TR	THQ	ATc	ATn	BWa	BWc	EF	ED	EDc	EDa	InhRa	InhRc	InhFadj
		(unitless)	(unitless)	(days)	(days)	(kg)		(days/year)	(years)			(m3/day)	(m3/day)	(m3-y/kg-d)
Residential	RME	1.0E-06	1	25550	10950	70	15	350	30	6	24	20	10	10.8571429
	CTE	1.0E-06	1	25550	3285	70	15	252	9	6	3	15	8.4	4.00285714
Industrial	RME	1.0E-06	1	25550	9125	70	--	250	25	--	--	20	--	--
	CTE	1.0E-06	1	25550	2409	70	--	212	6.6	--	--	15	--	--

	Toxicity Values		Ambient Air PRGs (mg/m3)							
	CSFi	RfDi	Residential				Industrial			
	$(mg/kg\text{-}d)^{-1}$	(mg/kg-d)	RME		CTE		RME		CTE	
EPA Region 9			cancer	noncancer	cancer	noncancer	cancer	noncancer	cancer	noncancer
Acenaphthene	--	6.00E-02	--	2.19E-01	--	4.06E-01	--	3.07E-01	--	4.82E-01
Acetone	--	9.00E-01	--	3.29E+00	--	6.08E+00	--	4.60E+00	--	7.23E+00
Benzene	2.70E-02	8.60E-03	2.49E-04	3.14E-02	9.38E-04	5.81E-02	5.30E-04	4.39E-02	3.16E-03	6.91E-02
Chloroform	8.10E-02	1.40E-02	8.30E-05	5.11E-02	3.13E-04	9.46E-02	1.77E-04	7.15E-02	1.05E-03	1.12E-01
Hexachlorobenzene	1.60E+00	8.00E-04	4.20E-06	2.92E-03	1.58E-05	5.41E-03	8.94E-06	4.09E-03	5.33E-05	6.43E-03
Fluorene	--	4.00E-02	--	1.46E-01	--	2.70E-01	--	2.04E-01	--	3.21E-01
4-Methyl-2-pentanone	--	8.60E-01	--	3.14E+00	--	5.81E+00	--	4.39E+00	--	6.91E+00
Methyl ethyl ketone	--	1.40E+00	--	5.11E+00	--	9.46E+00	--	7.15E+00	--	1.12E+01
Methyl tert-butyl ether	1.80E-03	8.57E-01	3.74E-03	3.13E+00	1.41E-02	5.79E+00	7.95E-03	4.38E+00	4.73E-02	6.89E+00
Methylene chloride	1.64E-03	8.57E-01	4.10E-03	3.13E+00	1.54E-02	5.79E+00	8.72E-03	4.38E+00	5.20E-02	6.89E+00
Naphthalene	--	8.60E-04	--	3.14E-03	--	5.81E-03	--	4.39E-03	--	6.91E-03
Pyrene	--	3.00E-02	--	1.10E-01	--	2.03E-01	--	1.53E-01	--	2.41E-01
Cal-Modified										
Acenaphthene	--	6.00E-02	--	2.19E-01	--	4.06E-01	--	3.07E-01	--	4.82E-01
Acetone	--	9.00E-01	--	3.29E+00	--	6.08E+00	--	4.60E+00	--	7.23E+00
Benzene	1.00E-01	1.71E-02	6.72E-05	6.24E-02	2.53E-04	1.16E-01	1.43E-04	8.74E-02	8.52E-04	1.37E-01
Chloroform	1.90E-02	8.57E-02	3.54E-04	3.13E-01	1.33E-03	5.79E-01	7.53E-04	4.38E-01	4.49E-03	6.89E-01
Hexachlorobenzene	1.80E+00	8.00E-04	3.74E-06	2.92E-03	1.41E-05	5.41E-03	7.95E-06	4.09E-03	4.73E-05	6.43E-03
Fluorene	--	4.00E-02	--	1.46E-01	--	2.70E-01	--	2.04E-01	--	3.21E-01
4-Methyl-2-pentanone	--	8.60E-01	--	3.14E+00	--	5.81E+00	--	4.39E+00	--	6.91E+00
Methyl ethyl ketone	--	1.40E+00	--	5.11E+00	--	9.46E+00	--	7.15E+00	--	1.12E+01
Methyl tert-butyl ether	1.80E-03	8.57E-01	3.74E-03	3.13E+00	1.41E-02	5.79E+00	7.95E-03	4.38E+00	4.73E-02	6.89E+00
Methylene chloride	3.50E-03	1.14E-01	1.92E-03	4.16E-01	7.24E-03	7.71E-01	4.09E-03	5.83E-01	2.43E-02	9.16E-01
Naphthalene	1.20E-01	2.57E-03	5.60E-05	9.38E-03	2.11E-04	1.74E-02	1.19E-04	1.31E-02	7.10E-04	2.06E-02
Pyrene	--	3.00E-02	--	1.10E-01	--	2.03E-01	--	1.53E-01	--	2.41E-01

Notes:

PRG = preliminary remediation goal
TR = target cancer risk
THQ = target hazard quotient
Atc = averaging time - carcinogens
Atn = averaging time - noncarcinogens
Bwa = body weight - adult
BWc = body weight - child
EF = exposure frequency
ED = exposure duration - total
EDc = exposure duration - child
EDa = exposure duration - adult
InhRa = inhalation rate - adult
InhRc = inhalation rate child
InhFadj = age-adjusted inhalation factor = (Eda x InhRc/BWc)+(Eda x InhRa/Bwa)

kg = kilograms
m3/day = cubic meters per day
m3-y/kg-d = cubic meter-years per kilogram-day

The daily inhalation rate was conservatively used for the industrial worker despite exposure time at the site of less than 24 hours per day.
For Methyl tert-butyl ether, EPA Region 9 uses use California-approved RfDi of 1.80E-03 mg/kg-day.

Table E1-3. Calculation of Exposed Skin Surface Area for Juvenile.

	Fraction of Total Body Surface Area (unitless)					Whole Body SA (m2)		Exposed SA (cm2)	
Age	Head	Forearms	Hands	Lower Legs	Total	male	female	male	female
6<7	0.131	0.059	0.0471	0.108	0.3451	0.866	0.843	2989	2909
7<8	0.12	0.0554	0.053	0.115	0.3434	0.936	0.917	3214	3149
8<9	0.12	0.0554	0.053	0.115	0.3434	1	1	3434	3434
9<10	0.12	0.0554	0.053	0.115	0.3434	1.07	1.06	3674	3640
10<11	0.0874	0.0617	0.0539	0.112	0.315	1.18	1.17	3717	3686
11<12	0.0874	0.0617	0.0539	0.112	0.315	1.23	1.3	3875	4095
12<13	0.0874	0.0617	0.0539	0.112	0.315	1.34	1.4	4221	4410
13<14	0.0997	0.0545	0.0511	0.128	0.3333	1.47	1.48	4900	4933
14<15	0.0796	0.059	0.0568	0.134	0.3294	1.61	1.55	5303	5106
15<16	0.0796	0.059	0.0568	0.134	0.3294	1.7	1.57	5600	5172
							6<16	4093	4053
							Average for juveniles (male and female)		**4073**

Reference: *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal* Risk Assessment), Exhibit C-1 (EPA 2004c).

Table E1-4. Calculation of Mean Juvenile Body Weight from 6 through 15 years of Age.

	Mean Body Weight (kg)
Age	Male and Female
6<7	21.3
7<8	25
8<9	27.4
9<10	31.8
10<11	35.2
11<12	40.6
12<13	47.2
13<14	53
14<15	56.9
15<16	59.6
Mean Juvenile Body Weight:	**39.8**

Reference: *Child-Specific Exposure Factors Handbook, Table 11-6 (EPA 2002a).*

Appendix E2
Screening Risk Assessment - Ecological

E2 Table 1-1. Comparison of Minimum Reporting Limit Range in Surface Soil to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Arithmetic Mean	95% UCL	RME	Soil Benchmark	Reference	Is Highest Value of Min Reporting Limit Range>Soil Benchmark?
Metals (mg/kg)												
Aluminum	33	33	100%		3570	15800	9138.79	9984	10200	50	2	
Antimony	1	38	3%	0.28 - 11.2	2.1	2.1	0.64	571	2.1	78	1	No
Arsenic	38	38	100%		1.6	4.63	2.93	3.14	3.17	10	2	
Barium	38	38	100%		50.9	187	97.65	104	105	330	1	
Beryllium	10	38	26%	0.03 - 0.49	0.09	0.31	0.13	0.191	0.191	40	1	No
Cadmium	33	38	87%	1.05 - 1.12	0.09	1	0.6	0.741	0.699	32	1	No
Calcium	33	33	100%		1590	25200	5236.52	8545	6050			
Chromium	38	38	100%		4.4	15.8	9.98	10.7	10.9	0.4	3	
Cobalt	38	38	100%		2.5	7.6	4.59	4.92	4.97	13	1	
Copper	38	38	100%		2.4	10.8	6.24	6.85	7.08	50	3	
Iron	33	33	100%		5880	19400	11592.27	12481	12600			
Lead	38	38	100%		1.6	20.7	7.07	8.48	8.89	110	1	
Magnesium	33	33	100%		1780	6900	4022.58	4373	4460			
Manganese	38	38	100%		104	289	185.67	196	198	500	2	
Mercury	33	38	87%	0.1 - 0.11	0.069	0.069	0.03	0.059	0.0354	0.1	2	Yes
Molybdenum	0	5	0%	2.1 - 2.24			1.09	1.11		2	2	Yes
Nickel	37	38	97%	2.14 - 2.14	4.4	13.7	7.18	7.81	8.28	30	2	No
Potassium	33	33	100%		1100	3970	2445.64	2644	2700			
Selenium	20	38	53%	0.62 - 1.12	0.27	1.1	0.49	0.743	0.543	1	2	Yes
Silver	1	38	3%	1 - 2.24	2	2	0.66	0.715	0.715	2	2	No
Sodium	0	33	0%	11.2 - 250			91.56	164		--		--
Thallium	0	38	0%	0.81 - 1.32			0.46	0.475		1	2	Yes
Vanadium	38	38	100%		13.5	44.1	26	27.8	28.1	2	2	
Zinc	38	38	100%		15.8	57.1	34.78	37.5	38.2	50	2	
Volatile Organics (ug/kg)												
1,1,1,2-Tetrachloroethane	0	33	0%	4.8 - 6.4			2.76	2.81		--		--
1,1,1-Trichloroethane	0	38	0%	4.8 - 16			2.99	3.15		--		--
1,1,2,2-Tetrachloroethane	0	38	0%	4.8 - 16			2.99	3.15		--		--
1,1,2-Trichloroethane	0	38	0%	4.8 - 16			2.99	3.15		--		--
1,1,2-Trichlorotrifluoroethane (Freon 113)	0	33	0%	4.8 - 6.4			2.76	2.81		--		--
1,1,-Dichloroethane	0	38	0%	4.8 - 16			2.99	3.15		--		--
1,1,-Dichloroethene	0	38	0%	4.8 - 16			2.99	3.15		--		--
1,2,3-Trichloropropane	0	33	0%	4.8 - 6.4			2.76	2.81		--		--
1,2-Dichloroethane	0	38	0%	4.8 - 16			2.99	3.15		--		--
1,2-Dichlorotetrafluoroethane (Freon 114)	0	33	0%	4.8 - 6.4			2.76	2.81		--		--
1,2-Dichlorpropane	0	38	0%	4.8 - 16			2.99	3.15		700000	3	No
2-Butanone (Methyl Ethyl Ketone, MEK)	0	38	0%	53 - 160			54.13	57.2		--		--
2-Chloroethyl vinyl ether	0	5	0%	53 - 160			47.4	92.5		--		--
2-Hexanone	0	38	0%	48 - 160			29.92	31.5		--		--
4-Methyl-2-pentanone (MIBK)	0	38	0%	53 - 160			29.92	31.5		--		--
Acetone	2	38	5%	53 - 160	46	100	56.12	59.2	59.2	--		--
Benzene	0	38	0%	4.8 - 16			3.02	3.2		--		--
Bromodichloromethane	0	38	0%	4.8 - 16			2.99	3.15		--		--

E2 Table 1-1. Comparison of Minimum Reporting Limit Range in Surface Soil to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Arithmetic Mean	95% UCL	RME	Soil Benchmark	Reference	Is Highest Value of Min Reporting Limit Range>Soil Benchmark?
Bromoform	0	38	0%	4.8 - 16			2.99	3.15		--		--
Bromomethane	0	38	0%	4.8 - 16			2.99	3.15		--		--
Carbon Disulfide	0	38	0%	4.8 - 16			2.99	3.15		--		--
Carbon Tetrachloride	0	38	0%	4.8 - 16			2.99	3.15		--		--
Chlorobenzene	0	38	0%	4.8 - 16			2.99	3.15		40000	3	No
Chloroethane	0	38	0%	4.8 - 16			2.99	3.15		--		--
Chloroform	0	38	0%	4.8 - 16			3.02	3.2		--		--
Chloromethane	0	38	0%	4.8 - 16			2.99	3.15		--		--
cis-1,2-Dichloroethene	0	38	0%	4.8 - 16			2.99	3.15		--		--
cis-1,3-Dichloropropene	0	38	0%	4.8 - 16			2.99	3.15		--		--
Dibromochloromethane	0	38	0%	4.8 - 16			2.99	3.15		--		--
Dichlorodifluoromethane (F12)	0	33	0%	4.8 - 6.4			2.76	2.81		--		--
Di-Isopropyl Ether (DIPE)	0	33	0%	4.8 - 6.4			2.76	2.81		--		--
Ethyl Benzene	0	38	0%	4.8 - 16			2.99	3.15		--		--
Ethyl Tertiary Butyl Ether	0	33	0%	4.8 - 6.4			2.76	2.81		--		--
Methyl tert-Butyl Ether (MTBE)	0	38	0%	4.8 - 32			3.56	3.86		--		--
Methylene Chloride	1	38	3%	4.8 - 16	9.2	9.2	3.16	3.39	3.39	--		--
Styrene	0	38	0%	4.8 - 16			3.02	3.2		300000	2	No
Tertiary Amyl Methyl Ether	0	33	0%	4.8 - 6.4			2.76	2.81		--		--
Tertiary Butyl Alcohol (TBA)	0	33	0%	19 - 26			11.07	11.3		--		--
Tetrachloroethene (PCE)	0	38	0%	4.8 - 16			2.99	3.15		--		--
Toluene	0	38	0%	4.8 - 16			2.99	3.15		200000	2	No
trans-1,2-Dichloroethene	0	38	0%	4.8 - 16			2.99	3.15		--		--
trans-1,3-dichloropropene	0	38	0%	4.8 - 16			2.99	3.15		--		--
Trichloroethene (TCE)	0	38	0%	4.8 - 16			2.99	3.15		--		--
Trichlorofluoromethane (Freon 11)	0	33	0%	4.8 - 6.4			2.76	2.81		--		--
Vinyl Acetate	0	5	0%	53 - 160			47.4	92.5		--		--
Vinyl Chloride	0	38	0%	4.8 - 16			2.99	3.15		--		--
Xylenes, Total	0	38	0%	5.3 - 19			7.87	8.53		--		--
Semivolatile Organics (ug/kg)												
1,2,4-Trichlorobenzene	0	38	0%	350 - 21000			571.19	500		20000	3	Yes
1,2-Dichlorobenzene	0	38	0%	350 - 21000			571.19	500		--		--
1,3-Dichlrobenzene	0	38	0%	350 - 21000			571.19	500		--		--
1,4-Dichlorobenzene	0	38	0%	350 - 21000			571.19	500		20000	3	Yes
2,2'-oxybis(1-Chloropropane)	0	33	0%	520 - 1200			306.35	324		--		--
2,4,5-Trichlorophenol	0	38	0%	520 - 52000			1018.69	695		4000	2	Yes
2,4,6-Trichlorophenol	0	38	0%	350 - 21000			571.19	500		10000	3	Yes
2,4-Dichlorophenol	0	38	0%	350 - 21000			571.19	500		--		--
2,4-Dimethylphenol	0	38	0%	350 - 21000			571.19	500		--		--
2,4-Dinitrotoluene	0	38	0%	350 - 21000			571.19	500		--		--
2,6-Dinitrotoluene	0	38	0%	350 - 21000			571.19	500		--		--
2,4-Dinitrophenol	0	38	0%	890 - 52000			2097.62	2140		20000	2	Yes
2-Chloronaphthalene	0	38	0%	350 - 21000			571.19	500		--		--
2-Chlorophenol	0	38	0%	350 - 21000			571.19	500		--		--

E2 Table 1-1. Comparison of Minimum Reporting Limit Range in Surface Soil to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Arithmetic Mean	95% UCL	RME	Soil Benchmark	Reference	Is Highest Value of Min Reporting Limit Range>Soil Benchmark?
2-Methyl-4,6-Dinitrophenol	0	33	0%	2600 - 5900			2097.62	2140		--		--
2-Methylphenol (o-Cresol)	0	38	0%	350 - 21000			571.19	500		--		--
2-Nitroaniline	0	38	0%	890 - 52000			2097.62	2140		--		--
2-Nitrophenol	0	38	0%	350 - 21000			571.19	500		--		--
3,3'-Dichlorobenzidine	0	38	0%	350 - 21000			840.6	856		--		--
3/4-Methylphenol (M/P-Cresol)	0	38	0%	350 - 21000			601.32	532		--		--
3-Nitroaniline	0	38	0%	890 - 52000			2097.62	2140		--		--
4-bromophenyl-phenylether	0	38	0%	350 - 21000			571.19	500		--		--
4-Chloro-3-Methylphenol	0	33	0%	520 - 1200			571.19	500		--		--
4-Chloroaniline	0	38	0%	350 - 21000			840.6	856		--		--
4-Chlorophenyl-phenyl ether	0	38	0%	350 - 21000			571.19	500		--		--
4-Methylphenol	0	38	0%	350 - 21000								
4-Nitroaniline	0	38	0%	890 - 52000			2097.62	2140		--		--
4-Nitrophenol	0	38	0%	890 - 52000			2097.62	2140		7000	3	Yes
Bis (2-chloroisopropyl)ether	0	38	0%	350 - 21000			2531	2290000		--		--
bis(2-Chloroethoxy) Methane	0	38	0%	350 - 21000			571.19	500		--		--
bis(2-Chloroethyl) Ether	0	38	0%	35 - 21000			366.73	221		--		--
bis(2-Ethylhexyl) Phthalate	3	38	8%	350 - 21000	51	70	62	87.9	70	--		--
Butylbenzylphthalate	0	38	0%	350 - 21000			571.19	500		--		--
Carbazole	0	33	0%	520 - 1200			306.35	324		10000	5	No
Dibenzofuran	0	38	0%	350 - 21000			571.19	500		19000	5	Yes
Diethylphthalate	2	38	5%	360 - 21000	96	225	167	1120	225	100000	2	No
Dimethylphthalate	0	38	0%	350 - 21000			571.19	500		200000	3	No
di-N-Butylphthalate	0	38	0%	350 - 21000			571.19	500		200000	2	No
di-N-Octylphthalate	0	38	0%	350 - 21000			571.19	500		--		--
Hexachlorbenzene	1	38	3%	35 - 21000	150	150	83.75		150	--		--
Hexachlorobutadiene	0	38	0%	350 - 21000			571.19	500		--		--
Hexachlorocyclopentadiene	0	38	0%	350 - 21000			1650.12	1980		10000	2	Yes
Hexachloroethane	0	38	0%	350 - 21000			571.19	500		--		--
Isophorone	0	33	0%	520 - 1200			306.35	324		--		--
Nitrobenzene	0	38	0%	350 - 21000			571.19	500		40000	3	No
N-Nitrosodi-N-Propylamine	0	38	0%	30 - 16000			228.82	75.1		--		--
N-Nitroso-Diphenylamine	0	38	0%	350 - 21000			1650.12	1980		20000	3	Yes
Pentachlorophenol	0	38	0%	180 - 21000			1210	1420		3000	2	Yes
Phenol	12	38	32%	350 - 21000	110	936	360.62	3485	419	30000	3	No
PAH SIM (ug/kg)												
2-Methylnapthalene	0	33	0%	25 - 51								
Acenaphthene	0	33	0%	25 - 51						20000	2	No
Acenapthylene	0	33	0%	25 - 51								
Anthracene	1	33	3%	25 - 32	44	44						
Benzo(a)Anthracene	7	33	21%	25 - 32	7	730				1200	4	No
Benzo(a)pyrene	4	33	12%	25 - 32	10	1030				1200	4	No
Benzo(b)Fluoranthene	5	33	15%	25 - 32	8	1790				1200	4	No
Benzo(g,h,I)Perylene	4	33	12%	25 - 32	7	440						

E2 Table 1-1. Comparison of Minimum Reporting Limit Range in Surface Soil to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Arithmetic Mean	95% UCL	RME	Soil Benchmark	Reference	Is Highest Value of Min Reporting Limit Range>Soil Benchmark?
Benzo(k)Fluoranthene	4	33	12%	25 - 32	7	510				1200	4	No
Chrysene	4	33	12%	25 - 32	8	870				1200	4	No
Dibenz(a,h)Anthracene	1	33	3%	25 - 32	97	97						
Fluoranthene	5	33	15%	25 - 32	8	1000				37000	5	No
Fluorene	0	33	0%	25 - 51						30000	3	No
indeno(1,2,3-c,d)Pyrene	2	33	6%	25 - 32	15	460				1200	4	No
Naphthalene	0	33	0%	25 - 51								
Phenanthrene	2	33	6%	25 - 32	9	290				23000	5	No
Pyrene	5	33	15%	25 - 32	11	960				10000	5	No
Dioxins (pg/g)												
Total 2,3,7,8-TCDD Bird	11	11	100%	-	0.01	35.3	3.81	126	35.3	500000	4	No
Total 2,3,7,8-TCDD Mammal	11	11	100%	-	0.05	18.4	2.21	9.99	9.99	500000	4	No
Petroleum Hydrocarbons (mg/kg)												
Gasoline	26	38	68%	9.5 - 30.1	0.02	2.78		16.7				
Diesel Fuel	17	38	45%	10 - 100	0.8	5600		1628				
Motor Oils	20	33	61%	10 - 13	3	160		43.9				
Miscellaneous (ug/kg)												
Perchlorate	0	2	0%	500 - 500			250			--		--

NOTES:
-- Screening value not available
mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram
pg/g = picograms per gram
(1) Direct contact Eco SSL (EPA, 2005).
(2) Plant screening value (Efroymson et al., 1997a).
(3) Soil invertebrate screening value (Efroymson et al., 1997b).
(4) EPA, 1999
(5) Sverdrup et al., 2001

E2 Table 1-2. Comparison of Minimum Reporting Limit Range in Sediment to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Soil Benchmark Values	Reference	Is Highest Value of Min Reporting Limit Range> Soil Benchmark?
Metals (mg/kg)									
Aluminum	4	4	100%		1750	3050	50	2	
Antimony	0	4	0%	3.3 - 3.6			78	1	No
Arsenic	3	4	75%	0.94 - 0.94	1.4	1.8	10	2	No
Barium	4	4	100%		25.6	110	330	1	
Beryllium	0	4	0%	0.22 - 0.24			40	1	No
Cadmium	2	4	50%	0.16 - 0.17	0.23	0.26	32	1	No
Calcium	4	4	100%		2620	4570			
Chromium	4	4	100%		2.5	4.4	0.4	3	
Cobalt	4	4	100%		1.2	2	13	1	
Copper	4	4	100%		1.3	2.5	50	3	
Iron	4	4	100%		2700	5050			
Lead	4	4	100%		1	1.9	110	1	No
Magnesium	4	4	100%		898	1610			
Manganese	4	4	100%		54.6	130	500	2	No
Mercury	1	4	25%	0.22 - 0.24	0.006	0.006	0.1	2	Yes
Nickel	4	4	100%		1.6	2.8	30	2	No
Potassium	4	4	100%		418	821			
Selenium	1	4	25%	0.33 - 0.36	0.17	0.17	1	2	No
Silver	0	4	0%	0.55 - 0.59			2	2	No
Sodium	2	4	50%	110 - 120	23.1	47.7	--		--
Thallium	0	4	0%	0.44 - 0.47			1	2	No
Vanadium	4	4	100%		7.5	13.9	2	2	
Zinc	4	4	100%		7.3	13.5	50	2	
Volatile Organics (ug/kg)									
1,1-Dichloroethane	0	4	0%	5.5 - 6.1			--		--
1,1-Dichloroethene	0	4	0%	5.5 - 6.1			--		--
1,1,1,2-Tetrachloroethane	0	4	0%	5.5 - 6.1			--		--
1,1,1-Trichloroethane	0	4	0%	5.5 - 6.1			--		--
1,1,2,2-Tetrachloroethane	0	4	0%	5.5 - 6.1			--		--
1,1,2-Trichloroethane	0	4	0%	5.5 - 6.1			--		--
1,1,2-Trichlorotrifluoroe	0	4	0%	5.5 - 6.1			--		--
1,2,3-Trichloropropane	0	4	0%	5.5 - 6.1			--		--

E2 Table 1-2. Comparison of Minimum Reporting Limit Range in Sediment to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Soil Benchmark Values	Reference	Is Highest Value of Min Reporting Limit Range> Soil Benchmark?
1,2-Dichloroethane	0	4	0%	5.5 - 6.1			--		--
1,2-Dichlorotetrafluoroethane (Freon 114)	0	4	0%	5.5 - 6.1			--		--
1,2-Dichlorpropane	0	4	0%	5.5 - 6.1			700000	3	No
2-Butanone (Methyl Ethyl Ketone, MEK)	0	4	0%	110 - 120			--		--
2-Hexanone	0	4	0%	55 - 61			--		--
4-Methyl-2-pentanone (MIBK)	0	4	0%	55 - 61			--		--
Acetone	0	4	0%	110 - 120			--		--
Benzene	0	4	0%	5.5 - 6.1			--		--
Bromodichloromethane	0	4	0%	5.5 - 6.1			--		--
Bromoform	0	4	0%	5.5 - 6.1			--		--
Bromomethane	0	4	0%	5.5 - 6.1			--		--
Carbon Disulfide	0	4	0%	5.5 - 6.1			--		--
Carbon Tetrachloride	0	4	0%	5.5 - 6.1			--		--
Chlorobenzene	0	4	0%	5.5 - 6.1			40000	3	No
Chloroethane	0	4	0%	5.5 - 6.1			--		--
Chloroform	0	4	0%	5.5 - 6.1			--		--
Chloromethane	0	4	0%	5.5 - 6.1			--		--
Cis-1,2-Dichloroethene	0	4	0%	5.5 - 6.1			--		--
Cis-1,3-Dichloropropene	0	4	0%	5.5 - 6.1			--		--
Di-Isopropyl Ether (DIPE)	0	4	0%	5.5 - 6.1			--		--
Dibromochloromethane	0	4	0%	5.5 - 6.1			--		--
Dichlorodifluoromethane (F12)	0	4	0%	5.5 - 6.1			--		--
Ethyl Benzene	0	4	0%	5.5 - 6.1			--		--
Ethyl Tertiary Butyl Ether	0	4	0%	5.5 - 6.1			--		--
Methyl tert-Butyl Ether (MTBE)	0	4	0%	5.5 - 6.1			--		--
Methylene Chloride	0	4	0%	5.5 - 6.1			--		--
Styrene	0	4	0%	5.5 - 6.1			300000	2	No
Tertiary Amyl Methyl Ether	0	4	0%	5.5 - 6.1			--		--
Tertiary Butyl Alcohol (TBA)	0	4	0%	22 - 24			--		--
Tetrachloroethene (PCE)	0	4	0%	5.5 - 6.1			--		--
Toluene	0	4	0%	5.5 - 6.1			200000	2	No
Trans-1,2-Dichloroethene	0	4	0%	5.5 - 6.1			--		--
Trans-1,3-dichloropropene	0	4	0%	5.5 - 6.1			--		--

E2 Table 1-2. Comparison of Minimum Reporting Limit Range in Sediment to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Soil Benchmark Values	Reference	Is Highest Value of Min Reporting Limit Range> Soil Benchmark?
Trichloroethene (TCE)	0	4	0%	5.5 - 6.1			--		--
Trichlorofluoromethane (Freon 11)	0	4	0%	5.5 - 6.1			--		--
Vinyl Chloride	0	4	0%	5.5 - 6.1			--		--
Xylenes, Total	0	4	0%	17 - 18			--		--
Semivolatile Organics (ug/kg)									
1,2,4-Trichlorobenzene	0	4	0%	550 - 590			20000	3	No
1,2-Dichlorobenzene	0	4	0%	550 - 590			--		--
1,3-Dichlrobenzene	0	4	0%	550 - 590			--		--
1,4-Dichlorobenzene	0	4	0%	550 - 590			20000	3	No
2,2'-oxybis(1-Chloropropane)	0	4	0%	550 - 590			--		
2,4,5-Trichlorophenol	0	4	0%	550 - 590			4000	2	No
2,4,6-Trichlorophenol	0	4	0%	550 - 590			10000	3	No
2,4-Dichlorophenol	0	4	0%	550 - 590			--		--
2,4-Dimethylphenol	0	4	0%	550 - 590			--		--
2,4-Dinitrotoluene	0	4	0%	550 - 590			--		--
2,6-Dinitrotoluene	0	4	0%	550 - 590			--		--
2-Chloronaphthalene	0	4	0%	550 - 590			--		--
2-Chlorophenol	0	4	0%	550 - 590			--		--
2-Methyl-4,6-Dinitrophenol	0	4	0%	2700 - 3000			--		--
2-Methylphenol (o-Cresol)	0	4	0%	550 - 590			--		--
2-Nitroaniline	0	4	0%	2700 - 3000			--		--
2-Nitrophenol	0	4	0%	550 - 590			--		--
2,4-Dinitrophenol	0	4	0%	2700 - 3000			20000	2	No
3,3'-Dichlorobenzene	0	4	0%	1100 - 1200			--		--
3-Nitroaniline	0	4	0%	2700 - 3000			--		--
3/4-Methylphenol (M/P-Cresol)	0	4	0%	550 - 590			--		--
4-bromophenyl-phenylether	0	4	0%	550 - 590			--		--
4-Chloro-3-Methylphenol	0	4	0%	550 - 590			--		--
4-Chloroaniline	0	4	0%	1100 - 1200			--		--
4-Chlorophenyl-phenyl ether	0	4	0%	550 - 590			--		--
4-Nitroaniline	0	4	0%	2700 - 3000			--		--
4-Nitrophenol	0	4	0%	2700 - 3000			7000	3	No
Bis(2-Chloroethoxy) Methane	0	4	0%	550 - 590			--		--

E2 Table 1-2. Comparison of Minimum Reporting Limit Range in Sediment to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Soil Benchmark Values	Reference	Is Highest Value of Min Reporting Limit Range> Soil Benchmark?
Bis(2-Chloroethyl) Ether	0	4	0%	180 - 190			--		--
Bis(2-Ethylhexyl) Phthalate	0	4	0%	550 - 590			--		--
Butylbenzylphthalate	0	4	0%	550 - 590			--		--
Carbazole	0	4	0%	550 - 590			10000	5	No
Di-N-Butylphthalate	0	4	0%	550 - 590			200000	2	No
Di-N-Octylphthalate	0	4	0%	550 - 590			--		--
Dibenzofuran	0	4	0%	550 - 590			19000	5	No
Diethylphthalate	0	4	0%	550 - 590			100000	2	No
Dimethylphthalate	0	4	0%	550 - 590			200000	3	No
Hexachlorbenzene	0	4	0%	550 - 590			--		--
Hexachlorobutadiene	0	4	0%	550 - 590			--		--
Hexachlorocyclopentadiene	0	4	0%	2700 - 3000			10000	2	No
Hexachloroethane	0	4	0%	550 - 590			--		--
Isophorone	0	4	0%	550 - 590			--		--
N-Nitroso-Diphenylamine	0	4	0%	2700 - 3000			20000	3	No
N-Nitrosodi-N-Propylamine	0	4	0%	43 - 46			--		--
Nitrobenzene	0	4	0%	550 - 590			40000	3	No
Pentachlorophenol	0	4	0%	1900 - 2000			3000	2	No
Phenol	0	4	0%	550 - 590			30000	3	No
PAH SIM (ug/kg)									
2-Methylnaphthalene	0	4	0%	27 - 30			--		--
Acenaphthene	0	4	0%	27 - 30			20000	2	No
Acenaphthylene	0	4	0%	27 - 30			--		--
Anthracene	0	4	0%	27 - 30			--		--
Benzo(a)Anthracene	0	4	0%	27 - 30			1200	4	No
Benzo(a)pyrene	0	4	0%	27 - 30			1200	4	No
Benzo(b)Fluoranthene	0	4	0%	27 - 30			1200	4	No
Benzo(g,h,I)Perylene	0	4	0%	27 - 30			--		--
Benzo(k)Fluoranthene	0	4	0%	27 - 30			1200	4	No
Chrysene	0	4	0%	27 - 30			1200	4	No
Dibenz(a,h)Anthracene	0	4	0%	27 - 30			--		--
Fluoranthene	0	4	0%	27 - 30			37000	5	No
Fluorene	0	4	0%	27 - 30			30000	3	No

E2 Table 1-2. Comparison of Minimum Reporting Limit Range in Sediment to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Soil Benchmark Values	Reference	Is Highest Value of Min Reporting Limit Range> Soil Benchmark?
Indeno(1,2,3-c,d)Pyrene	0	4	0%	27 - 30			1200	4	No
Naphthalene	0	4	0%	27 - 30			--		--
Phenanthrene	0	4	0%	27 - 30			23000	5	No
Pyrene	0	4	0%	27 - 30			1000	5	No
Petroleum Hydrocarbons (mg/kg)									
Gasoline	0	4	0%	11 - 14					
Diesel Fuels	0	4	0%	11 - 12					
Motor Oils	1	4	25%	11 - 11	20	20			

NOTES:

-- Screening value not available

mg/kg = milligrams per kilogram

ug/kg = micrograms per kilogram

(1) Direct contact Eco SSL (EPA, 2005).

E2 Table 1-3. Comparison of Minimum Reporting Limit Range in Surface Water to Ecological Screening Values for the Protection of Aquatic Life

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Cal. Toxics Rule Surface Water Benchmark (1)	Is Highest Value of Min Reporting Limit Range>ORNL Soil Benchmark?
Metals (ug/L)								
Aluminum	2	2	100%		86400	87500		
Antimony	0	2	0%	60 - 60			--	--
Arsenic	2	2	100%		33.8	34.2		
Barium	2	2	100%		867	871		
Berylium	2	2	100%		2.7	2.7		
Cadmium	2	2	100%		6	6.4		
Calcium	2	2	100%		109000	115000		
Chromium	2	2	100%		80.2	83.5		
Cobalt	2	2	100%		30.8	31.5		
Copper	0	2	0%	73 - 74.4			9	Yes
Iron	2	2	100%		70300	71900		
Lead	2	2	100%		26.7	28.2		
Magnesium	2	2	100%		49300	50400		
Manganese	2	2	100%		1070	1070		
Mercury	0	2	0%	0.13 - 0.19			0.77 [2]	No
Nickel	2	2	100%		75.5	78.5		
Potassium	2	2	100%		18000	19300		
Selenium	0	2	0%	5 - 5			5	No
Silver	0	2	0%	10 - 10			--	--
Sodium	2	2	100%		79000	79700		
Thallium	0	2	0%	2.7 - 4			--	--
Vanadium	2	2	100%		222	227		
Zinc	2	2	100%		242	286		
Volatile Organics (ug/L)								
1,1,1,2-Tetrachloroethane	0	2	0%	0.5 - 0.5			--	--
1,1,1-Trichloroethane	0	2	0%	1 - 1			--	--
1,1,2,2-Tetrachloroethane	0	2	0%	1 - 1			--	--
1,1,2-Trichloroethane	0	2	0%	1 - 1			--	--
1,1,2-Trichlorotrifluoroethane	0	2	0%	5 - 5			--	--
1,1,-Dichloroethane	0	2	0%	1 - 1			--	--
1,1,-Dichloroethene	0	2	0%	1 - 1			--	--

E2 Table 1-3. Comparison of Minimum Reporting Limit Range in Surface Water to Ecological Screening Values for the Protection of Aquatic Life

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Cal. Toxics Rule Surface Water Benchmark (1)	Is Highest Value of Min Reporting Limit Range>ORNL Soil Benchmark?
1,2,3-Trichloropropane	0	2	0%	0.5 - 0.5			--	--
1,2-Dichloroethane	0	2	0%	0.5 - 0.5			--	--
1,2-Dichlorotetrafluoroethane (Freon 114)	0	2	0%	5 - 5			--	--
1,2-Dichlorpropane	0	2	0%	1 - 1			--	--
2-Butanone (Methyl Ethyl Ketone, MEK)	0	2	0%	100 - 100			--	--
2-Hexanone	0	2	0%	50 - 50			--	--
4-Methyl-2-pentanone (MIBK)	0	2	0%	50 - 50			--	--
Acetone	0	2	0%	100 - 100			--	--
Benzene	0	2	0%	1 - 1			--	--
Bromodichloromethane	0	2	0%	0.1 - 0.1			--	--
Bromoform	0	2	0%	1 - 1			--	--
Bromomethane	0	2	0%	1 - 1			--	--
Carbon Disulfide	0	2	0%	1 - 1			--	--
Carbon Tetrachloride	0	2	0%	0.5 - 0.5			--	--
Chlorobenzene	0	2	0%	1 - 1			--	--
Chloroethane	0	2	0%	1 - 1			--	--
Chloroform	0	2	0%	0.1 - 0.1			--	--
Chloromethane	0	2	0%	1 - 1			--	--
Cis-1,2-Dichloroethene	0	2	0%	1 - 1			--	--
Cis-1,3-Dichloropropene	0	2	0%	0.5 - 0.5			--	--
Dibromochloromethane	0	2	0%	0.1 - 0.1			--	--
Dichlorodifluoromethane (F12)	0	2	0%	1 - 1			--	--
Di-Isopropyl Ether (DIPE)	0	2	0%	5 - 5			--	--
Ethyl Benzene	0	2	0%	1 - 1			--	--
Ethyl Tertiary Butyl Ether	0	2	0%	5 - 5			--	--
Methyl tert-Butyl Ether (MTBE)	0	2	0%	3 - 3			--	--
Methylene Chloride	0	2	0%	5 - 5			--	--
Styrene	0	2	0%	1 - 1			--	--
Tertiary Amyl Methyl Ether	0	2	0%	5 - 5			--	--
Tertiary Butyl Alcohol (TBA)	0	2	0%	2 - 2			--	--
Tetrachloroethene (PCE)	0	2	0%	1 - 1			--	--
Toluene	0	2	0%	1 - 1			--	--

E2 Table 1-3. Comparison of Minimum Reporting Limit Range in Surface Water to Ecological Screening Values for the Protection of Aquatic Life

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Cal. Toxics Rule Surface Water Benchmark (1)	Is Highest Value of Min Reporting Limit Range>ORNL Soil Benchmark?
Trans-1,2-Dichloroethene	0	2	0%	1 - 1			--	--
Trans-1,3-dichloropropene	0	2	0%	0.5 - 0.5			--	--
Trichloroethene (TCE)	0	2	0%	1 - 1			--	--
Trichlorofluoromethane (Freon 11)	0	2	0%	5 - 5			--	--
Vinyl Chloride	0	2	0%	0.5 - 0.5			--	--
Xylenes, Total	0	2	0%	1 - 1			--	--
Semivolatile Organics (ug/L)								
1,2,4-Trichlorobenzene	0	2	0%	9.6 - 9.6			--	--
1,2-Dichlorobenzene	0	2	0%	9.6 - 9.6			--	--
1,3-Dichlrobenzene	0	2	0%	9.6 - 9.6			--	--
1,4-Dichlorobenzene	0	2	0%	4.8 - 4.8			--	--
2,2'-oxybis(1-Chloropropane)	0	2	0%	9.6 - 9.6			--	--
2,4,5-Trichlorophenol	0	2	0%	9.6 - 9.6			--	--
2,4,6-Trichlorophenol	0	2	0%	4.8 - 4.8			--	--
2,4-Dichlorophenol	0	2	0%	9.6 - 9.6			--	--
2,4-Dimethylphenol	0	2	0%	9.6 - 9.6			--	--
2,4-Dinitrotoluene	0	2	0%	9.6 - 9.6			--	--
2,6-Dinitrotoluene	0	2	0%	9.6 - 9.6			--	--
2.4-Dinitrophenol	0	2	0%	48 - 48			--	--
2-Chloronaphthalene	0	2	0%	9.6 - 9.6			--	--
2-Chlorophenol	0	2	0%	9.6 - 9.6			--	--
2-Methyl-4,6-Dinitrophenol	0	2	0%	48 - 48			--	--
2-Methylphenol (o-Cresol)	0	2	0%	9.6 - 9.6			--	--
2-Nitroaniline	0	2	0%	48 - 48			--	--
2-Nitrophenol	0	2	0%	9.6 - 9.6			--	--
3,3'-Dichlorobenzene	0	2	0%	9.6 - 9.6			--	--
3/4-Methylphenol (M/P-Cresol)	0	2	0%	9.6 - 9.6			--	--
3-Nitroaniline	0	2	0%	48 - 48			--	--
4-bromophenyl-phenylether	0	2	0%	9.6 - 9.6			--	--
4-Chloro-3-Methylphenol	0	2	0%	9.6 - 9.6			--	--
4-Chloroaniline	0	2	0%	19 - 19			--	--
4-Chlorophenyl-phenyl ether	0	2	0%	9.6 - 9.6			--	--

E2 Table 1-3. Comparison of Minimum Reporting Limit Range in Surface Water to Ecological Screening Values for the Protection of Aquatic Life

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Cal. Toxics Rule Surface Water Benchmark (1)	Is Highest Value of Min Reporting Limit Range>ORNL Soil Benchmark?
4-Nitroaniline	0	2	0%	48 - 48			--	--
4-Nitrophenol	0	2	0%	48 - 48			--	--
Bis(2-Chloroethoxy) Methane	0	2	0%	9.6 - 9.6			--	--
Bis(2-Chloroethyl) Ether	0	2	0%	9.6 - 9.6			--	--
Bis(2-Ethylhexyl) Phthalate	0	2	0%	9.6 - 9.6			--	--
Butylbenzylphthalate	0	2	0%	9.6 - 9.6			--	--
Carbazole	0	2	0%	48 - 48			--	--
Dibenzofuran	0	2	0%	9.6 - 9.6			--	--
Diethylphthalate	0	2	0%	9.6 - 9.6			--	--
Dimethylphthalate	0	2	0%	9.6 - 9.6			--	--
Di-N-Butylphthalate	0	2	0%	9.6 - 9.6			--	--
Di-N-Octylphthalate	0	2	0%	9.6 - 9.6			--	--
Hexachlorbenzene	0	2	0%	0.96 - 0.96			--	--
Hexachlorobutadiene	0	2	0%	9.6 - 9.6			--	--
Hexachlorocyclopentadiene	0	2	0%	48 - 48			--	--
Hexachloroethane	0	2	0%	9.6 - 9.6			--	--
Isophorone	0	2	0%	9.6 - 9.6			--	--
Nitrobenzene	0	2	0%	4.8 - 4.8			--	--
N-Nitrosodi-N-Propylamine	0	2	0%	9.6 - 9.6			--	--
N-Nitroso-Diphenylamine	0	2	0%	9.6 - 9.6			--	--
Pentachlorophenol	0	2	0%	12 - 12			15	No
Phenol	0	2	0%	9.6 - 9.6			--	--
2-Methylnaphthalene	0	2	0%	0.48 - 0.48			--	--
Acenaphthene	0	2	0%	0.48 - 0.48			--	--
Acenaphthylene	0	2	0%	0.48 - 0.48			--	--
Anthracene	0	2	0%	0.48 - 0.48			--	--
Benzo(a)Anthracene	0	2	0%	0.48 - 0.48			--	--
Benzo(a)pyrene	0	2	0%	0.19 - 0.19			--	--
Benzo(b)Fluoranthene	0	2	0%	0.48 - 0.48			--	--
Benzo(g,h,I)Perylene	0	2	0%	0.48 - 0.48			--	--
Benzo(k)Fluoranthene	0	2	0%	0.48 - 0.48			--	--
Chrysene	0	2	0%	0.48 - 0.48			--	--

E2 Table 1-3. Comparison of Minimum Reporting Limit Range in Surface Water to Ecological Screening Values for the Protection of Aquatic Life

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Cal. Toxics Rule Surface Water Benchmark (1)	Is Highest Value of Min Reporting Limit Range>ORNL Soil Benchmark?
Dibenz(a,h)Anthracene	0	2	0%	0.48 - 0.48			--	--
Fluoranthene	0	2	0%	0.48 - 0.48			--	--
Fluorene	0	2	0%	0.48 - 0.48			--	--
Indeno(1,2,3-c,d)Pyrene	0	2	0%	0.48 - 0.48			--	--
Naphthalene	0	2	0%	0.48 - 0.48			--	--
Phenanthrene	0	2	0%	0.48 - 0.48			--	--
Pyrene	0	2	0%	0.48 - 0.48			--	--
Petroleum Hydrocarbons (mg/kg)								
Gasoline	0	2	0%	0.1 - 0.1				
Diesel Fuels	0	2	0%	0.096 - 0.096				
Motor Oils	0	2	0%	0.13 - 0.13				

NOTES:

NRWQC = National Recommended Water Quality Criteria (EPA, 2002)

– Screening value not available

ug/L = micrograms per liter

ug/L = micrograms per liter

(1) Freshwater chronic criterion for aluminum, 87 ug/L, is used. It is based on pH=6.5-9 in groundwater. EPA is aware of field data indicating that many high quality waters in the U.S. contain more than 87 ug/L of aluminum, when either total recoverable or dissolved is measured (EPA, 1998b).

(2) NRWQC value for mercury used. CTR value

E2 Table 1-4. Comparison of Maximum Detection in Wash Sediment to Wet Sediment Benchmark

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Detected	Maximum Detected	Sediment Benchmark	Is Highest Value of Max Detection>Sediment Benchmark?
Metals (mg/kg dw)							
Aluminum	4	4	100%	1750	3050	--	--
Arsenic	3	4	75%	1.4	1.8	9.79 [1]	No
Barium	4	4	100%	25.6	110	500 [2]	No
Cadmium	2	4	50%	0.23	0.26	0.99 [1]	No
Calcium	4	4	100%	2620	4570	--	--
Chromium	4	4	100%	2.5	4.4	43.4 [1]	No
Cobalt	4	4	100%	1.2	2	50 [3]	No
Copper	4	4	100%	1.3	2.5	31.6 [1]	No
Iron	4	4	100%	2700	5050	--	--
Lead	4	4	100%	1	1.9	35.8 [1]	No
Magnesium	4	4	100%	898	1610	--	--
Manganese	4	4	100%	54.6	130	300 [4]	No
Mercury	1	4	25%	0.006	0.006	0.18 [1]	No
Nickel	4	4	100%	1.6	2.8	22.7 [1]	No
Potassium	4	4	100%	418	821	--	--
Selenium	1	4	25%	0.17	0.17	5 [5]	No
Sodium	2	4	50%	23.1	47.7	--	--
Vanadium	4	4	100%	7.5	13.9	--	--
Zinc	4	4	100%	7.3	13.5	121 [1]	No
Petroleum Hydrocarbons (mg/kg dw)							
Motor Oils	1	4	25%	20	20		--

NOTES:

(1) TEC = Threshold Effect Concentration in: MacDonald, D.D., C.G. Ingersoll, and T.A. Berger, 2000. Development and Evaluation of Consenus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39:20-31.

(2) Interim Criteria for In-Water Disposal of Dredged Sediments in: Sullivan, J., J. Ball, E. Brick, S. Hausmann, G. Pilarski, and D. Sopcich. 1985. Report of the technical subcommittee on determination of dredge material suitability for in-water disposal. Wisconsin Department of Natural Resources Report (As cited in Fitchko 1989).

(3) OMOE Open Water Disposal Criteria in: Fitchko, J. 1989. Criteria for Contaminated Soil/Sediment Cleanup. Beak Consultants Limited. Brampton, Ontario. ISBN 0-934165-29-6. Pudvan Publishing Co. Inc. Northbrook, Illinois.

(4) Non Polluted Sediment Quality Guidelines for USEPA Region 5 Harbour Classification in: EPA. 1977. Guidelines for the pollution classification of Great Lakes Harbor sediments. U.S. Environmental Protection Agency. Region V. Great Lakes Surveillance Branch. Chicago, Illinois. (As cited in SAIC 1991).

(5) British Columbia Ministry of Environment Criterion in: BCMOELP (British Columbia Ministry of Environment Lands and Parks). 1994. Approved and working criteria for water quality - 1994. Water Quality Branch. Environmental Protection Department. British Columbia Ministry of Environment Lands and Parks. ISBN 0-7726-2061-X. Victoria, British Columbia. 45 pp.

-- Screening value not available

mg/kg dw = milligrams per kilogram on a dry weight basis

ug/kg dw = micrograms per kilogram on a dry weight basis

E2 Table 1-5. Comparison of Minimum Reporting Limit Range in Soil to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Soil Benchmark	Is Highest Value of Min Reporting Limit Range>Soil Benchmark?
Metals (mg/kg dw)								
Aluminum	4	4	100%		1750	3050	50 [1]	RS
Antimony	0	4	0%	3.3 - 3.6			78 [2]	No
Arsenic	3	4	75%	0.94 - 0.94	1.4	1.8	18 [2]	No
Barium	4	4	100%		25.6	110	330 [2]	RS
Beryllium	0	4	0%	0.22 - 0.24			40 [2]	No
Cadmium	2	4	50%	0.16 - 0.17	0.23	0.26	32 [2]	No
Calcium	4	4	100%		2620	4570	--	--
Chromium	4	4	100%		2.5	4.4	1 [1]	RS
Cobalt	4	4	100%		1.2	2	13 [2]	RS
Copper	4	4	100%		1.3	2.5	50 [1]	RS
Iron	4	4	100%		2700	5050	--	--
Lead	4	4	100%		1	1.9	110 [2]	RS
Magnesium	4	4	100%		898	1610	--	--
Manganese	4	4	100%		54.6	130	500 [1]	--
Mercury	1	4	25%	0.22 - 0.24	0.006	0.006	0.1 [1]	Yes
Nickel	4	4	100%		1.6	2.8	30 [1]	RS
Potassium	4	4	100%		418	821	--	--
Selenium	1	4	25%	0.33 - 0.36	0.17	0.17	1 [1]	No
Silver	0	4	0%	0.55 - 0.59			2 [1]	No
Sodium	2	4	50%	110 - 120	23.1	47.7	--	--
Thallium	0	4	0%	0.44 - 0.47			1 [1]	No
Vanadium	4	4	100%		7.5	13.9	2 [1]	RS
Zinc	4	4	100%		7.3	13.5	50 [1]	RS
Volatile Organics (ug/kg dw)								
1,1-Dichloroethane	0	4	0%	5.5 - 6.1			--	--
1,1-Dichloroethene	0	4	0%	5.5 - 6.1			--	--
1,1,1,2-Tetrachloroethane	0	4	0%	5.5 - 6.1			--	--
1,1,1-Trichloroethane	0	4	0%	5.5 - 6.1			--	--

E2 Table 1-5. Comparison of Minimum Reporting Limit Range in Soil to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Soil Benchmark	Is Highest Value of Min Reporting Limit Range>Soil Benchmark?
1,1,2,2-Tetrachloroethane	0	4	0%	5.5 - 6.1			--	--
1,1,2-Trichloroethane	0	4	0%	5.5 - 6.1			--	--
1,1,2-Trichlorotrifluoroe	0	4	0%	5.5 - 6.1			--	--
1,2,3-Trichloropropane	0	4	0%	5.5 - 6.1			--	--
1,2-Dichloroethane	0	4	0%	5.5 - 6.1			--	--
1,2-Dichlorotetrafluoroethane (Freon 114)	0	4	0%	5.5 - 6.1			--	--
1,2-Dichlorpropane	0	4	0%	5.5 - 6.1			700000 [1]	No
2-Butanone (Methyl Ethyl Ketone, MEK)	0	4	0%	110 - 120			--	--
2-Hexanone	0	4	0%	55 - 61			--	--
4-Methyl-2-pentanone (MIBK)	0	4	0%	55 - 61			--	--
Acetone	0	4	0%	110 - 120			--	--
Benzene	0	4	0%	5.5 - 6.1			500 [3]	--
Bromodichloromethane	0	4	0%	5.5 - 6.1			--	--
Bromoform	0	4	0%	5.5 - 6.1			--	--
Bromomethane	0	4	0%	5.5 - 6.1			--	--
Carbon Disulfide	0	4	0%	5.5 - 6.1			--	--
Carbon Tetrachloride	0	4	0%	5.5 - 6.1			--	--
Chlorobenzene	0	4	0%	5.5 - 6.1			40000 [1]	No
Chloroethane	0	4	0%	5.5 - 6.1			--	--
Chloroform	0	4	0%	5.5 - 6.1			--	--
Chloromethane	0	4	0%	5.5 - 6.1			--	--
Cis-1,2-Dichloroethene	0	4	0%	5.5 - 6.1			--	--
Cis-1,3-Dichloropropene	0	4	0%	5.5 - 6.1			--	--
Di-Isopropyl Ether (DIPE)	0	4	0%	5.5 - 6.1			--	--
Dibromochloromethane	0	4	0%	5.5 - 6.1			--	--
Dichlorodifluoromethane (F12)	0	4	0%	5.5 - 6.1			--	--
Ethyl Benzene	0	4	0%	5.5 - 6.1			1200 [3]	--
Ethyl Tertiary Butyl Ether	0	4	0%	5.5 - 6.1			--	--
Methyl tert-Butyl Ether (MTBE)	0	4	0%	5.5 - 6.1			--	--
Methylene Chloride	0	4	0%	5.5 - 6.1			--	--

E2 Table 1-5. Comparison of Minimum Reporting Limit Range in Soil to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Soil Benchmark	Is Highest Value of Min Reporting Limit Range>Soil Benchmark?
Styrene	0	4	0%	5.5 - 6.1			300000 [1]	No
Tertiary Amyl Methyl Ether	0	4	0%	5.5 - 6.1			--	--
Tertiary Butyl Alcohol (TBA)	0	4	0%	22 - 24			--	--
Tetrachloroethene (PCE)	0	4	0%	5.5 - 6.1			--	--
Toluene	0	4	0%	5.5 - 6.1			800 [3]	No
Trans-1,2-Dichloroethene	0	4	0%	5.5 - 6.1			--	--
Trans-1,3-dichloropropene	0	4	0%	5.5 - 6.1			--	--
Trichloroethene (TCE)	0	4	0%	5.5 - 6.1			--	--
Trichlorofluoromethane (Freon 11)	0	4	0%	5.5 - 6.1			--	--
Vinyl Chloride	0	4	0%	5.5 - 6.1			--	--
Xylenes, Total	0	4	0%	17 - 18			1000 [3]	--
Semivolatile Organics (ug/kg dw)								
1,2,4-Trichlorobenzene	0	4	0%	550 - 590			20000 [1]	No
1,2-Dichlorobenzene	0	4	0%	550 - 590			--	--
1,3-Dichlrobenzene	0	4	0%	550 - 590			--	--
1,4-Dichlorobenzene	0	4	0%	550 - 590			20000 [1]	No
2,2'-oxybis(1-Chloropropane)	0	4	0%	550 - 590			--	--
2,4,5-Trichlorophenol	0	4	0%	550 - 590			4000 [1]	No
2,4,6-Trichlorophenol	0	4	0%	550 - 590			10000 [1]	No
2,4-Dichlorophenol	0	4	0%	550 - 590			--	--
2,4-Dimethylphenol	0	4	0%	550 - 590			--	--
2,4-Dinitrotoluene	0	4	0%	550 - 590			--	--
2,6-Dinitrotoluene	0	4	0%	550 - 590			--	--
2-Chloronaphthalene	0	4	0%	550 - 590			--	--
2-Chlorophenol	0	4	0%	550 - 590			--	--
2-Methyl-4,6-Dinitrophenol	0	4	0%	2700 - 3000			--	--
2-Methylphenol (o-Cresol)	0	4	0%	550 - 590			--	--
2-Nitroaniline	0	4	0%	2700 - 3000			--	--
2-Nitrophenol	0	4	0%	550 - 590			20000 [1]	No
2,4-Dinitrophenol	0	4	0%	2700 - 3000			--	--

E2 Table 1-5. Comparison of Minimum Reporting Limit Range in Soil to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Soil Benchmark	Is Highest Value of Min Reporting Limit Range>Soil Benchmark?
3,3'-Dichlorobenzene	0	4	0%	1100 - 1200			--	--
3-Nitroaniline	0	4	0%	2700 - 3000			--	--
3/4-Methylphenol (M/P-Cresol)	0	4	0%	550 - 590			--	--
4-bromophenyl-phenylether	0	4	0%	550 - 590			--	--
4-Chloro-3-Methylphenol	0	4	0%	550 - 590			--	--
4-Chloroaniline	0	4	0%	1100 - 1200			--	--
4-Chlorophenyl-phenyl ether	0	4	0%	550 - 590			--	--
4-Nitroaniline	0	4	0%	2700 - 3000			--	--
4-Nitrophenol	0	4	0%	2700 - 3000			7000 [1]	No
Bis(2-Chloroethoxy) Methane	0	4	0%	550 - 590			--	--
Bis(2-Chloroethyl) Ether	0	4	0%	180 - 190			--	--
Bis(2-Ethylhexyl) Phthalate	0	4	0%	550 - 590			--	--
Butylbenzylphthalate	0	4	0%	550 - 590			--	--
Carbazole	0	4	0%	550 - 590			--	--
Di-N-Butylphthalate	0	4	0%	550 - 590			200000 [1]	No
Di-N-Octylphthalate	0	4	0%	550 - 590			--	--
Dibenzofuran	0	4	0%	550 - 590			--	--
Diethylphthalate	0	4	0%	550 - 590			100000 [1]	No
Dimethylphthalate	0	4	0%	550 - 590			--	--
Hexachlorbenzene	0	4	0%	550 - 590			--	--
Hexachlorobutadiene	0	4	0%	550 - 590			--	--
Hexachlorocyclopentadiene	0	4	0%	2700 - 3000			10000 [1]	No
Hexachloroethane	0	4	0%	550 - 590			--	--
Isophorone	0	4	0%	550 - 590			--	--
N-Nitroso-Diphenylamine	0	4	0%	2700 - 3000			--	--
N-Nitrosodi-N-Propylamine	0	4	0%	43 - 46			--	--
Nitrobenzene	0	4	0%	550 - 590			--	--
Pentachlorophenol	0	4	0%	1900 - 2000			5000 [2]	No
Phenol	0	4	0%	550 - 590			30000 [1]	No
PAH SIM (ug/kg dw)								

E2 Table 1-5. Comparison of Minimum Reporting Limit Range in Soil to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Soil Benchmark	Is Highest Value of Min Reporting Limit Range>Soil Benchmark?
2-Methylnaphthalene	0	4	0%	27 - 30			--	--
Acenaphthene	0	4	0%	27 - 30			--	--
Acenaphthylene	0	4	0%	27 - 30			--	--
Anthracene	0	4	0%	27 - 30			--	--
Benzo(a)Anthracene	0	4	0%	27 - 30			--	--
Benzo(a)pyrene	0	4	0%	27 - 30			--	--
Benzo(b)Fluoranthene	0	4	0%	27 - 30			--	--
Benzo(g,h,I)Perylene	0	4	0%	27 - 30			--	--
Benzo(k)Fluoranthene	0	4	0%	27 - 30			--	--
Chrysene	0	4	0%	27 - 30			--	--
Dibenz(a,h)Anthracene	0	4	0%	27 - 30			--	--
Fluoranthene	0	4	0%	27 - 30			--	--
Fluorene	0	4	0%	27 - 30			--	--
Indeno(1,2,3-c,d)Pyrene	0	4	0%	27 - 30			--	--
Naphthalene	0	4	0%	27 - 30			--	--
Phenanthrene	0	4	0%	27 - 30			--	--
Pyrene	0	4	0%	27 - 30			--	--
Petroleum Hydrocarbons (mg/kg dw)								
Gasoline	0	4	0%	11 - 14			--	--
Diesel Fuels	0	4	0%	11 - 12			--	--
Motor Oils	1	4	25%	11 - 11	20	20	--	--

NOTES:

[1] The lesser of plant screening value (Efroymson et al., 1997a) or soil invertebrate screening value (Efroymson et al., 1997b). ORNL = Oak Ridge National Laboratory

[2] Eco SSLs (EPA, 2005)

-- Screening value not available

RS--Reporting limit sufficient, 100 percent detection.

mg/kg dw = milligrams per kilogram on a dry weight basis

ug/kg dw = micrograms per kilogram on a dry weight basis

E2 Table 1-6. Comparison of Maximum Detection in Wash Sediment to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Detected	Maximum Detected	Soil Benchmark	Is Highest Value of Max Detection>Soil Benchmark?
Metals (mg/kg dw)							
Aluminum	4	4	100%	1750	3050	50 [1]	Yes
Arsenic	3	4	75%	1.4	1.8	18 [2]	No
Barium	4	4	100%	25.6	110	330 [2]	No
Cadmium	2	4	50%	0.23	0.26	32 [2]	No
Calcium	4	4	100%	2620	4570	--	--
Chromium	4	4	100%	2.5	4.4	1	Yes
Cobalt	4	4	100%	1.2	2	13 [2]	No
Copper	4	4	100%	1.3	2.5	50 [1]	No
Iron	4	4	100%	2700	5050	--	--
Lead	4	4	100%	1	1.9	110 [2]	No
Magnesium	4	4	100%	898	1610	--	--
Manganese	4	4	100%	54.6	130	500 [1]	No
Mercury	1	4	25%	0.006	0.006	0.1 [1]	No
Nickel	4	4	100%	1.6	2.8	30 [1]	No
Potassium	4	4	100%	418	821	--	--
Selenium	1	4	25%	0.17	0.17	1 [1]	No
Sodium	2	4	50%	23.1	47.7	--	--
Vanadium	4	4	100%	7.5	13.9	2 [1]	Yes
Zinc	4	4	100%	7.3	13.5	50 [1]	No

NOTES:

[1] The lesser of plant screening value (Efroymson et al., 1997a) or soil invertebrate screening value (Efroymson et al., 1997b). ORNL = Oak Ridge National Laboratory

[2] Eco SSLs (EPA, 2005)

-- Screening value not available

RS--Reporting limit sufficient, 100 percent detection.

mg/kg dw = milligrams per kilogram on a dry weight basis

E2 Table 1-7. Comparison of Minimum Reporting Limit Range in Soil to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Arithmetic Mean	95% UCL	RME	Soil Benchmark	Is Highest Value of Min Reporting Limit Range>Soil Benchmark?
Metals (mg/kg dw)											
Aluminum	33	33	100%		3570	15800	9138.79	9984	7984	50 [1]	RS
Antimony	1	38	3%	0.28 - 11.2	2.1	2.1	0.64	571	2.1	78 [2]	No
Arsenic	38	38	100%		1.6	4.63	2.93	3.14	3.14	18 [2]	RS
Barium	38	38	100%		50.9	187	97.65	104	104	330 [2]	No
Beryllium	10	38	26%	0.03 - 0.49	0.09	0.31	0.13	0.191	0.191	40 [2]	No
Cadmium	33	38	87%	1.05 - 1.12	0.09	1	0.6	0.741	0.741	32 [2]	No
Calcium	33	33	100%		1590	25200	5236.52	8545	8545	--	--
Chromium	38	38	100%		4.4	15.8	9.98	10.7	10.7	1 [1]	RS
Cobalt	38	38	100%		2.5	7.6	4.59	4.92	4.92	13 [2]	RS
Copper	38	38	100%		2.4	10.8	6.24	6.85	6.85	50 [1]	RS
Iron	33	33	100%		5880	19400	11592.27	12481	12481	--	--
Lead	38	38	100%		1.6	20.7	7.07	8.48	8.48	110 [2]	RS
Magnesium	33	33	100%		1780	6900	4022.58	4373	4373	--	--
Manganese	38	38	100%		104	289	185.67	196	196	500 [1]	RS
Mercury	33	38	87%	0.1 - 0.11	0.069	0.069	0.03	0.059	0.059	0.1 [1]	Yes
Molybdenum	0	5	0%	2.1 - 2.24			1.09	1.11		2 [1]	Yes
Nickel	37	38	97%	2.14 - 2.14	4.4	13.7	7.18	7.81	7.81	30 [1]	No
Potassium	33	33	100%		1100	3970	2445.64	2644	2644	--	--
Selenium	20	38	53%	0.62 - 1.12	0.27	1.1	0.49	0.743	0.743	1 [1]	Yes
Silver	1	38	3%	1 - 2.24	2	2	0.66	0.715	0.715	2 [1]	Yes
Sodium	0	33	0%	11.2 - 250			91.56	164		--	--
Thallium	0	38	0%	0.81 - 1.32			0.46	0.475		1 [1]	Yes
Vanadium	38	38	100%		13.5	44.1	26	27.8	27.8	2 [1]	RS
Zinc	38	38	100%		15.8	57.1	34.78	37.5	37.5	50 [1]	RS
Volatile Organics (ug/kg dw)											
1,1,1,2-Tetrachloroethane	0	33	0%	4.8 - 6.4			2.76	2.81		--	--
1,1,1-Trichloroethane	0	38	0%	4.8 - 16			2.99	3.15		--	--
1,1,2,2-Tetrachloroethane	0	38	0%	4.8 - 16			2.99	3.15		--	--
1,1,2-Trichloroethane	0	38	0%	4.8 - 16			2.99	3.15		--	--
1,1,2-Trichlorotrifluoroethane (Freon 113)	0	33	0%	4.8 - 6.4			2.76	2.81		--	--
1,1,-Dichloroethane	0	38	0%	4.8 - 16			2.99	3.15		--	--
1,1,-Dichloroethene	0	38	0%	4.8 - 16			2.99	3.15		--	--
1,2,3-Trichloropropane	0	33	0%	4.8 - 6.4			2.76	2.81		--	--
1,2-Dichloroethane	0	38	0%	4.8 - 16			2.99	3.15		--	--
1,2-Dichlorotetrafluoroethane (Freon 114)	0	33	0%	4.8 - 6.4			2.76	2.81		--	--
1,2-Dichlorpropane	0	38	0%	4.8 - 16			2.99	3.15		700000 [1]	No
2-Butanone (Methyl Ethyl Ketone, MEK)	0	38	0%	53 - 160			54.13	57.2		--	--
2-Chloroethyl vinyl ether	0	5	0%	53 - 160			47.4	92.5		--	--
2-Hexanone	0	38	0%	48 - 160			29.92	31.5		--	--
4-Methyl-2-pentanone (MIBK)	0	38	0%	53 - 160			29.92	31.5		--	--
Acetone	2	38	5%	53 - 160	46	100	56.12	59.2	59.2	--	--

E2 Table 1-7. Comparison of Minimum Reporting Limit Range in Soil to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Arithmetic Mean	95% UCL	RME	Soil Benchmark	Is Highest Value of Min Reporting Limit Range>Soil Benchmark?
Benzene	0	38	0%	4.8 - 16			3.02	3.2		500 [3]	--
Bromodichloromethane	0	38	0%	4.8 - 16			2.99	3.15		--	--
Bromoform	0	38	0%	4.8 - 16			2.99	3.15		--	--
Bromomethane	0	38	0%	4.8 - 16			2.99	3.15		--	--
Carbon Disulfide	0	38	0%	4.8 - 16			2.99	3.15		--	--
Carbon Tetrachloride	0	38	0%	4.8 - 16			2.99	3.15		--	--
Chlorobenzene	0	38	0%	4.8 - 16			2.99	3.15		40000 [1]	No
Chloroethane	0	38	0%	4.8 - 16			2.99	3.15		--	--
Chloroform	0	38	0%	4.8 - 16			3.02	3.2		--	--
Chloromethane	0	38	0%	4.8 - 16			2.99	3.15		--	--
cis-1,2-Dichloroethene	0	38	0%	4.8 - 16			2.99	3.15		--	--
cis-1,3-Dichloropropene	0	38	0%	4.8 - 16			2.99	3.15		--	--
Dibromochloromethane	0	38	0%	4.8 - 16			2.99	3.15		--	--
Dichlorodifluoromethane (F12)	0	33	0%	4.8 - 6.4			2.76	2.81		--	--
Di-Isopropyl Ether (DIPE)	0	33	0%	4.8 - 6.4			2.76	2.81		--	--
Ethyl Benzene	0	38	0%	4.8 - 16			2.99	3.15		1200 [3]	--
Ethyl Tertiary Butyl Ether	0	33	0%	4.8 - 6.4			2.76	2.81		--	--
Methyl tert-Butyl Ether (MTBE)	0	38	0%	4.8 - 32			3.56	3.86		--	--
Methylene Chloride	1	38	3%	4.8 - 16	9.2	9.2	3.16	3.39	3.39	--	--
Styrene	0	38	0%	4.8 - 16			3.02	3.2		300000 [1]	No
Tertiary Amyl Methyl Ether	0	33	0%	4.8 - 6.4			2.76	2.81		--	--
Tertiary Butyl Alcohol (TBA)	0	33	0%	19 - 26			11.07	11.3		--	--
Tetrachloroethene (PCE)	0	38	0%	4.8 - 16			2.99	3.15		--	--
Toluene	0	38	0%	4.8 - 16			2.99	3.15		800 [3]	No
trans-1,2-Dichloroethene	0	38	0%	4.8 - 16			2.99	3.15		--	--
trans-1,3-dichloropropene	0	38	0%	4.8 - 16			2.99	3.15		--	--
Trichloroethene (TCE)	0	38	0%	4.8 - 16			2.99	3.15		--	--
Trichlorofluoromethane (Freon 11)	0	33	0%	4.8 - 6.4			2.76	2.81		--	--
Vinyl Acetate	0	5	0%	53 - 160			47.4	92.5		--	--
Vinyl Chloride	0	38	0%	4.8 - 16			2.99	3.15		--	--
Xylenes, Total	0	38	0%	5.3 - 19			7.87	8.53		1000 [3]	--
Semivolatile Organics (ug/kg dw)											
1,2,4-Trichlorobenzene	0	38	0%	350 - 21000			571.19	500		20000 [1]	Yes
1,2-Dichlorobenzene	0	38	0%	350 - 21000			571.19	500		--	--
1,3-Dichlrobenzene	0	38	0%	350 - 21000			571.19	500		--	--
1,4-Dichlorobenzene	0	38	0%	350 - 21000			571.19	500		20000 [1]	Yes
2,2'-oxybis(1-Chloropropane)	0	33	0%	520 - 1200			306.35	324		--	--
2,4,5-Trichlorophenol	0	38	0%	520 - 52000			1018.69	695		4000 [1]	Yes
2,4,6-Trichlorophenol	0	38	0%	350 - 21000			571.19	500		10000 [1]	Yes
2,4-Dichlorophenol	0	38	0%	350 - 21000			571.19	500		--	--
2,4-Dimethylphenol	0	38	0%	350 - 21000			571.19	500		--	--
2,4-Dinitrotoluene	0	38	0%	350 - 21000			571.19	500		--	--
2,6-Dinitrotoluene	0	38	0%	350 - 21000			571.19	500		--	--

E2 Table 1-7. Comparison of Minimum Reporting Limit Range in Soil to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Arithmetic Mean	95% UCL	RME	Soil Benchmark	Is Highest Value of Min Reporting Limit Range>Soil Benchmark?
2,4-Dinitrophenol	0	38	0%	890 - 52000			2097.62	2140		20000 [1]	Yes
2-Chloronaphthalene	0	38	0%	350 - 21000			571.19	500		--	--
2-Chlorophenol	0	38	0%	350 - 21000			571.19	500		--	--
2-Methyl-4,6-Dinitrophenol	0	33	0%	2600 - 5900			2097.62	2140		--	--
2-Methylphenol (o-Cresol)	0	38	0%	350 - 21000			571.19	500		--	--
2-Nitroaniline	0	38	0%	890 - 52000			2097.62	2140		--	--
2-Nitrophenol	0	38	0%	350 - 21000			571.19	500		--	--
3,3'-Dichlorobenzidine	0	38	0%	350 - 21000			840.6	856		--	--
3/4-Methylphenol (M/P-Cresol)	0	38	0%	350 - 21000			601.32	532		--	--
3-Nitroaniline	0	38	0%	890 - 52000			2097.62	2140		--	--
4-bromophenyl-phenylether	0	38	0%	350 - 21000			571.19	500		--	--
4-Chloro-3-Methylphenol	0	33	0%	520 - 1200			571.19	500		--	--
4-Chloroaniline	0	38	0%	350 - 21000			840.6	856		--	--
4-Chlorophenyl-phenyl ether	0	38	0%	350 - 21000			571.19	500		--	--
4-Methylphenol	0	38	0%	350 - 21000							
4-Nitroaniline	0	38	0%	890 - 52000			2097.62	2140		--	--
4-Nitrophenol	0	38	0%	890 - 52000			2097.62	2140		7000 [1]	Yes
Bis (2-chloroisopropyl)ether	0	38	0%	350 - 21000			2531	2290000		--	--
bis(2-Chloroethoxy) Methane	0	38	0%	350 - 21000			571.19	500		--	--
bis(2-Chloroethyl) Ether	0	38	0%	35 - 21000			366.73	221		--	--
bis(2-Ethylhexyl) Phthalate	3	38	8%	350 - 21000	51	70	62	87.9	70	--	--
Butylbenzylphthalate	0	38	0%	350 - 21000			571.19	500		--	--
Carbazole	0	33	0%	520 - 1200			306.35	324		--	--
Dibenzofuran	0	38	0%	350 - 21000			571.19	500		--	--
Diethylphthalate	2	38	5%	360 - 21000	96	225	167	1120	225	100000 [1]	No
Dimethylphthalate	0	38	0%	350 - 21000			571.19	500		--	--
di-N-Butylphthalate	0	38	0%	350 - 21000			571.19	500		200000 [1]	No
di-N-Octylphthalate	0	38	0%	350 - 21000			571.19	500		--	--
Hexachlorbenzene	1	38	3%	35 - 21000	150	150	83.75		150	--	--
Hexachlorobutadiene	0	38	0%	350 - 21000			571.19	500		--	--
Hexachlorocyclopentadiene	0	38	0%	350 - 21000			1650.12	1980		10000 [1]	Yes
Hexachloroethane	0	38	0%	350 - 21000			571.19	500		--	--
Isophorone	0	33	0%	520 - 1200			306.35	324		--	--
Nitrobenzene	0	38	0%	350 - 21000			571.19	500		--	--
N-Nitrosodi-N-Propylamine	0	38	0%	30 - 16000			228.82	75.1		--	--
N-Nitroso-Diphenylamine	0	38	0%	350 - 21000			1650.12	1980		--	--
Pentachlorophenol	0	38	0%	180 - 21000			1210	1420		5000 [2]	Yes
Phenol	12	38	32%	350 - 21000	110	936	360.62	3485	936	30000 [1]	No
PAH SIM (ug/kg dw)											
2-Methylnapthalene	0	33	0%	25 - 51						--	
Acenaphthene	0	33	0%	25 - 51						--	
Acenapthylene	0	33	0%	25 - 51						--	
Anthracene	1	33	3%	25 - 32	44	44				--	
Benzo(a)Anthracene	7	33	21%	25 - 32	7	730				--	

E2 Table 1-7. Comparison of Minimum Reporting Limit Range in Soil to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Reporting Limit Range	Minimum Detected	Maximum Detected	Arithmetic Mean	95% UCL	RME	Soil Benchmark	Is Highest Value of Min Reporting Limit Range>Soil Benchmark?
Benzo(a)pyrene	4	33	12%	25 - 32	10	1030				--	
Benzo(b)Fluoranthene	5	33	15%	25 - 32	8	1790				--	
Benzo(g,h,I)Perylene	4	33	12%	25 - 32	7	440				--	
Benzo(k)Fluoranthene	4	33	12%	25 - 32	7	510				--	
Chrysene	4	33	12%	25 - 32	8	870				--	
Dibenz(a,h)Anthracene	1	33	3%	25 - 32	97	97				--	
Fluoranthene	5	33	15%	25 - 32	8	1000				--	
Fluorene	0	33	0%	25 - 51						--	
indeno(1,2,3-c,d)Pyrene	2	33	6%	25 - 32	15	460				--	
Naphthalene	0	33	0%	25 - 51						--	
Phenanthrene	2	33	6%	25 - 32	9	290				--	
Pyrene	5	33	15%	25 - 32	11	960				--	
Dioxins (pg/g dw)										--	
Total 2,3,7,8-TCDD Bird	11	11	100%	-	0.01	35.3	3.81	126	35.3	--	
Total 2,3,7,8-TCDD Mammal	11	11	100%	-	0.05	18.4	2.21	9.99	9.99	--	
Petroleum Hydrocarbons (mg/kg dw)											
Gasoline	26	38	68%	9.5 - 30.1	0.02	2.78		16.7		--	
Diesel Fuel	17	38	45%	10 - 100	0.8	5600		1628		--	
Motor Oils	20	33	61%	10 - 13	3	160		43.9		--	
Miscellaneous (ug/kg dw)											
Perchlorate	0	2	0%	500 - 500			250			--	--

NOTES:

[1] The lesser of plant screening value (Efroymson et al., 1997a) or soil invertebrate screening value (Efroymson et al., 1997b).

ORNL = Oak Ridge National Laboratory

[2] Eco SSLs (EPA, 2005)

[3] Canadian Council of Ministers of the Environment, 1999

-- Screening value not available

RS--Reporting limit sufficient, 100 percent detection.

mg/kg dw = milligrams per kilogram on a dry weight basis

ug/kg dw = micrograms per kilogram on a dry weight basis

pg/g = picograms per gram

E2 Table 1-8. Comparison of Maximum Detection in Soil to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Detected	Maximum Detected	Arithmetic Mean	95% UCL	RME	Soil Benchmark	Is Max Detection>Soil Benchmark?
Metals (mg/kg dw)										
Aluminum	33	33	100%	3570	15800	9138.79	9984	9984	50 [1]	Yes
Antimony	1	38	3%	2.1	2.1	0.64	571	2.1	78 [2]	No
Arsenic	38	38	100%	1.6	4.63	2.93	3.14	3.14	18 [2]	No
Barium	38	38	100%	50.9	187	97.65	104	104	330 [2]	No
Beryllium	10	38	26%	0.09	0.31	0.13	0.191	0.191	40 [2]	No
Cadmium	33	38	87%	0.09	1	0.6	0.741	0.741	32 [2]	No
Calcium	33	33	100%	1590	25200	5236.52	8545	8545	--	--
Chromium	38	38	100%	4.4	15.8	9.98	10.7	10.7	1 [1]	Yes
Cobalt	38	38	100%	2.5	7.6	4.59	4.92	4.92	13 [2]	No
Copper	38	38	100%	2.4	10.8	6.24	6.85	6.85	50 [1]	No
Iron	33	33	100%	5880	19400	11592.27	12481	12481	--	--
Lead	38	38	100%	1.6	20.7	7.07	8.48	8.48	110 [2]	No
Magnesium	33	33	100%	1780	6900	4022.58	4373	4373	--	--
Manganese	38	38	100%	104	289	185.67	196	196	500 [1]	No
Mercury	33	38	87%	0.069	0.069	0.03	0.059	0.059	0.1 [1]	No
Nickel	37	38	97%	4.4	13.7	7.18	7.81	7.81	30 [1]	No
Potassium	33	33	100%	1100	3970	2445.64	2644	2644	--	--
Selenium	20	38	53%	0.27	1.1	0.49	0.743	0.743	1 [1]	Yes
Silver	1	38	3%	2	2	0.66	0.715	0.715	2 [1]	No
Vanadium	38	38	100%	13.5	44.1	26	27.8	27.8	2 [1]	Yes
Zinc	38	38	100%	15.8	57.1	34.78	37.5	37.5	50 [1]	Yes
Volatile Organics (ug/kg dw)										
Acetone	2	38	5%	46	100	56.12	59.2	59.2	--	--
Methylene Chloride	1	38	3%	9.2	9.2	3.16	3.39	3.39	--	--
Semivolatile Organics (ug/kg dw)										
bis(2-Ethylhexyl) Phthalate	3	38	8%	51	70	62	87.9	70	--	--
Diethylphthalate	2	38	5%	96	225	167	1120	225	100000 [1]	No
Hexachlorbenzene	1	38	3%	150	150	83.75		150	--	--
Phenol	12	38	32%	110	936	360.62	3485	419	30000 [1]	No
PAH SIM (ug/kg dw)										
Anthracene	1	33	3%	44	44				--	--
Benzo(a)Anthracene	7	33	21%	7	730				--	--
Benzo(a)pyrene	4	33	12%	10	1030				--	--
Benzo(b)Fluoranthene	5	33	15%	8	1790				--	--
Benzo(g,h,I)Perylene	4	33	12%	7	440				--	--
Benzo(k)Fluoranthene	4	33	12%	7	510				--	--
Chrysene	4	33	12%	8	870				--	--
Dibenz(a,h)Anthracene	1	33	3%	97	97				--	--
Fluoranthene	5	33	15%	8	1000				--	--
Indeno(1,2,3-c,d)Pyrene	2	33	6%	15	460				--	--
Phenanthrene	2	33	6%	9	290				--	--

E2 Table 1-8. Comparison of Maximum Detection in Soil to Ecological Screening Values for Lower Level Trophic Organisms

Compound	No. of Detected Samples	Total No. of Samples	% Detected Samples	Minimum Detected	Maximum Detected	Arithmetic Mean	95% UCL	RME	Soil Benchmark	Is Max Detection>Soil Benchmark?
Pyrene	5	33	15%	11	960				--	--
Dioxins (pg/g dw)									--	
Total 2,3,7,8-TCDD Bird	11	11	100%	0.01	35.3	3.81	126	35.3	--	--
Total 2,3,7,8-TCDD Mammal	11	11	100%	0.05	18.4	2.21	9.99	9.99	--	--
Petroleum Hydrocarbons (mg/kg dw)										
Gasoline	26	38	68%	0.02	2.78		16.7		--	--
Diesel Fuel	17	38	45%	0.8	5600		1628		--	--
Motor Oils	20	33	61%	3	160		43.9		--	--

NOTES:

[1] The lesser of plant screening value (Efroymson et al., 1997a) or soil invertebrate screening value (Efroymson et al., 1997b).

ORNL = Oak Ridge National Laboratory

[2] Eco SSLs (EPA, 2005)

-- Screening value not available

mg/kg dw = milligrams per kilogram on a dry weight basis

ug/kg dw = micrograms per kilogram on a dry weight basis

pg/g dw = picograms per gram on a dry weight basis

Name: Ornate Shrew (*Sorex ornatus*)

Taxonomy: *Sorex ornatus* is a rare species of shrew located only in coastal marshes and riparian communities of California and Baja California. Nine subspecies have been described, two of which were widely distributed in past history while seven others were found in small patches along coastal marshes, inland valleys, and montane meadows (Maldonado et al. 2001). Differentiation of Ornate Shrews into subspecies is largely based on body size and pelage coloration of a small number of specimens, and while this species shows a large degree of variation in size and pelage color, and many exhibit different degrees of melanism, genetic differences between the subspecies are few. Therefore, "splitting" the species into subspecies based on these phenotypic variations may not be reliable (Maldonado et al. 2001).

Most of the available information on the Ornate Shrew pertains to two subspecies. The Suisun Shrew (*Sorex ornatus sinuosus*) is a Federal Species of Concern and a California Species of Special Concern. This subspecies is now restricted to remnants of natural tidal and brackish marshes along the northern borders of San Pablo and Suisun bays in California (WESCO 1986). The Buena Vista Lake Shrew (*Sorex ornatus relictus*) is one of two subspecies of the Ornate Shrew that occur in the San Joaquin Valley, and has been listed as an Endangered Species by the U.S. Fish and Wildlife Service (DOI 2002). The species profile that follows is therefore comprised of information taken from separate sources pertaining to different subspecies.

Size: Ornate Shrews range in length from 9.8 to 10.5 cm. Their body weights range from 4.1 to 7.6 grams, with a mean weight of 5.85 grams (Brown et al. 1996). In most shrews, winter weight is 70% of their first-year weight, and 50% of their second-year weight (Hays, 1990).

Foraging Area: Data regarding the foraging area or territory size of the Ornate Shrew are unavailable. The short-tailed shrew has an approximate foraging area of 0.22 ha (Platt 1976).

Density: A favorable habitat should support densities of 111 individual shrews per hectare, according to estimations by Newman (1970). Suisun shrews exist in aggregations that consist of one dominant male and several females. In between the aggregations are young and/or subdominant males that were dispersed from the groups (Hays 1990).

Habitat: Ornate Shrews prefer mesophytic communities with dense cover and an abundant litter layer. Typical plants found in these communities are Fremont cottonwood, willows, alkali heath, wild rye grass, and Baltic rush (Brown et al. 1996). Suisun Shrews tend to inhabit tidal marshes that can be characterized in order of their decreasing tolerance to inundation: *Spartina foliosa* (cordgrass), *Salicornia ambigua, Salicornia virginica* (pickleweed), and *Grindelia cuneifolia* and *humulis* (gumplant), and brackish marshes dominated by *Scirpus californicus* (California bulrush) and *Typha latifolia* (cattail) (Rudd 1955).

Ornate Shrews build dome-shaped nests made of dead plant material and paper scraps, usually on top of the soil surface below driftwood or planks situated above the high tide line (WESCO, 1986).

Ornate Shrews are active day and night but are rarely observed due to their small size and cryptic behavior. They do not hibernate, but can enter a daily state of inactivity (called torpor) to survive extreme environmental conditions (DOI 2002).

Reproduction: Breeding typically occurs February through early October (Brown et al. 1996) and peaks in May (Newman and Rudd 1978). Litter size ranges from 4 to 7 young, with a mean of 5.2. Gestation typically lasts 21 days (Cal/Ecotox 2000). After breeding occurs, each aggregation is left with one dominant male and several breeding and immature females. Young, subdominant males leave the aggregations but do return in early spring to compete with resident males during the next breeding season (Hays 1990). The longevity of Ornate Shrews is only 16 – 18 months (Cal/Ecotox 2000) and deaths tend to occur shortly after the breeding season (Rudd 1955).

Feeding: Ornate Shrews will feed indiscriminately on available larvae and adults of several species of aquatic and terrestrial insects, and are also known to consume spiders, centipedes, slugs, snails, and earthworms on a seasonally available basis (DOI 2002). They have a very high body metabolism and are therefore able to eat between 60 and 200% of their body mass daily, and lactating females can eat up to 300% of their body mass (Genoud and Vogel 1989). For the short-tailed shrew, the standard metabolic rate is approximately 190% the rate predicted from body weight (Deavers and Hudson 1981). This risk assessment will reference the latter data in calculating feeding rates as 190% times the feeding rates derived using the allometric equation for mammal food intake from USEPA 1993.

Predators: Shrews are seldom preyed upon, possibly because they tend to stay deeply under vegetation (Pearson 1946, Crowcroft 1957) or because they are unpalatable due to the distasteful secretions and offensive odor from their flank glands and feces (DOI 2002).

Exposure Factors:

Feeding Rate: Mean: 1.119 grams/day (DW) Max: 1.317 grams/day (DW) (derived using Nagy, 2001 allometric equation for mammal food intake) (Deavers and Hudson 1981; Nagy 2001).

Drinking Rate: Mean: 0.001 L/day; Max: 0.0012 L/day (derived using allometric equation for drinking water from USEPA 1993).

Diet Partitioning Factor:

Soil:	0.06 (Derived from Beyer et al. 1994)
Plants:	0.00
Animals:	0.94 (Derived from DOI 2002)

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Name: Deer Mouse (*Peromyscus maniculatus*)

Size: Deer mice range from 7.1 to 10.2 cm in length, with a 5.1 to 13 cm tail (Burt and Grossenheider 1980). Schlesinger and Potter (1974) reported a mean weight of 22 grams for adult females and 20 grams for adult males. Minimum, mean, and maximum weights of 18.25, 19.6, and 20.9 grams, respectively, were derived from Schlesinger and Potter's data and will be used in this risk assessment.

Foraging Area: The deer mouse nests in burrows in the ground, in trees, stumps, and buildings. Bowers and Smith (1979) report mean home ranges of 0.128 and 0.094 ha for male and female deer mice, respectively, for the Idaho high desert. This is most similar to site habitat, so as a conservative exposure estimate, a foraging area of 0.1 ha is assumed for the purposes of this assessment.

Density: Population densities vary over space and time and are often positively correlated with food abundance (Taitt 1981; Wolff 1989), moisture contents of plants (Bowers and Smith 1979), and vegetative cover (van Horne 1982). Population density can range from 3.9 to 28 per hectare (Metzgar 1979).

Habitat: The deer mouse inhabit nearly all types of dry-land habitats within their range: short- grass prairies, grass-sage communities, coastal sage scrub, sand dunes, wet prairies, upland mixed and cedar forests, deciduous forests, ponderosa pine forests, other habitats (Holbrook 1979; Kaufman and Kaufman 1989; Ribble and Samson 1987; Wolff and Hurlbutt 1982).

Reproduction: The breeding season of the deer mouse is normally from February to November; the duration of reproductive season varies with latitude (Burt and Grossenheider 1980). The deer mouse produces 2 to 4 litters per year; 3 to 5 pups per litter (Burt and Grossenheider 1980). In Alberta, Canada, deer mice reach sexual maturity 35 days after birth (Millar 1985).

Feeding: Deer mice eat seeds, arthropods, some green vegetation, roots, fruits, and fungi as available (Johnson 1961; Menhusen 1963; Whitaker 1966).

Predators: House cat, hawks, fox, coyote, and snakes.

Exposure Factors:

Feeding Rate: Mean is 3.322 grams/day dry weight and maximum is 3.491 grams (derived using allometric equation for rodent food ingestion, Nagy 2001).

Drinking Rate: Mean is 0.0029 L/day (derived using allometric equation for drinking water, USEPA 1993).

Diet Partitioning Factor:

Soil:	0.02 (Derived from Beyer et al. 1994)
Plants:	0.49 (Derived from USEPA 1993)
Animals:	0.49 (Derived from USEPA 1993)

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Name: Long-tailed Weasel (*Mustela frenata*)

Size: Males of this species tend to be somewhat larger than females, with head and body lengths of 22.8 – 26.6 cm (males) and 20.3 – 22.8 cm (females) (Burt and Grossenheider 1976). Tails of both sexes are about 50% of their total body length (Baker 1983). Given the range of adult weasel weights is 80 to 450 grams (Baker, 1983) we might assume that a mean weight for risk assessment purposes is 265 grams.

Foraging Area: The home range for the long-tailed weasel is 12 to 16 ha (Burt and Grossenheider 1976). As a conservative exposure estimate, a foraging area of 12 ha is assumed for the purposes of this assessment.

Density: The density of weasel populations is estimated at 15 to 20 per 259 ha (Burt and Grossenheider 1976).

Habitat: Weasels are found in temperate and tropical habitats in North and Central America. They inhabit crop fields and small wooded areas and will burrow and nest in hollow logs, rock piles, and under barns. Weasels sometimes take over the burrow of one of their prey (Baker 1983).

Reproduction: The long-tailed weasel mates in July or August. Four to eight young are born in late April or early May after a gestation period of 2.5 to 337 days. Their eyes open at 35 days. Males reach sexual maturity at one year, while females are capable of reproducing at 3 – 4 months (Baker 1983).

Feeding: Weasels are strictly carnivorous but may ingest some soil while feeding. They prey on mammals up to rabbit size, and also take a few birds and other animals by piercing the prey's skull with its canines and killing it (Burt and Grossenheider 1976).

Predators: Man

Exposure Factors:

Feeding Rate: Mean: 16.06 grams (DW) /day; Max: 24.97 grams (DW)/ day (derived using allometric equation for food ingestion for all mammals, Nagy 2001).

Drinking Rate: Mean: 0.030 L/day; Max: 0.048 L/day (derived using allometric equation for drinking water, USEPA 1993).

Diet Partitioning Factor:

Soil:	0.03 Beyer et al. 1994; Similar to fox
Plants:	0.000
Animals:	0.97 (Derived from Burt and Grossenheider 1976)

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Name: Mourning Dove (*Zenaida macroura*)

Size: The average size of a mourning dove is 30.5 cm; its weight ranges from 115-140 grams with a mean weight of 119 grams (Dunning 1993).

Foraging Area: A search for the foraging area of the Mourning dove was unsuccessful. A calculation involving the relationship of daily food consumption to body weight for the Mourning dove was used to estimate a foraging area of 0.53 (ha) (Schoener 1966). The herbivore relationship was assumed to best apply to the Mourning dove because seeds and vegetable matter comprises over 90 percent of its diet.

Density: Population densities range from 1 to 5 per 2.02 ha in California (Garber 1955).

Habitat: Mourning doves can be found in the desert (near water) to open woodland, agricultural areas with scattered trees, and suburbs. They will nest in the fork of a horizontal tree branch, on ground, on deserted nest of other species, or anywhere else providing solid support (Ehrlich et al. 1988).

Reproduction: Mourning doves generally nest between mid-March and mid-September and produce 2-3, but occasionally 3-6 clutches per year (Ehrlich et al. 1988). Mourning doves almost always lay two eggs (Brown 1989; Verner 1980); gestation period is approximately 15 days (Ehrlich et al. 1988).

Feeding: Since the mourning dove's diet consists of seeds, including waste grain from cultivated fields (Ehrlich et al. 1988), incidental ingestion of soil will occur. Since the Mourning dove feeds on the ground, it is assumed that at least a minimal amount of incidental soil ingestion occurs and incidental soil ingestion is set at 2 percent for the exposure model.

Predators: Humans, hawks, owls, cats, dogs, blue jays, and squirrels (Assoc. of Game and Fish 1957).

Exposure Factors:

Feeding Rate: Mean is 12.5 grams (ww)/day, range is 1 to 17 g/day (J. Wildl. Manage. 1988). Mean is 16.48 grams (dw)/day with a maximum of 18.41 grams (dw)/day (derived using allometric equation for food ingestion for all mammals, Nagy 2001).

Drinking Rate: Mean is .014 L/day (derived using allometric equation for drinking water, USEPA 1993).

Diet Partitioning Factor

Soil:	0.093 (derived from Beyer et al., 1994)
Plants:	0.907 (Derived from Ehrlich et al. 1988)
Animal:	0.00 (Derived from Ehrlich et al. 1988)

References:

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Name: Western Meadowlark (*Sturnella neglecta)*

Size: The western meadowlark measures about 28 cm long with a 13 cm tail, thick stout body, large legs, and a long, straight bill (Dunn 1998). The minimum and maximum weight of the adult western meadowlark has been reported as 74.1 and 114 grams, respectively (Lanyon 1962). From those data a mean weight of approximately 94.05 grams can be derived. A unique foot structure allows the meadowlark to walk about on the ground, instead of hopping like other birds.

Foraging Area: The foraging area of the western meadowlark is approximately 3.0 ha (Schoener 1968).

Density: The density of western meadowlarks ranges from 0.1-1.0 birds/acre (Bryant 1914).

Habitat: The western meadowlark habitats include meadows, plains and prairies.

Reproduction: In California, the western meadowlark nests between March and August (Bryant 1914). The female builds a nest on the ground, hidden in a clump of grass and domed with grass and weed fibers. A small hole on the side, and a hidden runway up to four feet long, allows the meadowlark an entrance to the nest. The female lays one whitish pink egg, speckled with lavender and brown, each day for five days. The female incubates for 14 days and only leaves the nest for brief periods, while the male searches for food (Dunn 1998).

Feeding: The western meadowlark feeding habits are marked by seasonal differences in their main staples. They eat grain during winter and early spring, insects late spring and summer, and weed seeds in fall. (Lanyon 1994). It is a powerful flyer that eats insects, making it an asset to landowners (Dunn 1998).

Predators: Cats, dogs, hawks, owls, foxes and skunks.

Exposure Factors:

Feeding Rate: Mean: 14.04 grams/day (DW); Min: 11.92 grams/day (DW); Max: 16.00 grams/day (derived using passerine allometric equation, Nagy 2001).

Drinking Rate: 12.1 ml/day (derived using passerine allometric equation EPA 1993).

Diet Partitioning Factor:

Soil:	0.093 (derived from Beyer et al., 1994)
Plant:	0.339 (derived from Lanyon 1994)
Invertebrate:	0.568 (derived from Lanyon 1994)

References:

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Name: Spotted Towhee (*Pipilo maculatus*)

Size: Spotted Towhee range in length from 18 to 20 cm. Their body weights range from 32.1 to 52.3 grams, with a mean weight of 40.5 grams (Clench and Leberman 1978).

Foraging Area: Foraging area (provided in literature as home range) is probably variable, depending upon specific locality and season. Areas range from 3.8 to 12.5 hectares (Barbour 1941). As a conservative exposure estimate, a foraging area of 3.8 ha is assumed for the purposes of this assessment.

Density: Spotted Towhee densities have been reported as high as 108 per 40 hectares, which was in a California chaparral (Yeaton 1974).

Habitat: The Spotted Towhee ranges principally in the western United States and southern Canada southward through Mexico and into Central America. In general, it inhabits mountain manzanita thickets, scrub oaks, and pinyon-juniper woods with dense understory (Cornell Lab of Ornithology 1999). In California, the Spotted Towhee can be found in chaparrals and other shrub habitats and in open stands of riparian, hardwood, hardwood-conifer, and lower-elevation conifer habitats (Dobkin 2003).

Reproduction: Nests are usually constructed in a depression on the ground with grasses, bark shreds, rootlets, and dead leaves and have a lining made of fine grasses and hairs. Occasionally, nests are built in slash piles, dense shrubs, or a vine tangle up to 1.8 meters above ground (Harrison 1978).

Breeding takes place in late April through August and peaks in May and June. Spotted Towhees are monogamous, solitary breeders with clutches of 2 to 6 eggs, averaging 3 to 4. Two broods are possible each breeding season. The females incubate the eggs for 12 to 14 days, and during 8 – 11 days of fledging, the young are tended to by both parents (Baumann 1959; Davis 1960; Harrison 1978).

Feeding: During the spring and summer, the Spotted Towhee's diet consists of approximately 50% insects, with the remainder including seeds, other invertebrates, berries, and acorns (Martin et al., 1961). It forages by scratching and gleaning in litter and foliage, sometimes by plucking seeds and fruits from plants, and on rare occasions flycatching (Davis 1957).

Predators: Spotted Towhees may be preyed upon by prairie falcons (Bond 1939), or by scrub jays, king snakes, and California ground squirrels (Davis 1960).

Exposure Factors:

Feeding Rate: Mean: 7.893 grams/day (DW) Max: 9.399 grams/day (DW) (derived using allometric equation for passerine birds food intake from Nagy 2001).

Drinking Rate: Mean: 0.0069 L/day (derived using allometric equation for drinking water from USEPA 1993).

Diet Partitioning Factor:

Soil:	0.093 (Derived from Beyer et al., 1994)
Plants:	0.269 (Derived from Martin et al. 1961)
Animal:	0.638 (Derived from Martin et al. 1961)

References:

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Name: Red-shouldered Hawk (*Buteo lineatus*)

Size: The minimum weight of the Red-shouldered Hawk is 398 g, the mean weight is 559 g, and the maximum weight is 720 g (Hartman 1961). The adults are 41 cm in length and have a 102 cm wingspan (Robbins et al. 1966).

Foraging Area: The foraging area for the Red-shouldered Hawk (given as the maximum breeding home range for females in a California study) is 36.8 ha (McCrary 1982).

Density: Red-shouldered Hawk densities have been reported as high as 3.6 birds per square kilometer (derived from Jacobs and Jacobs 2002).

Habitat: The typical habitat for the Red-shouldered Hawk includes dense riparian deciduous cover bordered by foraging areas (edges, swamps, marshes, and wet meadows). In the western Sierra Nevada foothills, it can be found foraging in successional stages of valley foothill hardwood and valley foothill hardwood-conifer habitats (Polite 2003).

Reproduction: *(following is paraphrased from Cornel, 2003):* Courtship behavior includes very vocal aerial displays of "high-circling" and "sky-dancing" which is followed by copulation while standing. Red-shouldered hawks nest below the forest canopy, typically 9 – 20 m above ground (1.5 – 35 m range) in lower main branches of trees. Nests are built of live or dead sticks, dried leaves, bark, Spanish Moss, and lichens. Eggs (usually 2 – 4) are laid between January and June, but mostly during March through April. Both sexes incubate eggs and the male feeds the female during this period. Eggs hatch in approximately 33 days and is followed by 5 to 6 weeks of fledging. Parents continue to supply food to their young for 8 to 10 weeks after fledging (Cornell 2003).

Feeding: The Red-shouldered Hawk searches for prey from its perches on trees, snags, and posts. It primarily feeds on small mammals, snakes, lizards, amphibians, small or young birds, and large insects (Polite 2003). On rare occasions, it will feed on such items as carrion or (regionally) crayfish (Cornell 2003).

Predators: Nests of the Red-shouldered Hawk are sometimes raided by great horned owls and raccoons (Cooper 1999).

Exposure Factors:

Feeding Rate: Mean: 56.29 grams/day (DW) Max: 66.58 grams/day (DW) (derived using allometric equation for all birds food intake from USEPA 1993).

Drinking Rate: Mean: 0.04 L/day (derived using allometric equation for drinking water from USEPA 1993).

Diet Partitioning Factor:

Soil:	0.02 (Derived from Beyer et al. 1994)
Plants:	0.00 (Derived from Polite 2003)
Animal:	0.98 (Derived from Polite 2003)

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E2 Table 3-1. Chemical-Specific Exposure Factors - Tier 1 Soil Pathways

Chemical	Tier 1, Step 2 BCFp	Tier 1, Step 2 BCFp Abbreviated Reference	Tier 1, Step 2BCFi	Tier 1, Step 2 BCFi Abbreviated Reference	Tier 1, Step 2 BTFa	Tier 1, Step 2 BTFa Abbreviated Reference
Dioxins						
2,3,7,8-TCDD TEQ	1.54E-01	EPA, 2003	4.71E+00	Sample et al., 1998	1.99E-02	Birak et al., 2001
Inorganic						
Aluminum	1.80E-04	Strenge and Peterson, 1989	3.40E-01	Beyer and Stafford, 1993	1.50E-03	Strenge and Peterson, 1989
Antimony	3.76E-02	Bechtel Jacobs Co. LLC, 1998	2.24E-01	As surrogate	3.00E-03	Napier et al., 1980
Arsenic	3.75E-02	Bechtel-Jacobs, 1998	1.54E-01	Sample et al., 1998	1.50E-03	Strenge and Peterson, 1989
Barium	1.56E-01	Bechtel-Jacobs, 1998	9.10E-02	EPA, 2003	5.00E-04	Strenge and Peterson, 1989
Beryllium	1.00E-02	Baes et al., 1984	4.50E-02	EPA, 2003	8.00E-04	Strenge and Peterson, 1989
Cadmium	6.22E-01	Bechtel Jacobs Co. LLC, 1998	8.28E+00	Sample et al., 1998	1.60E-02	Strenge and Peterson, 1989
Chromium	4.10E-02	Bechtel-Jacobs, 1998	3.06E-01	EPA, 2003	2.40E-03	Strenge and Peterson, 1989
Cobalt	7.50E-03	Bechtel-Jacobs, 1998	1.22E-01	EPA, 2003	1.00E-03	Strenge and Peterson, 1989
Copper	4.61E-01	Bechtel Jacobs Co. LLC, 1998	5.15E-01	EPA, 2003	1.00E-02	Strenge and Peterson, 1989
Lead	7.01E-02	Bechtel Jacobs Co. LLC, 1998	4.48E-01	Sample et al., 1998	2.90E-04	Strenge and Peterson, 1989
Manganese	7.90E-02	Bechtel-Jacobs, 1998	7.35E-02	Sample et al., 1998	5.00E-03	Strenge and Peterson, 1989
Mercury	1.25E+00	Bechtel Jacobs Co. LLC, 1998	5.33E+00	Sample et al., 1998	1.00E-01	Strenge and Peterson, 1989
Nickel	5.60E-02	Bechtel Jacobs Co. LLC, 1998	1.06E+00	EPA, 2003	1.00E-03	Strenge and Peterson, 1989
Selenium	5.13E-01	Bechtel Jacobs Co. LLC, 1998	9.04E-01	Sample et al., 1998	1.00E+00	Strenge and Peterson, 1989
Silver	1.40E-02	Bechtel-Jacobs, 1998	2.05E+00	EPA, 2003	1.70E-02	Strenge and Peterson, 1989

E2 Table 3-1. Chemical-Specific Exposure Factors - Tier 1 Soil Pathways

Chemical	Tier 1, Step 2 BCFp	Tier 1, Step 2 BCFp Abbreviated Reference	Tier 1, Step 2BCFi	Tier 1, Step 2 BCFi Abbreviated Reference	Tier 1, Step 2 BTFa	Tier 1, Step 2 BTFa Abbreviated Reference
Vanadium	1.30E-03	Strenge and Peterson, 1989	2.24E-01	As as surrogate	2.30E-03	Strenge and Peterson, 1989
Zinc	7.95E-01	Bechtel Jacobs Co. LLC, 1998	5.65E+00	Sample et al., 1998	5.00E-02	Strenge and Peterson, 1989
Misc. Organic						
Methylene chloride	6.74E+00	EPA, 2003	1.00E+00	Default	0.00E+00	
PAH Group 1						
Anthracene	1.64E+00	Bechtel Jacobs Co. LLC, 1998	3.20E-01	Beyer and Stafford, 1993	1.28E-03	Birak et al., 2001
Benzo(g,h,i)perylene	6.02E-02	Bechtel Jacobs Co. LLC, 1998	1.50E-01	Beyer and Stafford, 1993	1.76E-02	Birak et al., 2001
Fluoranthene	2.47E+00	EPA, 2003	3.70E-01	Beyer and Stafford, 1993	2.56E-03	Birak et al., 2001
Phenanthrene	3.84E+00	EPA, 2003	2.80E-01	Beyer and Stafford, 1993	1.28E-03	Birak et al., 2001
Pyrene	1.85E+00	EPA, 2003	3.90E-01	Beyer and Stafford, 1993	2.53E-03	Birak et al., 2001
PAH Group 2						
Benzo(a)anthracene	5.37E-01	EPA, 2003	2.70E-01	Beyer and Stafford, 1993	5.20E-03	Birak et al., 2001
Benzo(a)pyrene	1.27E-01	Bechtel Jacobs Co. LLC, 1998	3.40E-01	Beyer and Stafford, 1993	8.57E-03	Birak et al., 2001
Benzo(b)fluoranthene	1.73E-01	EPA, 2003	2.10E-01	Beyer and Stafford, 1993	9.57E-03	Birak et al., 2001
Benzo(k)fluoranthene	2.55E-01	EPA, 2003	2.10E-01	Beyer and Stafford, 1993	9.57E-03	Birak et al., 2001
Chrysene	7.84E-01	EPA, 2003	1.30E-01	Beyer and Stafford, 1993	5.20E-03	Birak et al., 2001
Dibenz(a,h)anthracene	1.28E-01	EPA, 2003	5.20E-02	Beyer and Stafford, 1993	1.74E-02	Birak et al., 2001
Indeno(1,2,3-cd)pyrene	1.10E-01	EPA, 2003	4.10E-01	Beyer and Stafford, 1993	1.66E-02	Birak et al., 2001

E2 Table 3-1. Chemical-Specific Exposure Factors - Tier 1 Soil Pathways

Chemical	Tier 1, Step 2 BCFp	Tier 1, Step 2 BCFp Abbreviated Reference	Tier 1, Step 2BCFi	Tier 1, Step 2 BCFi Abbreviated Reference	Tier 1, Step 2 BTFa	Tier 1, Step 2 BTFa Abbreviated Reference
Phthalate Esters						
Bis (2-ethylhexyl) phthalate	8.68E-02	EPA, 2003	5.79E+01	EPA, 2003	3.66E-02	Birak et al., 2001
Diethylphthalate	2.10E+01	EPA, 2003	5.79E+01	EPA, 2003	1.05E-04	Birak et al., 2001
Semivolatile Organic Compound						
Hexachlorobenzene	1.10E-01	EPA, 2003	1.69E+00	Beyer, 1996	6.55E-03	Birak et al., 2001
Phenol	6.73E+01	EPA, 2003	1.00E+00	Default	3.01E-05	Birak et al., 2001
Volatile Organic Compound						
Acetone	2.53E+01	EPA, 2003	1.00E+00	Default	3.70E-06	Birak et al., 2001

E2 Table 3-2. Chemical-Specific Exposure Factors - Tier 1 Sediment Pathways

Chemical	Tier 1, Step 2 BCFp	Tier 1, Step 2 BCFp Abbreviated Reference	Tier 1, Step 2 BCFi	Tier 1, Step 2 BCFi Abbreviated Reference
Inorganic				
Aluminum	1.80E-04	Strenge and Peterson, 1989	3.40E-01	Beyer and Stafford, 1993
Arsenic	3.75E-02	Bechtel-Jacobs, 1998	2.03E-01	Sample et al., 1998
Barium	1.56E-01	Bechtel-Jacobs, 1998	9.10E-02	EPA, 2003
Cadmium	1.15E+00	Bechtel Jacobs Co. LLC, 1998	1.09E+01	Sample et al., 1998
Chromium	4.10E-02	Bechtel-Jacobs, 1998	3.06E-01	EPA, 2003
Cobalt	7.50E-03	Bechtel-Jacobs, 1998	1.22E-01	EPA, 2003
Copper	1.12E+00	Bechtel Jacobs Co. LLC, 1998	5.15E-01	EPA, 2003
Lead	2.00E-01	Bechtel Jacobs Co. LLC, 1998	7.10E-01	Sample et al., 1998
Manganese	7.90E-02	Bechtel-Jacobs, 1998	9.47E-02	Sample et al., 1998
Mercury	3.81E+00	Bechtel Jacobs Co. LLC, 1998	4.60E+01	Sample et al., 1998
Nickel	8.35E-02	Bechtel Jacobs Co. LLC, 1998	1.06E+00	EPA, 2003
Selenium	2.06E-01	Bechtel Jacobs Co. LLC, 1998	9.42E+00	Sample et al., 1998
Vanadium	1.30E-03	Strenge and Peterson, 1989	2.24E-01	As as surrogate
Zinc	1.51E+00	Bechtel Jacobs Co. LLC, 1998	1.49E+01	Sample et al., 1998

E2 Table 4- xicity Reference Values for Ornate Shrew

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	TRV (mg/kg-day)
Dioxins											
2,3,7,8-TCDD TEQ	2,3,7,8-TCDD	Rat	NOAEL	0.000001	Reproduction	Murray et al., 1979	1	1	1	1.28E+00	1.28E-06
Inorganic											
Aluminum	Aluminum	Mouse	LOAEL	19.3	Reproduction	Ondreicka et al., 1966	1	1	10	1.10E+00	2.13E+00
Antimony	Antimony	Various Mammals	NOAEL	0.06	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	6.00E-02
Arsenic	Arsenic	Rat	NOAEL	0.32	Growth rate, survival, blood pressure, and tumor effects	Schroeder et al, 1968	1	1	1	1.28E+00	4.09E-01
Barium	Barium	Various mammals	NOAEL	48	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	4.80E+01
Beryllium	Beryllium	Various Mammals	NOAEL	0.48	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	4.80E-01
Cadmium	Cadmium	Various Mammals	NOAEL	0.55	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	5.50E-01
Chromium	Chromium	Rat	NOAEL	2737	Reproduction and longevity	Ivankovic and Preussmann, 1975	1	1	1	1.28E+00	3.50E+03
Cobalt	Cobalt	Various Mammals	NOAEL	7.3	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	7.30E+00
Copper	Copper	Mouse	NOAEL	2.67	several effects were reported from immune response experiments at doses below the no effect dose of 26.67 mg/kg-day.	Pocino and others, 1991	1	1	1	1.10E+00	2.95E+00
Lead	Lead	Various Mammals	NOAEL	5.8	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	5.80E+00
Manganese	Manganese	Mouse	NOAEL	13.7	Decrease in paired testes weight, seminal vesicle weight, and preputial gland weight	Gray and Laskey, 1980	1	1	1	1.10E+00	1.51E+01
Mercury	Mercury	Rat	NOAEL	0.25	No adverse reproductive or developmental effects in rats exposed to methylmercury for 122 days	Khera and Tabacova, 1973	1	1	1	1.28E+00	3.20E-01
Nickel	Nickel	Rat	NOAEL	0.133	Increase in number of pups born dead or dying shortly after birth during G2	Smith et al., 1993	1	1	1	1.25E+00	1.67E-01

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	TRV (mg/kg-day)
Selenium	Selenium	Mouse	NOAEL	0.05	No hepatic lesions	Harr et al., 1966	1	1	1	1.09E+00	5.46E-02
Silver	Silver	Rat	LOAEL	89	Ventricular hypertrophy	Olcott, 1950	1	1	10	1.28E+00	1.14E+01
Vanadium	Vanadium	Rat	NOAEL	0.89	Growth and survival	Stockinger et al., 1953	1	1	1	1.28E+00	1.14E+00
Zinc	Zinc	Mouse	NOAEL	9.6	Cellular changes in pancreas and adrenal cortax	Aughey et al., 1977	1	1	1	1.09E+00	1.05E+01
Misc. Organic											
Methylene chloride	Methylene chloride	Rat	NOAEL	5.85	Hepatic Effects	National Coffee Association, 1982.	1	1	1	1.28E+00	7.48E+00
PAH Group 1											
Anthracene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.26E+00	6.30E+01
Benzo(g,h,i)perylene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.26E+00	6.30E+01
Fluoranthene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.26E+00	6.30E+01
Phenanthrene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.26E+00	6.30E+01
Pyrene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.26E+00	6.30E+01
PAH Group 2											
Benzo(a)anthracene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.10E+00	1.45E+00
Benzo(a)pyrene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.10E+00	1.45E+00
Benzo(b)fluoranthene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.10E+00	1.45E+00
Benzo(k)fluoranthene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.10E+00	1.45E+00
Chrysene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.10E+00	1.45E+00
Dibenz(a,h)anthracene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.10E+00	1.45E+00

E2 Table 4- xicity Reference Values for Ornate Shrew

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	TRV (mg/kg-day)
Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.10E+00	1.45E+00
Phthalate Esters											
Bis (2-ethylhexyl) phthalate	Bis (2-ethylhexyl) phthalate	Rat	LOAEL	200	Slowed growth; no effect on mortality, life expectancy, or reproduction	Carpenter et al., 1953	1	1	10	1.28E+00	2.56E+01
Diethylphthalate	Diethylphthalate	Mouse	NOAEL	4583	Testicular and accessory gland weight	Lamb et al., 1987.	1	1	1	1.10E+00	5.06E+03
Semivolatile Organic Compound											
Hexachlorobenzene	Hexachlorobenzene	Rat	NOAEL	2	Growth, feed consumption, hematological parametners, survival, viability index	Arnold et al., 1985	1	1	1	1.28E+00	2.56E+00
Phenol	Phenol	Rat	NOAEL	721	Liver abnormalitites	NCI, 1980	1	1	1	1.28E+00	9.22E+02
Volatile Organic Compound											
Acetone	Acetone	Rat	NOAEL	100	Liver and Kidney damage	EPA, 1986	10	1	1	1.28E+00	1.28E+01

Empty cells indicate that no toxicity data were available for the COPEC or a suitable surrogate.

E2 Table 4 Toxicity Reference Values for Deer Mouse

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	TRV (mg/kg-day)
Dioxins											
2,3,7,8-TCDD TEQ	2,3,7,8-TCDD	Rat	NOAEL	0.000001	Reproduction	Murray et al., 1979	1	1	1	1.19E+00	1.19E-06
Inorganic											
Aluminum	Aluminum	Mouse	LOAEL	19.3	Reproduction	Ondreicka et al., 1966	1	1	10	1.03E+00	1.98E+00
Antimony	Antimony	Various Mammals	NOAEL	0.06	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	6.00E-02
Arsenic	Arsenic	Rat	NOAEL	0.32	Growth rate, survival, blood pressure, and tumor effects	Schroeder et al, 1968	1	1	1	1.19E+00	3.80E-01
Barium	Barium	Various mammals	NOAEL	48	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	4.80E+01
Beryllium	Beryllium	Various Mammals	NOAEL	0.48	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	4.80E-01
Cadmium	Cadmium	Various Mammals	NOAEL	0.55	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	5.50E-01
Chromium	Chromium	Rat	NOAEL	2737	Reproduction and longevity	Ivankovic and Preussmann, 1975	1	1	1	1.19E+00	3.25E+03
Cobalt	Cobalt	Various Mammals	NOAEL	7.3	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	7.30E+00
Copper	Copper	Mouse	NOAEL	2.67	several effects were reported from immune response experiments at doses below the no effect dose of 26.67 mg/kg-day.	Pocino and others, 1991	1	1	1	1.03E+00	2.74E+00
Lead	Lead	Various Mammals	NOAEL	5.8	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	5.80E+00
Manganese	Manganese	Mouse	NOAEL	13.7	Decrease in paired testes weight, seminal vesicle weight, and preputial gland weight	Gray and Laskey, 1980	1	1	1	1.03E+00	1.41E+01
Mercury	Mercury	Rat	NOAEL	0.25	No adverse reproductive or developmental effects in rats exposed to methylmercury for 122 days	Khera and Tabacova, 1973	1	1	1	1.19E+00	2.97E-01
Nickel	Nickel	Rat	NOAEL	0.133	Increase in number of pups born dead or dying shortly after birth during G2	Smith et al., 1993	1	1	1	1.16E+00	1.55E-01

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	TRV (mg/kg-day)
Selenium	Selenium	Mouse	NOAEL	0.05	No hepatic lesions	Harr et al., 1966	1	1	1	1.01E+00	5.07E-02
Silver	Silver	Rat	LOAEL	89	Ventricular hypertrophy	Olcott, 1950	1	1	10	1.19E+00	1.06E+01
Vanadium	Vanadium	Rat	NOAEL	0.89	Growth and survival	Stockinger et al., 1953	1	1	1	1.19E+00	1.06E+00
Zinc	Zinc	Mouse	NOAEL	9.6	Cellular changes in pancreas and adrenal cortax	Aughey et al., 1977	1	1	1	1.02E+00	9.76E+00
Misc. Organic											
Methylene chloride	Methylene chloride	Rat	NOAEL	5.85	Hepatic Effects	National Coffee Association, 1982.	1	1	1	1.19E+00	6.95E+00
PAH Group 1											
Anthracene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.17E+00	5.86E+01
Benzo(g,h,i)perylene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.17E+00	5.86E+01
Fluoranthene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.17E+00	5.86E+01
Phenanthrene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.17E+00	5.86E+01
Pyrene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.17E+00	5.86E+01
PAH Group 2											
Benzo(a)anthracene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.03E+00	1.34E+00
Benzo(a)pyrene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.03E+00	1.34E+00
Benzo(b)fluoranthene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.03E+00	1.34E+00
Benzo(k)fluoranthene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.03E+00	1.34E+00
Chrysene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.03E+00	1.34E+00

E2 Table [illegible]oxicity Reference Values for Deer Mouse

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	TRV (mg/kg-day)
Dibenz(a,h)anthracene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.03E+00	1.34E+00
Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	1.03E+00	1.34E+00
Phthalate Esters											
Bis (2-ethylhexyl) phthalate	Bis (2-ethylhexyl) phthalate	Rat	LOAEL	200	Slowed growth; no effect on mortality, life expectancy, or reproduction	Carpenter et al., 1953	1	1	10	1.19E+00	2.38E+01
Diethylphthalate	Diethylphthalate	Mouse	NOAEL	4583	Testicular and accessory gland weight	Lamb et al., 1987.	1	1	1	1.03E+00	4.70E+03
Semivolatile Organic Compound											
Hexachlorobenzene	Hexachlorobenzene	Rat	NOAEL	2	Growth, feed consumption, hematological parametners, survival, viability index	Arnold et al., 1985	1	1	1	1.19E+00	2.38E+00
Phenol	Phenol	Rat	NOAEL	721	Liver abnormalitites	NCI, 1980	1	1	1	1.19E+00	8.57E+02
Volatile Organic Compound											
Acetone	Acetone	Rat	NOAEL	100	Liver and Kidney damage	EPA, 1986	10	1	1	1.19E+00	1.19E+01

Empty cells indicate that no toxicity data were available for the COPEC or a suitable surrogate.

E2 Table 4- xicity Reference Values for Long-tailed Weasel

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	TRV (mg/kg-day)
Dioxins											
2,3,7,8-TCDD TEQ	2,3,7,8-TCDD	Rat	NOAEL	0.000001	Reproduction	Murray et al., 1979	1	1	1	1.02E+00	1.02E-06
Inorganic											
Aluminum	Aluminum	Mouse	LOAEL	19.3	Reproduction	Ondreicka et al., 1966	1	1	10	8.77E-01	1.69E+00
Antimony	Antimony	Various Mammals	NOAEL	0.06	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	6.00E-02
Arsenic	Arsenic	Rat	NOAEL	0.32	Growth rate, survival, blood pressure, and tumor effects	Schroeder et al, 1968	1	1	1	1.02E+00	3.25E-01
Barium	Barium	Various mammals	NOAEL	48	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	4.80E+01
Beryllium	Beryllium	Various Mammals	NOAEL	0.48	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	4.80E-01
Cadmium	Cadmium	Various Mammals	NOAEL	0.55	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	5.50E-01
Chromium	Chromium	Rat	NOAEL	2737	Reproduction and longevity	Ivankovic and Preussmann, 1975	1	1	1	1.02E+00	2.78E+03
Cobalt	Cobalt	Various Mammals	NOAEL	7.3	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	7.30E+00
Copper	Copper	Mouse	NOAEL	2.67	several effects were reported from immune response experiments at doses below the no effect dose of 26.67 mg/kg-day.	Pocino and others, 1991	1	1	1	8.77E-01	2.34E+00
Lead	Lead	Various Mammals	NOAEL	5.8	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	5.80E+00
Manganese	Manganese	Mouse	NOAEL	13.7	Decrease in paired testes weight, seminal vesicle weight, and preputial gland weight	Gray and Laskey, 1980	1	1	1	8.77E-01	1.20E+01
Mercury	Mercury	Rat	NOAEL	0.25	No adverse reproductive or developmental effects in rats exposed to methylmercury for 122 days	Khera and Tabacova, 1973	1	1	1	1.02E+00	2.54E-01
Nickel	Nickel	Rat	NOAEL	0.133	Increase in number of pups born dead or dying shortly after birth during G2	Smith et al., 1993	1	1	1	9.96E-01	1.33E-01

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	TRV (mg/kg-day)
Selenium	Selenium	Mouse	NOAEL	0.05	No hepatic lesions	Harr et al., 1966	1	1	1	8.68E-01	4.34E-02
Silver	Silver	Rat	LOAEL	89	Ventricular hypertrophy	Olcott, 1950	1	1	10	1.02E+00	9.05E+00
Vanadium	Vanadium	Rat	NOAEL	0.89	Growth and survival	Stockinger et al., 1953	1	1	1	1.02E+00	9.05E-01
Zinc	Zinc	Mouse	NOAEL	9.6	Cellular changes in pancreas and adrenal cortax	Aughey et al., 1977	1	1	1	8.70E-01	8.35E+00
Misc. Organic											
Methylene chloride	Methylene chloride	Rat	NOAEL	5.85	Hepatic Effects	National Coffee Association, 1982.	1	1	1	1.02E+00	5.95E+00
PAH Group 1											
Anthracene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.00E+00	5.01E+01
Benzo(g,h,i)perylene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.00E+00	5.01E+01
Fluoranthene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.00E+00	5.01E+01
Phenanthrene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.00E+00	5.01E+01
Pyrene	Naphthalene	Rat	NOAEL	50	Reproductive	Navarro et al., 1991	1	1	1	1.00E+00	5.01E+01
PAH Group 2											
Benzo(a)anthracene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	8.77E-01	1.15E+00
Benzo(a)pyrene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	8.77E-01	1.15E+00
Benzo(b)fluoranthene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	8.77E-01	1.15E+00
Benzo(k)fluoranthene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	8.77E-01	1.15E+00
Chrysene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	8.77E-01	1.15E+00

E2 Table 4- xicity Reference Values for Long-tailed Weasel

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjust-ment	TRV (mg/kg-day)
Dibenz(a,h)anthracene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	8.77E-01	1.15E+00
Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	Mouse	NOAEL	1.31	Life span and gastric neoplasms	Neal and Rigdon, 1967	1	1	1	8.77E-01	1.15E+00
Phthalate Esters											
Bis (2-ethylhexyl) phthalate	Bis (2-ethylhexyl) phthalate	Rat	LOAEL	200	Slowed growth; no effect on mortality, life expectancy, or reproduction	Carpenter et al., 1953	1	1	10	1.02E+00	2.03E+01
Diethylphthalate	Diethylphthalate	Mouse	NOAEL	4583	Testicular and accessory gland weight	Lamb et al., 1987.	1	1	1	8.77E-01	4.02E+03
Semivolatile Organic Compound											
Hexachlorobenzene	Hexachlorobenzene	Rat	NOAEL	2	Growth, feed consumption, hematological parametners, survival, viability index	Arnold et al., 1985	1	1	1	1.02E+00	2.03E+00
Phenol	Phenol	Rat	NOAEL	721	Liver abnormalitites	NCI, 1980	1	1	1	1.02E+00	7.33E+02
Volatile Organic Compound											
Acetone	Acetone	Rat	NOAEL	100	Liver and Kidney damage	EPA, 1986	10	1	1	1.02E+00	1.02E+01

Empty cells indicate that no toxicity data were available for the COPEC or a suitable surrogate.

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Concentration in Feed (mg/kg)	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjustment	TRV (mg/kg-day)
Dioxins												
2,3,7,8-TCDD TEQ	2,3,7,8-TCDD	Ring-necked Pheasant	NOAEL	Not Available	1.43E-05	Reproduction	Nosek et al., 1992	1	1	1	1.00E+00	1.43E-05
Inorganic												
Aluminum	Aluminum	Ring Dove	NOAEL	Not Available	1.10E+02	Reproduction	Carriere et al., 1986	1	1	1	1.00E+00	1.10E+02
Antimony	Antimony	Various Mammals	NOAEL	Not Available	6.00E-02	Reproduction, growth, and survival	EPA, 2003	1	10	1	1.00E+00	6.00E-03
Arsenic	Arsenic	Mallard Duck	NOAEL	Not Available	5.50E+00	Liver, egg, and body weight	Stanley et al., 1994	1	1	1	1.00E+00	5.50E+00
Barium	Barium	Chicks	NOAEL	Not Available	2.08E+01	Mortality	Johnson et al., 1960	1	1	1	1.00E+00	2.08E+01
Beryllium	Beryllium	Various Mammals	NOAEL	Not Available	4.80E-01	Reproduction, growth, and survival	EPA, 2003	1	10	1	1.00E+00	4.80E-02
Cadmium	Cadmium	Various	NOAEL	Not Available	1.60E+00	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	1.60E+00
Chromium	Chromium	Black Duck	NOAEL	Not Available	1.00E+00	Reproduction	Haseltine et al., 1985	1	1	1	1.00E+00	1.00E+00
Cobalt	Cobalt	Various	NOAEL	Not Available	7.60E+00	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	7.60E+00
Copper	Copper	Chicks	NOAEL	Not Available	2.30E+00	No effect on weight gain	Norvell and others, 1974	1	1	1	1.00E+00	2.30E+00
Lead	Lead	Various	NOAEL	Not Available	1.60E+00	Reproduction, growth, and survival	EPA, 2003	1	1	1	1.00E+00	1.60E+00
Manganese	Manganese	Japanese Quail	NOAEL	Not Available	7.76E+01	Growth, aggressive behavior	Laskey and Edens, 1985	1	1	1	1.00E+00	7.76E+01
Mercury	Mercury	Mallard Duck	NOAEL	Not Available	3.90E-02	Reproduction	EPA-Great Lakes, Heinz 1974, 1975, 1976, 1979	1	1	1	1.00E+00	3.90E-02
Nickel	Nickel	Mallard Duckling	NOAEL	Not Available	1.38E+00	No effect on tremors and edema in toe and leg joints	Cain and Pafford, 1981	1	1	1	1.00E+00	1.38E+00
Selenium	Selenium	Mallard Duck	NOAEL	Not Available	2.30E-01	Food consumption, growth, mortality	Heinz et al., 1988	1	1	1	1.00E+00	2.30E-01
Silver	Silver	Rat	LOAEL	0	8.90E+01	Ventricular hypertrophy	Olcott, 1950	1	10	10	1.00E+00	8.90E-01
Vanadium	Vanadium	Mallard Duck	NOAEL	110	1.14E+01	Weight loss, mortality, Vd residues in eggs	White and Deiter, 1978	1	1	1	1.00E+00	1.14E+01
Zinc	Zinc	Mallard Duck	NOAEL	Not Available	1.72E+01	Body weight, reproductive and pancreatic effects	Gasaway and Buss 1972	1	1	1	1.00E+00	1.72E+01
Misc. Organic												
Methylene chloride	Methylene chloride	Rat	NOAEL	Not Available	5.85E+00	Hepatic Effects	National Coffee Association, 1982.	1	10	1	1.00E+00	5.85E-01
PAH Group 1												
Anthracene	Phenanthrene	Mallard Duck	LOAEL	4000	2.09E+02 *	Increased liver weight and blood flow to liver	Patton and Dieter, 1980	1	1	10	1.00E+00	2.09E+01
Benzo(g,h,i)perylene	Phenanthrene	Mallard Duck	LOAEL	4000	2.09E+02 *	Increased liver weight and blood flow to liver	Patton and Dieter, 1980	1	1	10	1.00E+00	2.09E+01
Fluoranthene	Phenanthrene	Mallard Duck	LOAEL	4000	2.09E+02 *	Increased liver weight and blood flow to liver	Patton and Dieter, 1980	1	1	10	1.00E+00	2.09E+01
Phenanthrene	Phenanthrene	Mallard Duck	LOAEL	4000	2.09E+02 *	Increased liver weight and blood flow to liver	Patton and Dieter, 1980	1	1	10	1.00E+00	2.09E+01
Pyrene	Phenanthrene	Mallard Duck	LOAEL	4000	2.09E+02 *	Increased liver weight and blood flow to liver	Patton and Dieter, 1980	1	1	10	1.00E+00	2.09E+01

COPEC	Surrogate Chemical	Test Species	Endpoint Type	Concentration in Feed (mg/kg)	Dosage (mg/kg-day)	Effect or Measurement Endpoint	Reference	Chemical Extrapo-lation	Taxonomic Extrapo-lation	Endpoint Extrapo-lation	Allometric Adjustment	TRV (mg/kg-day)
PAH Group 2												
Benzo(a)anthracene	Phenanthrene	Mallard Duck	LOAEL	4000	2.09E+02 *	Increased liver weight and blood flow to liver	Patton and Dieter, 1980	10	1	10	1.00E+00	2.09E+00
Benzo(a)pyrene	Phenanthrene	Mallard Duck	LOAEL	4000	2.09E+02 *	Increased liver weight and blood flow to liver	Patton and Dieter, 1980	10	1	10	1.00E+00	2.09E+00
Benzo(b)fluoranthene	Phenanthrene	Mallard Duck	LOAEL	4000	2.09E+02 *	Increased liver weight and blood flow to liver	Patton and Dieter, 1980	10	1	10	1.00E+00	2.09E+00
Benzo(k)fluoranthene	Phenanthrene	Mallard Duck	LOAEL	4000	2.09E+02 *	Increased liver weight and blood flow to liver	Patton and Dieter, 1980	10	1	10	1.00E+00	2.09E+00
Chrysene	Phenanthrene	Mallard Duck	LOAEL	4000	2.09E+02 *	Increased liver weight and blood flow to liver	Patton and Dieter, 1980	10	1	10	1.00E+00	2.09E+00
Dibenz(a,h)anthracene	Phenanthrene	Mallard Duck	LOAEL	4000	2.09E+02 *	Increased liver weight and blood flow to liver	Patton and Dieter, 1980	10	1	10	1.00E+00	2.09E+00
Indeno(1,2,3-cd)pyrene	Phenanthrene	Mallard Duck	LOAEL	4000	2.09E+02 *	Increased liver weight and blood flow to liver	Patton and Dieter, 1980	10	1	10	1.00E+00	2.09E+00
Phthalate Esters												
Bis (2-ethylhexyl) phthalate	Bis (2-ethylhexyl) phthalate	Ringed Dove	NOAEL	Not Available	1.10E+00	Reproduction	Peakall, 1974	1	1	1	1.00E+00	1.10E+00
Diethylphthalate	Bis (2-ethylhexyl) phthalate	Ringed Dove	NOAEL	Not Available	1.10E+00	Reproduction	Peakall, 1974	1	1	1	1.00E+00	1.10E+00
Semivolatile Organic Compound												
Hexachlorobenzene	Hexachlorobenzene	Japanese Quail	NOAEL	5	4.32E-01 *	Decreased egg volume	Vos et al., 1971	1	1	1	1.00E+00	4.32E-01
Phenol	Phenol	Rat	NOAEL	Not Available	7.21E+02	Liver abnormalitites	NCI, 1980	1	10	1	1.00E+00	7.21E+01
Volatile Organic Compound												
Acetone	Acetone	Rat	NOAEL	0	1.00E+02	Liver and Kidney damage	EPA, 1986	1	10	1	1.00E+00	1.00E+01

* = Dose calculated from concentration in feed as described in the text.
Empty cells indicate that no toxicity data were available for the COPEC or a suitable surrogate.

E2 Table 5-1. Ornate Shrew Soil Pathway, Anomaly Area 3, Tier 1 Screen

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
2,3,7,8-TCDD TEQ	1.85E-05	3.56E-07	0.00E+00	2.79E-05	2.83E-05	1.28E-06	2E+01	1
Aluminum	1.58E+04	3.05E+02	0.00E+00	1.73E+03	2.03E+03	2.13E+00	1E+03	1
Antimony	2.10E+00	4.05E-02	0.00E+00	1.51E-01	1.92E-01	6.00E-02	3E+00	1
Arsenic	4.63E+00	8.92E-02	0.00E+00	2.29E-01	3.18E-01	4.09E-01	8E-01	1
Barium	1.87E+02	3.60E+00	0.00E+00	5.47E+00	9.07E+00	4.80E+01	2E-01	1
Beryllium	3.10E-01	5.97E-03	0.00E+00	4.48E-03	1.05E-02	4.80E-01	2E-02	1
Cadmium	1.00E+00	1.93E-02	0.00E+00	2.66E+00	2.68E+00	5.50E-01	5E+00	1
Chromium	1.58E+01	3.05E-01	0.00E+00	1.55E+00	1.86E+00	3.50E+03	5E-04	1
Cobalt	7.60E+00	1.46E-01	0.00E+00	2.98E-01	4.44E-01	7.30E+00	6E-02	1
Copper	1.08E+01	2.08E-01	0.00E+00	1.79E+00	1.99E+00	2.95E+00	7E-01	1
Lead	2.07E+01	3.99E-01	0.00E+00	2.98E+00	3.38E+00	5.80E+00	6E-01	1
Manganese	2.89E+02	5.57E+00	0.00E+00	6.82E+00	1.24E+01	1.51E+01	8E-01	1
Mercury	6.90E-02	1.33E-03	0.00E+00	1.18E-01	1.20E-01	3.20E-01	4E-01	1
Nickel	1.37E+01	2.64E-01	0.00E+00	4.66E+00	4.92E+00	1.67E-01	3E+01	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Selenium	1.10E+00	2.12E-02	0.00E+00	3.20E-01	3.41E-01	5.46E-02	6E+00	1
Silver	2.00E+00	3.85E-02	0.00E+00	1.32E+00	1.36E+00	1.14E+01	1E-01	1
Vanadium	4.41E+01	8.50E-01	0.00E+00	3.17E+00	4.02E+00	1.14E+00	4E+00	1
Zinc	5.71E+01	1.10E+00	0.00E+00	1.04E+02	1.05E+02	1.05E+01	1E+01	1
Methylene chloride	9.20E-03	1.77E-04	0.00E+00	2.96E-03	3.13E-03	7.48E+00	4E-04	1
Anthracene	4.40E-02	8.48E-04	0.00E+00	4.52E-03	5.37E-03	6.30E+01	9E-05	1
Benzo(g,h,i)perylene	4.40E-01	8.48E-03	0.00E+00	2.12E-02	2.97E-02	6.30E+01	5E-04	1
Fluoranthene	1.00E+00	1.93E-02	0.00E+00	1.19E-01	1.38E-01	6.30E+01	2E-03	1
Phenanthrene	2.90E-01	5.59E-03	0.00E+00	2.61E-02	3.17E-02	6.30E+01	5E-04	1
Pyrene	9.60E-01	1.85E-02	0.00E+00	1.20E-01	1.39E-01	6.30E+01	2E-03	1
Benzo(a)anthracene	7.30E-01	1.41E-02	0.00E+00	6.33E-02	7.74E-02	1.45E+00	5E-02	1
Benzo(a)pyrene	1.03E+00	1.99E-02	0.00E+00	1.12E-01	1.32E-01	1.45E+00	9E-02	1
Benzo(b)fluoranthene	1.79E+00	3.45E-02	0.00E+00	1.21E-01	1.55E-01	1.45E+00	1E-01	1
Benzo(k)fluoranthene	5.10E-01	9.83E-03	0.00E+00	3.44E-02	4.42E-02	1.45E+00	3E-02	1
Chrysene	8.70E-01	1.68E-02	0.00E+00	3.63E-02	5.31E-02	1.45E+00	4E-02	1
Dibenz(a,h)anthracene	9.70E-02	1.87E-03	0.00E+00	1.62E-03	3.49E-03	1.45E+00	2E-03	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Indeno(1,2,3-cd)pyrene	4.60E-01	8.87E-03	0.00E+00	6.06E-02	6.94E-02	1.45E+00	5E-02	1
Bis (2-ethylhexyl) phthalate	7.00E-02	1.35E-03	0.00E+00	1.30E+00	1.30E+00	2.56E+01	5E-02	1
Diethylphthalate	2.25E-01	4.34E-03	0.00E+00	4.18E+00	4.19E+00	5.06E+03	8E-04	1
Hexachlorobenzene	1.50E-01	2.89E-03	0.00E+00	8.14E-02	8.43E-02	2.56E+00	3E-02	1
Phenol	9.36E-01	1.80E-02	0.00E+00	3.01E-01	3.19E-01	9.22E+02	3E-04	1
Acetone	1.00E-01	1.93E-03	0.00E+00	3.21E-02	3.40E-02	1.28E+01	3E-03	1

E2 Table 5-2. Deer Mouse Soil Pathway, Anomaly Area 3, Tier 1 Screen

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
2,3,7,8-TCDD TEQ	1.85E-05	7.06E-08	5.44E-07	0.00E+00	6.14E-07	1.19E-06	5E-01	1
Aluminum	1.58E+04	6.04E+01	5.44E-01	0.00E+00	6.10E+01	1.98E+00	3E+01	1
Antimony	2.10E+00	8.03E-03	1.51E-02	0.00E+00	2.32E-02	6.00E-02	4E-01	1
Arsenic	4.63E+00	1.77E-02	3.32E-02	0.00E+00	5.09E-02	3.80E-01	1E-01	1
Barium	1.87E+02	7.15E-01	5.58E+00	0.00E+00	6.30E+00	4.80E+01	1E-01	1
Beryllium	3.10E-01	1.19E-03	5.93E-04	0.00E+00	1.78E-03	4.80E-01	4E-03	1
Cadmium	1.00E+00	3.83E-03	1.19E-01	0.00E+00	1.23E-01	5.50E-01	2E-01	1
Chromium	1.58E+01	6.04E-02	1.24E-01	0.00E+00	1.84E-01	3.25E+03	6E-05	1
Cobalt	7.60E+00	2.91E-02	1.09E-02	0.00E+00	4.00E-02	7.30E+00	5E-03	1
Copper	1.08E+01	4.13E-02	9.53E-01	0.00E+00	9.94E-01	2.74E+00	4E-01	1
Lead	2.07E+01	7.92E-02	2.77E-01	0.00E+00	3.57E-01	5.80E+00	6E-02	1
Manganese	2.89E+02	1.11E+00	4.37E+00	0.00E+00	5.47E+00	1.41E+01	4E-01	1
Mercury	6.90E-02	2.64E-04	1.65E-02	0.00E+00	1.68E-02	2.97E-01	6E-02	1
Nickel	1.37E+01	5.24E-02	1.47E-01	0.00E+00	1.99E-01	1.55E-01	1E+00	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Selenium	1.10E+00	4.21E-03	1.08E-01	0.00E+00	1.12E-01	5.07E-02	2E+00	1
Silver	2.00E+00	7.65E-03	5.36E-03	0.00E+00	1.30E-02	1.06E+01	1E-03	1
Vanadium	4.41E+01	1.69E-01	1.10E-02	0.00E+00	1.80E-01	1.06E+00	2E-01	1
Zinc	5.71E+01	2.18E-01	8.69E+00	0.00E+00	8.91E+00	9.76E+00	9E-01	1
Methylene chloride	9.20E-03	3.52E-05	1.19E-02	0.00E+00	1.19E-02	6.95E+00	2E-03	1
Anthracene	4.40E-02	1.68E-04	1.38E-02	0.00E+00	1.40E-02	5.86E+01	2E-04	1
Benzo(g,h,i)perylene	4.40E-01	1.68E-03	5.06E-03	0.00E+00	6.75E-03	5.86E+01	1E-04	1
Fluoranthene	1.00E+00	3.83E-03	4.72E-01	0.00E+00	4.76E-01	5.86E+01	8E-03	1
Phenanthrene	2.90E-01	1.11E-03	2.13E-01	0.00E+00	2.14E-01	5.86E+01	4E-03	1
Pyrene	9.60E-01	3.67E-03	3.40E-01	0.00E+00	3.43E-01	5.86E+01	6E-03	1
Benzo(a)anthracene	7.30E-01	2.79E-03	7.50E-02	0.00E+00	7.78E-02	1.34E+00	6E-02	1
Benzo(a)pyrene	1.03E+00	3.94E-03	2.50E-02	0.00E+00	2.90E-02	1.34E+00	2E-02	1
Benzo(b)fluoranthene	1.79E+00	6.85E-03	5.92E-02	0.00E+00	6.61E-02	1.34E+00	5E-02	1
Benzo(k)fluoranthene	5.10E-01	1.95E-03	2.49E-02	0.00E+00	2.68E-02	1.34E+00	2E-02	1
Chrysene	8.70E-01	3.33E-03	1.30E-01	0.00E+00	1.34E-01	1.34E+00	1E-01	1
Dibenz(a,h)anthracene	9.70E-02	3.71E-04	2.38E-03	0.00E+00	2.75E-03	1.34E+00	2E-03	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Indeno(1,2,3-cd)pyrene	4.60E-01	1.76E-03	9.68E-03	0.00E+00	1.14E-02	1.34E+00	9E-03	1
Bis (2-ethylhexyl) phthalate	7.00E-02	2.68E-04	1.16E-03	0.00E+00	1.43E-03	2.38E+01	6E-05	1
Diethylphthalate	2.25E-01	8.61E-04	9.04E-01	0.00E+00	9.05E-01	4.70E+03	2E-04	1
Hexachlorobenzene	1.50E-01	5.74E-04	3.16E-03	0.00E+00	3.73E-03	2.38E+00	2E-03	1
Phenol	9.36E-01	3.58E-03	1.20E+01	0.00E+00	1.21E+01	8.57E+02	1E-02	1
Acetone	1.00E-01	3.83E-04	4.84E-01	0.00E+00	4.84E-01	1.19E+01	4E-02	1

E2 Table 5-3. Long-tailed Weasel Soil Pathway, Anomaly Area 3, Tier 1 Screen

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
2,3,7,8-TCDD TEQ	1.85E-05	1.73E-07	0.00E+00	0.00E+00	1.09E-10	1.12E-09	1.74E-07	1.02E-06	2E-01	1
Aluminum	1.58E+04	1.48E+02	0.00E+00	0.00E+00	8.14E-04	6.09E-03	1.48E+02	1.69E+00	9E+01	1
Antimony	2.10E+00	1.97E-02	0.00E+00	0.00E+00	6.18E-07	1.15E-06	1.97E-02	6.00E-02	3E-01	1
Arsenic	4.63E+00	4.34E-02	0.00E+00	0.00E+00	6.80E-07	9.54E-07	4.34E-02	3.25E-01	1E-01	1
Barium	1.87E+02	1.75E+00	0.00E+00	0.00E+00	2.80E-05	9.07E-06	1.75E+00	4.80E+01	4E-02	1
Beryllium	3.10E-01	2.90E-03	0.00E+00	0.00E+00	1.27E-08	1.67E-08	2.90E-03	4.80E-01	6E-03	1
Cadmium	1.00E+00	9.36E-03	0.00E+00	0.00E+00	1.75E-05	8.57E-05	9.47E-03	5.50E-01	2E-02	1
Chromium	1.58E+01	1.48E-01	0.00E+00	0.00E+00	3.94E-06	8.92E-06	1.48E-01	2.78E+03	5E-05	1
Cobalt	7.60E+00	7.12E-02	0.00E+00	0.00E+00	3.56E-07	8.89E-07	7.12E-02	7.30E+00	1E-02	1
Copper	1.08E+01	1.01E-01	0.00E+00	0.00E+00	8.85E-05	3.99E-05	1.01E-01	2.34E+00	4E-02	1
Lead	2.07E+01	1.94E-01	0.00E+00	0.00E+00	9.21E-07	1.96E-06	1.94E-01	5.80E+00	3E-02	1
Manganese	2.89E+02	2.71E+00	0.00E+00	0.00E+00	2.44E-04	1.24E-04	2.71E+00	1.20E+01	2E-01	1
Mercury	6.90E-02	6.46E-04	0.00E+00	0.00E+00	1.49E-05	2.39E-05	6.85E-04	2.54E-01	3E-03	1
Nickel	1.37E+01	1.28E-01	0.00E+00	0.00E+00	1.77E-06	9.85E-06	1.28E-01	1.33E-01	1E+00	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Selenium	1.10E+00	1.03E-02	0.00E+00	0.00E+00	9.99E-04	6.81E-04	1.20E-02	4.34E-02	3E-01	1
Silver	2.00E+00	1.87E-02	0.00E+00	0.00E+00	1.97E-06	4.61E-05	1.88E-02	9.05E+00	2E-03	1
Vanadium	4.41E+01	4.13E-01	0.00E+00	0.00E+00	3.68E-06	1.85E-05	4.13E-01	9.05E-01	5E-01	1
Zinc	5.71E+01	5.35E-01	0.00E+00	0.00E+00	3.96E-03	1.05E-02	5.49E-01	8.35E+00	7E-02	1
Methylene chloride	9.20E-03	8.62E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.62E-05	5.95E+00	1E-05	1
Anthracene	4.40E-02	4.12E-04	0.00E+00	0.00E+00	1.59E-07	1.37E-08	4.12E-04	5.01E+01	8E-06	1
Benzo(g,h,i)perylene	4.40E-01	4.12E-03	0.00E+00	0.00E+00	1.06E-06	1.04E-06	4.12E-03	5.01E+01	8E-05	1
Fluoranthene	1.00E+00	9.36E-03	0.00E+00	0.00E+00	1.09E-05	7.07E-07	9.38E-03	5.01E+01	2E-04	1
Phenanthrene	2.90E-01	2.72E-03	0.00E+00	0.00E+00	2.44E-06	8.11E-08	2.72E-03	5.01E+01	5E-05	1
Pyrene	9.60E-01	8.99E-03	0.00E+00	0.00E+00	7.73E-06	7.02E-07	9.00E-03	5.01E+01	2E-04	1
Benzo(a)anthracene	7.30E-01	6.84E-03	0.00E+00	0.00E+00	3.60E-06	8.05E-07	6.84E-03	1.15E+00	6E-03	1
Benzo(a)pyrene	1.03E+00	9.65E-03	0.00E+00	0.00E+00	2.21E-06	2.27E-06	9.65E-03	1.15E+00	8E-03	1
Benzo(b)fluoranthene	1.79E+00	1.68E-02	0.00E+00	0.00E+00	5.63E-06	2.97E-06	1.68E-02	1.15E+00	1E-02	1
Benzo(k)fluoranthene	5.10E-01	4.78E-03	0.00E+00	0.00E+00	2.29E-06	8.47E-07	4.78E-03	1.15E+00	4E-03	1
Chrysene	8.70E-01	8.15E-03	0.00E+00	0.00E+00	6.19E-06	5.52E-07	8.15E-03	1.15E+00	7E-03	1
Dibenz(a,h)anthracene	9.70E-02	9.08E-04	0.00E+00	0.00E+00	4.25E-07	1.21E-07	9.09E-04	1.15E+00	8E-04	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Indeno(1,2,3-cd)pyrene	4.60E-01	4.31E-03	0.00E+00	0.00E+00	1.69E-06	2.31E-06	4.31E-03	1.15E+00	4E-03	1
Bis (2-ethylhexyl) phthalate	7.00E-02	6.56E-04	0.00E+00	0.00E+00	4.66E-07	9.54E-05	7.51E-04	2.03E+01	4E-05	1
Diethylphthalate	2.25E-01	2.11E-03	0.00E+00	0.00E+00	8.46E-07	8.80E-07	2.11E-03	4.02E+03	5E-07	1
Hexachlorobenzene	1.50E-01	1.40E-03	0.00E+00	0.00E+00	2.17E-07	1.10E-06	1.41E-03	2.03E+00	7E-04	1
Phenol	9.36E-01	8.77E-03	0.00E+00	0.00E+00	3.23E-06	1.92E-08	8.77E-03	7.33E+02	1E-05	1
Acetone	1.00E-01	9.36E-04	0.00E+00	0.00E+00	1.60E-08	2.52E-10	9.37E-04	1.02E+01	9E-05	1

E2 Table 5-4. Mourning Dove Soil Pathway, Anomaly Area 3, Tier 1 Screen

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
2,3,7,8-TCDD TEQ	3.53E-05	5.25E-07	8.70E-07	0.00E+00	1.40E-06	1.43E-05	1E-01	1
Aluminum	1.58E+04	2.35E+02	4.55E-01	0.00E+00	2.36E+02	1.10E+02	2E+00	1
Antimony	2.10E+00	3.13E-02	1.27E-02	0.00E+00	4.39E-02	6.00E-03	7E+00	1
Arsenic	4.63E+00	6.89E-02	2.78E-02	0.00E+00	9.67E-02	5.50E+00	2E-02	1
Barium	1.87E+02	2.78E+00	4.67E+00	0.00E+00	7.46E+00	2.08E+01	4E-01	1
Beryllium	3.10E-01	4.62E-03	4.96E-04	0.00E+00	5.11E-03	4.80E-02	1E-01	1
Cadmium	1.00E+00	1.49E-02	9.96E-02	0.00E+00	1.14E-01	1.60E+00	7E-02	1
Chromium	1.58E+01	2.35E-01	1.04E-01	0.00E+00	3.39E-01	1.00E+00	3E-01	1
Cobalt	7.60E+00	1.13E-01	9.13E-03	0.00E+00	1.22E-01	7.60E+00	2E-02	1
Copper	1.08E+01	1.61E-01	7.97E-01	0.00E+00	9.58E-01	2.30E+00	4E-01	1
Lead	2.07E+01	3.08E-01	2.32E-01	0.00E+00	5.41E-01	1.60E+00	3E-01	1
Manganese	2.89E+02	4.30E+00	3.66E+00	0.00E+00	7.96E+00	7.76E+01	1E-01	1
Mercury	6.90E-02	1.03E-03	1.38E-02	0.00E+00	1.48E-02	3.90E-02	4E-01	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Nickel	1.37E+01	2.04E-01	1.23E-01	0.00E+00	3.27E-01	1.38E+00	2E-01	1
Selenium	1.10E+00	1.64E-02	9.04E-02	0.00E+00	1.07E-01	2.30E-01	5E-01	1
Silver	2.00E+00	2.98E-02	4.48E-03	0.00E+00	3.43E-02	8.90E-01	4E-02	1
Vanadium	4.41E+01	6.57E-01	9.18E-03	0.00E+00	6.66E-01	1.14E+01	6E-02	1
Zinc	5.71E+01	8.50E-01	7.27E+00	0.00E+00	8.12E+00	1.72E+01	5E-01	1
Methylene chloride	9.20E-03	1.37E-04	9.93E-03	0.00E+00	1.01E-02	5.85E-01	2E-02	1
Anthracene	4.40E-02	6.55E-04	1.16E-02	0.00E+00	1.22E-02	2.09E+01	6E-04	1
Benzo(g,h,i)perylene	4.40E-01	6.55E-03	4.24E-03	0.00E+00	1.08E-02	2.09E+01	5E-04	1
Fluoranthene	1.00E+00	1.49E-02	3.96E-01	0.00E+00	4.10E-01	2.09E+01	2E-02	1
Phenanthrene	2.90E-01	4.32E-03	1.78E-01	0.00E+00	1.83E-01	2.09E+01	9E-03	1
Pyrene	9.60E-01	1.43E-02	2.84E-01	0.00E+00	2.99E-01	2.09E+01	1E-02	1
Benzo(a)anthracene	7.30E-01	1.09E-02	6.28E-02	0.00E+00	7.36E-02	2.09E+00	4E-02	1
Benzo(a)pyrene	1.03E+00	1.53E-02	2.09E-02	0.00E+00	3.63E-02	2.09E+00	2E-02	1
Benzo(b)fluoranthene	1.79E+00	2.67E-02	4.96E-02	0.00E+00	7.62E-02	2.09E+00	4E-02	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Benzo(k)fluoranthene	5.10E-01	7.59E-03	2.08E-02	0.00E+00	2.84E-02	2.09E+00	1E-02	1
Chrysene	8.70E-01	1.30E-02	1.09E-01	0.00E+00	1.22E-01	2.09E+00	6E-02	1
Dibenz(a,h)anthracene	9.70E-02	1.44E-03	1.99E-03	0.00E+00	3.43E-03	2.09E+00	2E-03	1
Indeno(1,2,3-cd)pyrene	4.60E-01	6.85E-03	8.10E-03	0.00E+00	1.50E-02	2.09E+00	7E-03	1
Bis (2-ethylhexyl) phthalate	7.00E-02	1.04E-03	9.73E-04	0.00E+00	2.02E-03	1.10E+00	2E-03	1
Diethylphthalate	2.25E-01	3.35E-03	7.57E-01	0.00E+00	7.60E-01	1.10E+00	7E-01	1
Hexachlorobenzene	1.50E-01	2.23E-03	2.64E-03	0.00E+00	4.88E-03	4.32E-01	1E-02	1
Phenol	9.36E-01	1.39E-02	1.01E+01	0.00E+00	1.01E+01	7.21E+01	1E-01	1
Acetone	1.00E-01	1.49E-03	4.05E-01	0.00E+00	4.07E-01	1.00E+01	4E-02	1

E2 Table 5-5. Western Meadowlark Soil Pathway, Anomaly Area 3, Tier 1 Screen

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
2,3,7,8-TCDD TEQ	3.53E-05	7.09E-07	0.00E+00	4.04E-05	4.11E-05	1.43E-05	3E+00	1
Aluminum	1.58E+04	3.17E+02	0.00E+00	1.16E+03	1.48E+03	1.10E+02	1E+01	1
Antimony	2.10E+00	4.22E-02	0.00E+00	1.02E-01	1.44E-01	6.00E-03	2E+01	1
Arsenic	4.63E+00	9.30E-02	0.00E+00	1.54E-01	2.47E-01	5.50E+00	4E-02	1
Barium	1.87E+02	3.76E+00	0.00E+00	3.68E+00	7.43E+00	2.08E+01	4E-01	1
Beryllium	3.10E-01	6.23E-03	0.00E+00	3.01E-03	9.24E-03	4.80E-02	2E-01	1
Cadmium	1.00E+00	2.01E-02	0.00E+00	1.79E+00	1.81E+00	1.60E+00	1E+00	1
Chromium	1.58E+01	3.17E-01	0.00E+00	1.04E+00	1.36E+00	1.00E+00	1E+00	1
Cobalt	7.60E+00	1.53E-01	0.00E+00	2.00E-01	3.53E-01	7.60E+00	5E-02	1
Copper	1.08E+01	2.17E-01	0.00E+00	1.20E+00	1.42E+00	2.30E+00	6E-01	1
Lead	2.07E+01	4.16E-01	0.00E+00	2.00E+00	2.42E+00	1.60E+00	2E+00	1
Manganese	2.89E+02	5.80E+00	0.00E+00	4.59E+00	1.04E+01	7.76E+01	1E-01	1
Mercury	6.90E-02	1.39E-03	0.00E+00	7.95E-02	8.09E-02	3.90E-02	2E+00	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Nickel	1.37E+01	2.75E-01	0.00E+00	3.13E+00	3.41E+00	1.38E+00	2E+00	1
Selenium	1.10E+00	2.21E-02	0.00E+00	2.15E-01	2.37E-01	2.30E-01	1E+00	1
Silver	2.00E+00	4.02E-02	0.00E+00	8.85E-01	9.26E-01	8.90E-01	1E+00	1
Vanadium	4.41E+01	8.86E-01	0.00E+00	2.13E+00	3.02E+00	1.14E+01	3E-01	1
Zinc	5.71E+01	1.15E+00	0.00E+00	6.96E+01	7.08E+01	1.72E+01	4E+00	1
Methylene chloride	9.20E-03	1.85E-04	0.00E+00	1.99E-03	2.17E-03	5.85E-01	4E-03	1
Anthracene	4.40E-02	8.84E-04	0.00E+00	3.04E-03	3.92E-03	2.09E+01	2E-04	1
Benzo(g,h,i)perylene	4.40E-01	8.84E-03	0.00E+00	1.43E-02	2.31E-02	2.09E+01	1E-03	1
Fluoranthene	1.00E+00	2.01E-02	0.00E+00	7.99E-02	1.00E-01	2.09E+01	5E-03	1
Phenanthrene	2.90E-01	5.82E-03	0.00E+00	1.75E-02	2.34E-02	2.09E+01	1E-03	1
Pyrene	9.60E-01	1.93E-02	0.00E+00	8.09E-02	1.00E-01	2.09E+01	5E-03	1
Benzo(a)anthracene	7.30E-01	1.47E-02	0.00E+00	4.26E-02	5.72E-02	2.09E+00	3E-02	1
Benzo(a)pyrene	1.03E+00	2.07E-02	0.00E+00	7.56E-02	9.63E-02	2.09E+00	5E-02	1
Benzo(b)fluoranthene	1.79E+00	3.60E-02	0.00E+00	8.12E-02	1.17E-01	2.09E+00	6E-02	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Benzo(k)fluoranthene	5.10E-01	1.02E-02	0.00E+00	2.31E-02	3.34E-02	2.09E+00	2E-02	1
Chrysene	8.70E-01	1.75E-02	0.00E+00	2.44E-02	4.19E-02	2.09E+00	2E-02	1
Dibenz(a,h)anthracene	9.70E-02	1.95E-03	0.00E+00	1.09E-03	3.04E-03	2.09E+00	1E-03	1
Indeno(1,2,3-cd)pyrene	4.60E-01	9.24E-03	0.00E+00	4.07E-02	5.00E-02	2.09E+00	2E-02	1
Bis (2-ethylhexyl) phthalate	7.00E-02	1.41E-03	0.00E+00	8.75E-01	8.77E-01	1.10E+00	8E-01	1
Diethylphthalate	2.25E-01	4.52E-03	0.00E+00	2.81E+00	2.82E+00	1.10E+00	3E+00	1
Hexachlorobenzene	1.50E-01	3.01E-03	0.00E+00	5.47E-02	5.78E-02	4.32E-01	1E-01	1
Phenol	9.36E-01	1.88E-02	0.00E+00	2.02E-01	2.21E-01	7.21E+01	3E-03	1
Acetone	1.00E-01	2.01E-03	0.00E+00	2.16E-02	2.36E-02	1.00E+01	2E-03	1

E2 Table 5-6. Red-shouldered Hawk Soil Pathway, Anomaly Area 3, Tier 1 Screen

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
2,3,7,8-TCDD TEQ	3.53E-05	1.18E-07	0.00E+00	0.00E+00	1.11E-10	1.29E-09	1.19E-07	1.43E-05	8E-03	1
Aluminum	1.58E+04	5.29E+01	0.00E+00	0.00E+00	4.36E-04	3.26E-03	5.29E+01	1.10E+02	5E-01	1
Antimony	2.10E+00	7.03E-03	0.00E+00	0.00E+00	3.31E-07	6.16E-07	7.03E-03	6.00E-03	1E+00	1
Arsenic	4.63E+00	1.55E-02	0.00E+00	0.00E+00	3.64E-07	5.11E-07	1.55E-02	5.50E+00	3E-03	1
Barium	1.87E+02	6.26E-01	0.00E+00	0.00E+00	1.50E-05	4.86E-06	6.26E-01	2.08E+01	3E-02	1
Beryllium	3.10E-01	1.04E-03	0.00E+00	0.00E+00	6.79E-09	8.96E-09	1.04E-03	4.80E-02	2E-02	1
Cadmium	1.00E+00	3.35E-03	0.00E+00	0.00E+00	9.37E-06	4.59E-05	3.40E-03	1.60E+00	2E-03	1
Chromium	1.58E+01	5.29E-02	0.00E+00	0.00E+00	2.11E-06	4.78E-06	5.29E-02	1.00E+00	5E-02	1
Cobalt	7.60E+00	2.54E-02	0.00E+00	0.00E+00	1.91E-07	4.76E-07	2.54E-02	7.60E+00	3E-03	1
Copper	1.08E+01	3.61E-02	0.00E+00	0.00E+00	4.74E-05	2.14E-05	3.62E-02	2.30E+00	2E-02	1
Lead	2.07E+01	6.93E-02	0.00E+00	0.00E+00	4.93E-07	1.05E-06	6.93E-02	1.60E+00	4E-02	1
Manganese	2.89E+02	9.67E-01	0.00E+00	0.00E+00	1.31E-04	6.64E-05	9.67E-01	7.76E+01	1E-02	1
Mercury	6.90E-02	2.31E-04	0.00E+00	0.00E+00	8.00E-06	1.28E-05	2.52E-04	3.90E-02	6E-03	1
Nickel	1.37E+01	4.58E-02	0.00E+00	0.00E+00	9.50E-07	5.28E-06	4.58E-02	1.38E+00	3E-02	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Selenium	1.10E+00	3.68E-03	0.00E+00	0.00E+00	5.35E-04	3.65E-04	4.58E-03	2.30E-01	2E-02	1
Silver	2.00E+00	6.69E-03	0.00E+00	0.00E+00	1.05E-06	2.47E-05	6.72E-03	8.90E-01	8E-03	1
Vanadium	4.41E+01	1.48E-01	0.00E+00	0.00E+00	1.97E-06	9.92E-06	1.48E-01	1.14E+01	1E-02	1
Zinc	5.71E+01	1.91E-01	0.00E+00	0.00E+00	2.12E-03	5.61E-03	1.99E-01	1.72E+01	1E-02	1
Methylene chloride	9.20E-03	3.08E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.08E-05	5.85E-01	5E-05	1
Anthracene	4.40E-02	1.47E-04	0.00E+00	0.00E+00	8.53E-08	7.37E-09	1.47E-04	2.09E+01	7E-06	1
Benzo(g,h,i)perylene	4.40E-01	1.47E-03	0.00E+00	0.00E+00	5.67E-07	5.60E-07	1.47E-03	2.09E+01	7E-05	1
Fluoranthene	1.00E+00	3.35E-03	0.00E+00	0.00E+00	5.82E-06	3.79E-07	3.35E-03	2.09E+01	2E-04	1
Phenanthrene	2.90E-01	9.70E-04	0.00E+00	0.00E+00	1.31E-06	4.34E-08	9.72E-04	2.09E+01	5E-05	1
Pyrene	9.60E-01	3.21E-03	0.00E+00	0.00E+00	4.14E-06	3.76E-07	3.22E-03	2.09E+01	2E-04	1
Benzo(a)anthracene	7.30E-01	2.44E-03	0.00E+00	0.00E+00	1.93E-06	4.31E-07	2.44E-03	2.09E+00	1E-03	1
Benzo(a)pyrene	1.03E+00	3.45E-03	0.00E+00	0.00E+00	1.18E-06	1.22E-06	3.45E-03	2.09E+00	2E-03	1
Benzo(b)fluoranthene	1.79E+00	5.99E-03	0.00E+00	0.00E+00	3.02E-06	1.59E-06	5.99E-03	2.09E+00	3E-03	1
Benzo(k)fluoranthene	5.10E-01	1.71E-03	0.00E+00	0.00E+00	1.22E-06	4.54E-07	1.71E-03	2.09E+00	8E-04	1
Chrysene	8.70E-01	2.91E-03	0.00E+00	0.00E+00	3.32E-06	2.96E-07	2.91E-03	2.09E+00	1E-03	1
Dibenz(a,h)anthracene	9.70E-02	3.25E-04	0.00E+00	0.00E+00	2.28E-07	6.51E-08	3.25E-04	2.09E+00	2E-04	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Indeno(1,2,3-cd)pyrene	4.60E-01	1.54E-03	0.00E+00	0.00E+00	9.06E-07	1.24E-06	1.54E-03	2.09E+00	7E-04	1
Bis (2-ethylhexyl) phthalate	7.00E-02	2.34E-04	0.00E+00	0.00E+00	2.50E-07	5.11E-05	2.86E-04	1.10E+00	3E-04	1
Diethylphthalate	2.25E-01	7.53E-04	0.00E+00	0.00E+00	4.53E-07	4.71E-07	7.54E-04	1.10E+00	7E-04	1
Hexachlorobenzene	1.50E-01	5.02E-04	0.00E+00	0.00E+00	1.17E-07	5.92E-07	5.03E-04	4.32E-01	1E-03	1
Phenol	9.36E-01	3.13E-03	0.00E+00	0.00E+00	1.73E-06	1.03E-08	3.13E-03	7.21E+01	4E-05	1
Acetone	1.00E-01	3.35E-04	0.00E+00	0.00E+00	8.55E-09	1.35E-10	3.35E-04	1.00E+01	3E-05	1

E2 Table 5-7. Deer Mouse Phreatophyte Pathway, Anomaly Area 3, Tier 1 Screen

Chemical	Groundwater Concentration (mg/L)	Subsurface Soil Concentration (mg/kg-dw)	Plant Concentration (mg/kg-dw)	Plant Ingested Dose (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
2-Butanone	1.00E-03	2.14E-04	1.44E-03	2.75E-04	2.06E+02	1E-06	1
3/4-Methylphenol	6.00E-03	2.96E-03	1.15E-01	2.21E-02	5.94E+01	4E-04	1
4-Methyl-2-pentanone	1.35E-02	3.91E-03	2.64E-02	5.06E-03	2.97E+02	2E-05	1
Aluminum	1.70E+00	2.55E+03	4.59E-01	8.78E-02	1.98E+00	4E-02	1
Antimony	2.85E-02	1.29E+00	4.77E-02	9.12E-03	6.00E-02	2E-01	1
Arsenic	6.02E-02	1.76E+00	6.60E-02	1.26E-02	3.80E-01	3E-02	1
Barium	3.32E-01	1.37E+01	2.13E+00	4.08E-01	4.80E+01	9E-03	1
Bis (2-ethylhexyl) phthalate	3.90E-03	2.04E+00	1.77E-01	3.39E-02	2.38E+01	1E-03	1
Butylbenzylphthalate	7.00E-04	7.15E-02	1.04E-01	1.98E-02	2.38E+01	8E-04	1
Cadmium	2.10E-03	1.58E-01	9.25E-02	1.77E-02	5.50E-01	3E-02	1
Chloroform	9.50E-04	4.18E-04	1.17E-03	2.25E-04	1.78E+01	1E-05	1
Chromium	3.57E-01	6.85E+00	2.81E-01	5.38E-02	3.25E+03	2E-05	1
Cobalt	1.29E-02	5.84E-01	4.38E-03	8.37E-04	7.30E+00	1E-04	1
Copper	4.72E-02	1.66E+00	2.07E-01	3.95E-02	2.74E+00	1E-02	1

Chemical	Groundwater Concentration (mg/L)	Subsurface Soil Concentration (mg/kg-dw)	Plant Concentration (mg/kg-dw)	Plant Ingested Dose (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Diethylphthalate	2.00E-03	1.23E-03	2.58E-02	4.93E-03	4.70E+03	1E-06	1
Lead	7.75E-03	6.98E+00	2.71E-01	5.18E-02	5.80E+00	9E-03	1
Manganese	1.95E+00	1.27E+02	1.00E+01	1.92E+00	1.41E+01	1E-01	1
Mercury	1.20E-03	6.26E-02	5.32E-02	1.02E-02	2.97E-01	3E-02	1
Methylene Chloride	6.60E-04	1.80E-04	1.21E-03	2.31E-04	6.95E+00	3E-05	1
Nickel	1.05E-01	6.85E+00	1.22E-01	2.34E-02	1.55E-01	2E-01	1
Phenol	1.20E-02	4.01E-03	2.70E-01	5.17E-02	8.57E+02	6E-05	1
Selenium	1.65E-01	8.58E-01	5.76E-01	1.10E-01	5.07E-02	2E+00	1
Silver	1.81E-02	1.54E-01	2.15E-03	4.12E-04	1.06E+01	4E-05	1
Thallium	7.80E-03	5.55E-01	1.39E-01	2.66E-02	5.16E-01	5E-02	1
Vanadium	5.75E-02	5.75E+01	7.48E-02	1.43E-02	1.06E+00	1E-02	1
Zinc	2.05E-01	1.28E+01	4.67E+00	8.93E-01	9.76E+00	9E-02	1

E2 Table 5-8. Mourning Dove Phreatophyte Pathway, Anomaly Area 3, Tier 1 Screen

Chemical	Groundwater Concentration (mg/L)	Subsurface Soil Concentration (mg/kg-dw)	Plant Concentration (mg/kg-dw)	Plant Ingested Dose (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
2-Butanone	1.00E-03	2.14E-04	1.44E-03	2.30E-04	1.73E+01	1E-05	1
3/4-Methylphenol	6.00E-03	2.96E-03	1.15E-01	1.85E-02	5.00E+00	4E-03	1
4-Methyl-2-pentanone	1.35E-02	3.91E-03	2.64E-02	4.23E-03	2.50E+01	2E-04	1
Aluminum	1.70E+00	2.55E+03	4.59E-01	7.35E-02	1.10E+02	7E-04	1
Antimony	2.85E-02	1.29E+00	4.77E-02	7.63E-03	6.00E-03	1E+00	1
Arsenic	6.02E-02	1.76E+00	6.60E-02	1.06E-02	5.50E+00	2E-03	1
Barium	3.32E-01	1.37E+01	2.13E+00	3.42E-01	2.08E+01	2E-02	1
Bis (2-ethylhexyl) phthalate	3.90E-03	2.04E+00	1.77E-01	2.83E-02	1.10E+00	3E-02	1
Butylbenzylphthalate	7.00E-04	7.15E-02	1.04E-01	1.66E-02	1.10E+00	2E-02	1
Cadmium	2.10E-03	1.58E-01	9.25E-02	1.48E-02	1.60E+00	9E-03	1
Chloroform	9.50E-04	4.18E-04	1.17E-03	1.88E-04	2.00E+01	9E-06	1
Chromium	3.57E-01	6.85E+00	2.81E-01	4.50E-02	1.00E+00	4E-02	1
Cobalt	1.29E-02	5.84E-01	4.38E-03	7.01E-04	7.60E+00	9E-05	1
Copper	4.72E-02	1.66E+00	2.07E-01	3.31E-02	2.30E+00	1E-02	1

Chemical	Groundwater Concentration (mg/L)	Subsurface Soil Concentration (mg/kg-dw)	Plant Concentration (mg/kg-dw)	Plant Ingested Dose (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Diethylphthalate	2.00E-03	1.23E-03	2.58E-02	4.13E-03	1.10E+00	4E-03	1
Lead	7.75E-03	6.98E+00	2.71E-01	4.33E-02	1.60E+00	3E-02	1
Manganese	1.95E+00	1.27E+02	1.00E+01	1.61E+00	7.76E+01	2E-02	1
Mercury	1.20E-03	6.26E-02	5.32E-02	8.53E-03	3.90E-02	2E-01	1
Methylene Chloride	6.60E-04	1.80E-04	1.21E-03	1.94E-04	5.85E-01	3E-04	1
Nickel	1.05E-01	6.85E+00	1.22E-01	1.96E-02	1.38E+00	1E-02	1
Phenol	1.20E-02	4.01E-03	2.70E-01	4.32E-02	7.21E+01	6E-04	1
Selenium	1.65E-01	8.58E-01	5.76E-01	9.23E-02	2.30E-01	4E-01	1
Silver	1.81E-02	1.54E-01	2.15E-03	3.45E-04	8.90E-01	4E-04	1
Thallium	7.80E-03	5.55E-01	1.39E-01	2.22E-02	2.56E-01	9E-02	1
Vanadium	5.75E-02	5.75E+01	7.48E-02	1.20E-02	1.14E+01	1E-03	1
Zinc	2.05E-01	1.28E+01	4.67E+00	7.48E-01	1.72E+01	4E-02	1

E2 Table 6-1. Ornate Shrew Sediment Pathway, Anomaly Area 3, Tier 1 Screen

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Aluminum	3.05E+03	5.88E+01	0.00E+00	3.33E+02	3.92E+02	2.13E+00	2E+02	1
Arsenic	1.80E+00	3.47E-02	0.00E+00	1.17E-01	1.52E-01	4.09E-01	4E-01	1
Barium	1.10E+02	2.12E+00	0.00E+00	3.22E+00	5.34E+00	4.80E+01	1E-01	1
Cadmium	2.60E-01	5.01E-03	0.00E+00	9.12E-01	9.17E-01	5.50E-01	2E+00	1
Chromium	4.40E+00	8.48E-02	0.00E+00	4.32E-01	5.17E-01	3.50E+03	1E-04	1
Cobalt	2.00E+00	3.85E-02	0.00E+00	7.84E-02	1.17E-01	7.30E+00	2E-02	1
Copper	2.50E+00	4.82E-02	0.00E+00	4.14E-01	4.62E-01	2.95E+00	2E-01	1
Lead	1.90E+00	3.66E-02	0.00E+00	4.34E-01	4.70E-01	5.80E+00	8E-02	1
Manganese	1.30E+02	2.51E+00	0.00E+00	3.96E+00	6.46E+00	1.51E+01	4E-01	1
Mercury	6.00E-03	1.16E-04	0.00E+00	8.86E-02	8.87E-02	3.20E-01	3E-01	1
Nickel	2.80E+00	5.40E-02	0.00E+00	9.52E-01	1.01E+00	1.67E-01	6E+00	1
Selenium	1.70E-04	3.28E-06	0.00E+00	5.14E-04	5.17E-04	5.46E-02	9E-03	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Vanadium	1.39E+01	2.68E-01	0.00E+00	1.00E+00	1.27E+00	1.14E+00	1E+00	1
Zinc	1.35E+01	2.60E-01	0.00E+00	6.45E+01	6.48E+01	1.05E+01	6E+00	1

E2 Table 6-2. Deer Mouse Sediment Pathway, Anomaly Area 3, Tier 1 Screen

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Aluminum	3.05E+03	1.17E+01	1.05E-01	0.00E+00	1.18E+01	1.98E+00	6E+00	1
Arsenic	1.80E+00	6.89E-03	1.29E-02	0.00E+00	1.98E-02	3.80E-01	5E-02	1
Barium	1.10E+02	4.21E-01	3.28E+00	0.00E+00	3.70E+00	4.80E+01	8E-02	1
Cadmium	2.60E-01	9.95E-04	5.70E-02	0.00E+00	5.80E-02	5.50E-01	1E-01	1
Chromium	4.40E+00	1.68E-02	3.45E-02	0.00E+00	5.13E-02	3.25E+03	2E-05	1
Cobalt	2.00E+00	7.65E-03	2.87E-03	0.00E+00	1.05E-02	7.30E+00	1E-03	1
Copper	2.50E+00	9.56E-03	5.35E-01	0.00E+00	5.45E-01	2.74E+00	2E-01	1
Lead	1.90E+00	7.27E-03	7.27E-02	0.00E+00	7.99E-02	5.80E+00	1E-02	1
Manganese	1.30E+02	4.97E-01	1.96E+00	0.00E+00	2.46E+00	1.41E+01	2E-01	1
Mercury	6.00E-03	2.30E-05	4.37E-03	0.00E+00	4.39E-03	2.97E-01	1E-02	1
Nickel	2.80E+00	1.07E-02	4.47E-02	0.00E+00	5.55E-02	1.55E-01	4E-01	1
Selenium	1.70E-04	6.50E-07	6.70E-06	0.00E+00	7.35E-06	5.07E-02	1E-04	1
Vanadium	1.39E+01	5.32E-02	3.46E-03	0.00E+00	5.66E-02	1.06E+00	5E-02	1
Zinc	1.35E+01	5.16E-02	3.91E+00	0.00E+00	3.96E+00	9.76E+00	4E-01	1

E2 Table 6-3. Long-tailed Weasel Sediment Pathway, Anomaly Area 3, Tier 1 Screen

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Aluminum	3.05E+03	2.86E+01	0.00E+00	0.00E+00	1.57E-04	1.18E-03	2.86E+01	1.69E+00	2E+01	1
Arsenic	1.80E+00	1.69E-02	0.00E+00	0.00E+00	2.64E-07	4.56E-07	1.69E-02	3.25E-01	5E-02	1
Barium	1.10E+02	1.03E+00	0.00E+00	0.00E+00	1.65E-05	5.33E-06	1.03E+00	4.80E+01	2E-02	1
Cadmium	2.60E-01	2.43E-03	0.00E+00	0.00E+00	8.26E-06	2.93E-05	2.47E-03	5.50E-01	4E-03	1
Chromium	4.40E+00	4.12E-02	0.00E+00	0.00E+00	1.10E-06	2.48E-06	4.12E-02	2.78E+03	1E-05	1
Cobalt	2.00E+00	1.87E-02	0.00E+00	0.00E+00	9.37E-08	2.34E-07	1.87E-02	7.30E+00	3E-03	1
Copper	2.50E+00	2.34E-02	0.00E+00	0.00E+00	4.85E-05	9.23E-06	2.35E-02	2.34E+00	1E-02	1
Lead	1.90E+00	1.78E-02	0.00E+00	0.00E+00	2.06E-07	2.73E-07	1.78E-02	5.80E+00	3E-03	1
Manganese	1.30E+02	1.22E+00	0.00E+00	0.00E+00	1.10E-04	6.46E-05	1.22E+00	1.20E+01	1E-01	1
Mercury	6.00E-03	5.62E-05	0.00E+00	0.00E+00	3.91E-06	1.77E-05	7.78E-05	2.54E-01	3E-04	1
Nickel	2.80E+00	2.62E-02	0.00E+00	0.00E+00	4.94E-07	2.01E-06	2.62E-02	1.33E-01	2E-01	1
Selenium	1.70E-04	1.59E-06	0.00E+00	0.00E+00	6.54E-08	1.03E-06	2.69E-06	4.34E-02	6E-05	1
Vanadium	1.39E+01	1.30E-01	0.00E+00	0.00E+00	1.16E-06	5.83E-06	1.30E-01	9.05E-01	1E-01	1
Zinc	1.35E+01	1.26E-01	0.00E+00	0.00E+00	1.76E-03	6.48E-03	1.35E-01	8.35E+00	2E-02	1

E2 Table 6-4. Mourning Dove Sediment Pathway, Anomaly Area 3, Tier 1 Screen

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Aluminum	3.05E+03	4.54E+01	8.79E-02	0.00E+00	4.55E+01	1.10E+02	4E-01	1
Arsenic	1.80E+00	2.68E-02	1.08E-02	0.00E+00	3.76E-02	5.50E+00	7E-03	1
Barium	1.10E+02	1.64E+00	2.75E+00	0.00E+00	4.39E+00	2.08E+01	2E-01	1
Cadmium	2.60E-01	3.87E-03	4.77E-02	0.00E+00	5.16E-02	1.60E+00	3E-02	1
Chromium	4.40E+00	6.55E-02	2.89E-02	0.00E+00	9.44E-02	1.00E+00	9E-02	1
Cobalt	2.00E+00	2.98E-02	2.40E-03	0.00E+00	3.22E-02	7.60E+00	4E-03	1
Copper	2.50E+00	3.72E-02	4.48E-01	0.00E+00	4.85E-01	2.30E+00	2E-01	1
Lead	1.90E+00	2.83E-02	6.08E-02	0.00E+00	8.91E-02	1.60E+00	6E-02	1
Manganese	1.30E+02	1.94E+00	1.64E+00	0.00E+00	3.58E+00	7.76E+01	5E-02	1
Mercury	6.00E-03	8.93E-05	3.66E-03	0.00E+00	3.75E-03	3.90E-02	1E-01	1
Nickel	2.80E+00	4.17E-02	3.75E-02	0.00E+00	7.91E-02	1.38E+00	6E-02	1
Selenium	1.70E-04	2.53E-06	5.61E-06	0.00E+00	8.14E-06	2.30E-01	4E-05	1
Vanadium	1.39E+01	2.07E-01	2.89E-03	0.00E+00	2.10E-01	1.14E+01	2E-02	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Zinc	1.35E+01	2.01E-01	3.27E+00	0.00E+00	3.47E+00	1.72E+01	2E-01	1

E2 Table 6-5. Spotted Towhee Sediment Pathway, Anomaly Area 3, Tier 1 Screen

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Aluminum	3.05E+03	8.31E+01	0.00E+00	3.04E+02	3.87E+02	1.10E+02	4E+00	1
Arsenic	1.80E+00	4.90E-02	0.00E+00	1.07E-01	1.56E-01	5.50E+00	3E-02	1
Barium	1.10E+02	3.00E+00	0.00E+00	2.93E+00	5.93E+00	2.08E+01	3E-01	1
Cadmium	2.60E-01	7.08E-03	0.00E+00	8.31E-01	8.38E-01	1.60E+00	5E-01	1
Chromium	4.40E+00	1.20E-01	0.00E+00	3.94E-01	5.14E-01	1.00E+00	5E-01	1
Cobalt	2.00E+00	5.45E-02	0.00E+00	7.14E-02	1.26E-01	7.60E+00	2E-02	1
Copper	2.50E+00	6.81E-02	0.00E+00	3.77E-01	4.45E-01	2.30E+00	2E-01	1
Lead	1.90E+00	5.17E-02	0.00E+00	3.95E-01	4.47E-01	1.60E+00	3E-01	1
Manganese	1.30E+02	3.54E+00	0.00E+00	3.61E+00	7.15E+00	7.76E+01	9E-02	1
Mercury	6.00E-03	1.63E-04	0.00E+00	8.08E-02	8.10E-02	3.90E-02	2E+00	1
Nickel	2.80E+00	7.62E-02	0.00E+00	8.68E-01	9.44E-01	1.38E+00	7E-01	1
Selenium	1.70E-04	4.63E-06	0.00E+00	4.69E-04	4.73E-04	2.30E-01	2E-03	1
Vanadium	1.39E+01	3.79E-01	0.00E+00	9.12E-01	1.29E+00	1.14E+01	1E-01	1

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Zinc	1.35E+01	3.68E-01	0.00E+00	5.88E+01	5.92E+01	1.72E+01	3E+00	1

E2 Table 6-6. Red-shouldered Hawk Sediment Pathway, Anomaly Area 3, Tier 1 Screen

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Aluminum	3.05E+03	1.02E+01	0.00E+00	0.00E+00	8.42E-05	6.30E-04	1.02E+01	1.10E+02	9E-02	1
Arsenic	1.80E+00	6.02E-03	0.00E+00	0.00E+00	1.42E-07	2.45E-07	6.02E-03	5.50E+00	1E-03	1
Barium	1.10E+02	3.68E-01	0.00E+00	0.00E+00	8.83E-06	2.86E-06	3.68E-01	2.08E+01	2E-02	1
Cadmium	2.60E-01	8.70E-04	0.00E+00	0.00E+00	4.43E-06	1.57E-05	8.90E-04	1.60E+00	6E-04	1
Chromium	4.40E+00	1.47E-02	0.00E+00	0.00E+00	5.88E-07	1.33E-06	1.47E-02	1.00E+00	1E-02	1
Cobalt	2.00E+00	6.69E-03	0.00E+00	0.00E+00	5.02E-08	1.25E-07	6.69E-03	7.60E+00	9E-04	1
Copper	2.50E+00	8.36E-03	0.00E+00	0.00E+00	2.60E-05	4.95E-06	8.39E-03	2.30E+00	4E-03	1
Lead	1.90E+00	6.36E-03	0.00E+00	0.00E+00	1.11E-07	1.46E-07	6.36E-03	1.60E+00	4E-03	1
Manganese	1.30E+02	4.35E-01	0.00E+00	0.00E+00	5.87E-05	3.46E-05	4.35E-01	7.76E+01	6E-03	1
Mercury	6.00E-03	2.01E-05	0.00E+00	0.00E+00	2.10E-06	9.51E-06	3.17E-05	3.90E-02	8E-04	1
Nickel	2.80E+00	9.37E-03	0.00E+00	0.00E+00	2.65E-07	1.08E-06	9.37E-03	1.38E+00	7E-03	1
Selenium	1.70E-04	5.69E-07	0.00E+00	0.00E+00	3.51E-08	5.55E-07	1.16E-06	2.30E-01	5E-06	1
Vanadium	1.39E+01	4.65E-02	0.00E+00	0.00E+00	6.21E-07	3.13E-06	4.65E-02	1.14E+01	4E-03	1
Zinc	1.35E+01	4.52E-02	0.00E+00	0.00E+00	9.44E-04	3.47E-03	4.96E-02	1.72E+01	3E-03	1

E2 Table 7-1. Chemical-Specific Exposure Factors - Tier 1 Soil Pathways

Chemical	Tier 1, Step 2 BCFp	Tier 1, Step 2 BCFp Abbreviated Reference	Tier 1, Step 2BCFi	Tier 1, Step 2 BCFi Abbreviated Reference	Tier 1, Step 2 BTFa	Tier 1, Step 2 BTFa Abbreviated Reference
Dioxins						
2,3,7,8-TCDD TEQ	1.54E-01	EPA, 2003	4.71E+00	Sample et al., 1998	1.99E-02	Birak et al., 2001
Inorganic						
Aluminum	1.80E-04	Strenge and Peterson, 1989	3.40E-01	Beyer and Stafford, 1993	1.50E-03	Strenge and Peterson, 1989
Antimony	3.76E-02	Bechtel Jacobs Co. LLC, 1998	2.24E-01	As surrogate	3.00E-03	Napier et al., 1980
Arsenic	3.75E-02	Bechtel-Jacobs, 1998	1.54E-01	Sample et al., 1998	1.50E-03	Strenge and Peterson, 1989
Barium	1.56E-01	Bechtel-Jacobs, 1998	9.10E-02	EPA, 2003	5.00E-04	Strenge and Peterson, 1989
Beryllium	1.00E-02	Baes et al., 1984	4.50E-02	EPA, 2003	8.00E-04	Strenge and Peterson, 1989
Cadmium	6.22E-01	Bechtel Jacobs Co. LLC, 1998	8.28E+00	Sample et al., 1998	1.60E-02	Strenge and Peterson, 1989
Chromium	4.10E-02	Bechtel-Jacobs, 1998	3.06E-01	EPA, 2003	2.40E-03	Strenge and Peterson, 1989
Cobalt	7.50E-03	Bechtel-Jacobs, 1998	1.22E-01	EPA, 2003	1.00E-03	Strenge and Peterson, 1989
Copper	4.61E-01	Bechtel Jacobs Co. LLC, 1998	5.15E-01	EPA, 2003	1.00E-02	Strenge and Peterson, 1989
Lead	7.01E-02	Bechtel Jacobs Co. LLC, 1998	4.48E-01	Sample et al., 1998	2.90E-04	Strenge and Peterson, 1989
Manganese	7.90E-02	Bechtel-Jacobs, 1998	7.35E-02	Sample et al., 1998	5.00E-03	Strenge and Peterson, 1989
Mercury	1.25E+00	Bechtel Jacobs Co. LLC, 1998	5.33E+00	Sample et al., 1998	1.00E-01	Strenge and Peterson, 1989
Nickel	5.60E-02	Bechtel Jacobs Co. LLC, 1998	1.06E+00	EPA, 2003	1.00E-03	Strenge and Peterson, 1989
Selenium	5.13E-01	Bechtel Jacobs Co. LLC, 1998	9.04E-01	Sample et al., 1998	1.00E+00	Strenge and Peterson, 1989
Silver	1.40E-02	Bechtel-Jacobs, 1998	2.05E+00	EPA, 2003	1.70E-02	Strenge and Peterson, 1989

E2 Table 7-1. Chemical-Specific Exposure Factors - Tier 1 Soil Pathways

Chemical	Tier 1, Step 2 BCFp	Tier 1, Step 2 BCFp Abbreviated Reference	Tier 1, Step 2BCFi	Tier 1, Step 2 BCFi Abbreviated Reference	Tier 1, Step 2 BTFa	Tier 1, Step 2 BTFa Abbreviated Reference
Vanadium	1.30E-03	Strenge and Peterson, 1989	2.24E-01	As as surrogate	2.30E-03	Strenge and Peterson, 1989
Zinc	7.95E-01	Bechtel Jacobs Co. LLC, 1998	5.65E+00	Sample et al., 1998	5.00E-02	Strenge and Peterson, 1989
Misc. Organic						
Methylene chloride	6.74E+00	EPA, 2003	1.00E+00	Default	0.00E+00	
PAH Group 1						
Anthracene	1.64E+00	Bechtel Jacobs Co. LLC, 1998	3.20E-01	Beyer and Stafford, 1993	1.28E-03	Birak et al., 2001
Benzo(g,h,i)perylene	6.02E-02	Bechtel Jacobs Co. LLC, 1998	1.50E-01	Beyer and Stafford, 1993	1.76E-02	Birak et al., 2001
Fluoranthene	2.47E+00	EPA, 2003	3.70E-01	Beyer and Stafford, 1993	2.56E-03	Birak et al., 2001
Phenanthrene	3.84E+00	EPA, 2003	2.80E-01	Beyer and Stafford, 1993	1.28E-03	Birak et al., 2001
Pyrene	1.85E+00	EPA, 2003	3.90E-01	Beyer and Stafford, 1993	2.53E-03	Birak et al., 2001
PAH Group 2						
Benzo(a)anthracene	5.37E-01	EPA, 2003	2.70E-01	Beyer and Stafford, 1993	5.20E-03	Birak et al., 2001
Benzo(a)pyrene	1.27E-01	Bechtel Jacobs Co. LLC, 1998	3.40E-01	Beyer and Stafford, 1993	8.57E-03	Birak et al., 2001
Benzo(b)fluoranthene	1.73E-01	EPA, 2003	2.10E-01	Beyer and Stafford, 1993	9.57E-03	Birak et al., 2001
Benzo(k)fluoranthene	2.55E-01	EPA, 2003	2.10E-01	Beyer and Stafford, 1993	9.57E-03	Birak et al., 2001
Chrysene	7.84E-01	EPA, 2003	1.30E-01	Beyer and Stafford, 1993	5.20E-03	Birak et al., 2001
Dibenz(a,h)anthracene	1.28E-01	EPA, 2003	5.20E-02	Beyer and Stafford, 1993	1.74E-02	Birak et al., 2001
Indeno(1,2,3-cd)pyrene	1.10E-01	EPA, 2003	4.10E-01	Beyer and Stafford, 1993	1.66E-02	Birak et al., 2001

E2 Table 7-1. Chemical-Specific Exposure Factors - Tier 1 Soil Pathways

Chemical	Tier 1, Step 2 BCFp	Tier 1, Step 2 BCFp Abbreviated Reference	Tier 1, Step 2BCFi	Tier 1, Step 2 BCFi Abbreviated Reference	Tier 1, Step 2 BTFa	Tier 1, Step 2 BTFa Abbreviated Reference
Phthalate Esters						
Bis (2-ethylhexyl) phthalate	8.68E-02	EPA, 2003	5.79E+01	EPA, 2003	3.66E-02	Birak et al., 2001
Diethylphthalate	2.10E+01	EPA, 2003	5.79E+01	EPA, 2003	1.05E-04	Birak et al., 2001
Semivolatile Organic Compound						
Hexachlorobenzene	1.10E-01	EPA, 2003	1.69E+00	Beyer, 1996	6.55E-03	Birak et al., 2001
Phenol	6.73E+01	EPA, 2003	1.00E+00	Default	3.01E-05	Birak et al., 2001
Volatile Organic Compound						
Acetone	2.53E+01	EPA, 2003	1.00E+00	Default	3.70E-06	Birak et al., 2001

E2 Table 7-2. Chemical-Specific Exposure Factors - Tier 2 Soil Pathways

	Chemical	Tier 2, Step 3aBCFp	Tier 2, Step 3a BCFp Abbreviated Reference	Tier 2, Step 3a BCFi	Tier 2, Step 3a BCFi Abbreviated Reference
Dioxins					
	2,3,7,8-TCDD TEQ	1.54E-01	EPA, 2003	4.21E+00	Sample et al., 1998
Inorganic					
	Antimony	3.76E-02	Bechtel Jacobs Co. LLC, 1	2.24E-01	As surrogate
	Cadmium	7.13E-01	Bechtel Jacobs Co. LLC, 1	8.81E+00	Sample et al., 1998
	Chromium	4.10E-02	Bechtel-Jacobs, 1998	3.06E-01	EPA, 2003
	Lead	1.04E-01	Bechtel Jacobs Co. LLC, 1	5.32E-01	Sample et al., 1998
	Mercury	1.34E+00	Bechtel Jacobs Co. LLC, 1	6.12E+00	Sample et al., 1998
	Nickel	6.45E-02	Bechtel Jacobs Co. LLC, 1	1.06E+00	EPA, 2003
	Selenium	4.93E-01	Bechtel Jacobs Co. LLC, 1	1.00E+00	Sample et al., 1998
	Silver	1.40E-02	Bechtel-Jacobs, 1998	2.05E+00	EPA, 2003
	Vanadium	1.30E-03	Strenge and Peterson, 19	2.24E-01	As as surrogate
	Zinc	9.59E-01	Bechtel Jacobs Co. LLC, 1	7.49E+00	Sample et al., 1998
Phthalate Esters					
	Diethylphthalate	2.10E+01	EPA, 2003	5.79E+01	EPA, 2003

E2 Table 7-3. Chemical-Specific Exposure Factors - Tier 1 Sediment Pathways

Chemical	Tier 1, Step 2 BCFp	Tier 1, Step 2 BCFp Abbreviated Reference	Tier 1, Step 2 BCFi	Tier 1, Step 2 BCFi Abbreviated Reference
Inorganic				
Aluminum	1.80E-04	Strenge and Peterson, 1989	3.40E-01	Beyer and Stafford, 1993
Arsenic	3.75E-02	Bechtel-Jacobs, 1998	2.03E-01	Sample et al., 1998
Barium	1.56E-01	Bechtel-Jacobs, 1998	9.10E-02	EPA, 2003
Cadmium	1.15E+00	Bechtel Jacobs Co. LLC, 1998	1.09E+01	Sample et al., 1998
Chromium	4.10E-02	Bechtel-Jacobs, 1998	3.06E-01	EPA, 2003
Cobalt	7.50E-03	Bechtel-Jacobs, 1998	1.22E-01	EPA, 2003
Copper	1.12E+00	Bechtel Jacobs Co. LLC, 1998	5.15E-01	EPA, 2003
Lead	2.00E-01	Bechtel Jacobs Co. LLC, 1998	7.10E-01	Sample et al., 1998
Manganese	7.90E-02	Bechtel-Jacobs, 1998	9.47E-02	Sample et al., 1998
Mercury	3.81E+00	Bechtel Jacobs Co. LLC, 1998	4.60E+01	Sample et al., 1998
Nickel	8.35E-02	Bechtel Jacobs Co. LLC, 1998	1.06E+00	EPA, 2003
Selenium	2.06E-01	Bechtel Jacobs Co. LLC, 1998	9.42E+00	Sample et al., 1998
Vanadium	1.30E-03	Strenge and Peterson, 1989	2.24E-01	As as surrogate
Zinc	1.51E+00	Bechtel Jacobs Co. LLC, 1998	1.49E+01	Sample et al., 1998

E2 Table 7-4. Chemical-Specific Exposure Factors - Tier 2 Sediment Pathways

	Chemical	Tier 2, Step 3a BCFp	Tier 2, Step 3a BCFp Abbreviated Reference	Tier 2, Step 3a BCFe	Tier 2, Step 3a BCFe Abbreviated Reference
Inorganic					
	Cadmium	1.15E+00	Bechtel Jacobs Co.	1.09E+01	Sample et al., 1998
	Mercury	3.81E+00	Bechtel Jacobs Co.	4.60E+01	Sample et al., 1998
	Nickel	8.35E-02	Bechtel Jacobs Co.	1.06E+00	EPA, 2003
	Vanadium	1.30E-03	Strenge and Peters	2.24E-01	As as surrogate
	Zinc	1.51E+00	Bechtel Jacobs Co.	1.49E+01	Sample et al., 1998

E2 Table 8-1. Ornate Shrew Soil Pathway, Anomaly Area 3, Tier 2, Step 3A

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
2,3,7,8-TCDD TEQ	9.99E-06	1.15E-07	0.00E+00	8.46E-06	8.57E-06	1.28E-06	7E+00	1
Mercury	5.91E-02	6.78E-04	0.00E+00	5.67E-02	5.73E-02	3.20E-01	2E-01	1
Cadmium	7.41E-01	8.50E-03	0.00E+00	1.10E+00	1.11E+00	5.50E-01	2E+00	1
Selenium	7.43E-01	8.52E-03	0.00E+00	1.21E-01	1.29E-01	5.46E-02	2E+00	1
Silver	2.00E+00	2.30E-02	0.00E+00	7.37E-01	7.60E-01	1.14E+01	7E-02	1
Antimony	2.10E+00	2.41E-02	0.00E+00	8.46E-02	1.09E-01	6.00E-02	2E+00	1
Nickel	7.81E+00	8.97E-02	0.00E+00	1.49E+00	1.58E+00	1.67E-01	9E+00	1
Lead	8.48E+00	9.74E-02	0.00E+00	6.84E-01	7.81E-01	5.80E+00	1E-01	1
Chromium	1.07E+01	1.23E-01	0.00E+00	5.91E-01	7.15E-01	3.50E+03	2E-04	1
Vanadium	2.78E+01	3.20E-01	0.00E+00	1.12E+00	1.44E+00	1.14E+00	1E+00	1
Zinc	3.75E+01	4.30E-01	0.00E+00	3.81E+01	3.85E+01	1.05E+01	4E+00	1
Diethylphthalate	2.25E-01	2.58E-03	0.00E+00	2.34E+00	2.34E+00	5.06E+03	5E-04	1

E2 Table 8-2. Deer Mouse Soil Pathway, Anomaly Area 3, Tier 2, Step 3a

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
2,3,7,8-TCDD TEQ	9.99E-06	3.39E-08	1.28E-07	3.49E-06	3.65E-06	1.19E-06	3E+00	1
Antimony	2.10E+00	7.12E-03	6.56E-03	3.91E-02	5.27E-02	6.00E-02	9E-01	1
Cadmium	7.41E-01	2.51E-03	4.39E-02	5.42E-01	5.88E-01	5.50E-01	1E+00	1
Chromium	1.07E+01	3.64E-02	3.66E-02	2.73E-01	3.46E-01	3.25E+03	1E-04	1
Lead	8.48E+00	2.88E-02	7.30E-02	3.75E-01	4.77E-01	5.80E+00	8E-02	1
Mercury	5.91E-02	2.00E-04	6.58E-03	3.00E-02	3.68E-02	2.97E-01	1E-01	1
Nickel	7.81E+00	2.65E-02	4.19E-02	6.87E-01	7.56E-01	1.55E-01	5E+00	1
Selenium	7.43E-01	2.52E-03	3.04E-02	6.19E-02	9.48E-02	5.07E-02	2E+00	1
Silver	2.00E+00	6.78E-03	2.33E-03	3.41E-01	3.50E-01	1.06E+01	3E-02	1
Vanadium	2.78E+01	9.44E-02	3.01E-03	5.18E-01	6.15E-01	1.06E+00	6E-01	1
Zinc	3.75E+01	1.27E-01	2.99E+00	2.33E+01	2.64E+01	9.76E+00	3E+00	1
Diethylphthalate	2.25E-01	7.63E-04	3.92E-01	1.08E+00	1.48E+00	4.70E+03	3E-04	1

E2 Table 8-3. Long-tailed Weasel Soil Pathway, Anomaly Area 3, Tier 2, Step 3A

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
2,3,7,8-TCDD TEQ	9.99E-06	1.82E-08	0.00E+00	0.00E+00	2.27E-11	3.67E-11	1.82E-08	1.02E-06	2E-02	0.1733
Antimony	2.10E+00	3.82E-03	0.00E+00	0.00E+00	4.94E-08	3.75E-08	3.82E-03	6.00E-02	6E-02	0.1733
Cadmium	7.41E-01	1.35E-03	0.00E+00	0.00E+00	2.94E-06	2.80E-06	1.35E-03	5.50E-01	2E-03	0.1733
Chromium	1.07E+01	1.95E-02	0.00E+00	0.00E+00	2.59E-07	2.91E-07	1.95E-02	2.78E+03	7E-06	0.1733
Lead	8.48E+00	1.54E-02	0.00E+00	0.00E+00	4.31E-08	6.39E-08	1.54E-02	5.80E+00	3E-03	0.1733
Mercury	5.91E-02	1.07E-04	0.00E+00	0.00E+00	1.15E-06	7.80E-07	1.09E-04	2.54E-01	4E-04	0.1733
Nickel	7.81E+00	1.42E-02	0.00E+00	0.00E+00	2.36E-07	3.21E-07	1.42E-02	1.33E-01	1E-01	0.1733
Selenium	7.43E-01	1.35E-03	0.00E+00	0.00E+00	2.96E-05	2.22E-05	1.40E-03	4.34E-02	3E-02	0.1733
Silver	2.00E+00	3.64E-03	0.00E+00	0.00E+00	1.85E-06	1.50E-06	3.64E-03	9.05E+00	4E-04	0.1733
Vanadium	2.78E+01	5.06E-02	0.00E+00	0.00E+00	4.42E-07	6.04E-07	5.06E-02	9.05E-01	6E-02	0.1733
Zinc	3.75E+01	6.82E-02	0.00E+00	0.00E+00	4.12E-04	3.42E-04	6.89E-02	8.35E+00	8E-03	0.1733
Diethylphthalate	2.25E-01	4.09E-04	0.00E+00	0.00E+00	4.83E-08	2.87E-08	4.09E-04	4.02E+03	1E-07	0.1733

E2 Table 8-4. Mourning Dove Soil Pathway, Anomaly Area 3, Tier 2, Step 3A

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
2,3,7,8-TCDD TEQ	3.53E-06	4.54E-08	6.82E-08	0.00E+00	1.14E-07	1.43E-05	8E-03	1
Antimony	2.10E+00	2.70E-02	9.93E-03	0.00E+00	3.70E-02	6.00E-03	6E+00	1
Cadmium	7.42E-01	9.55E-03	6.63E-02	0.00E+00	7.59E-02	1.60E+00	5E-02	1
Chromium	1.07E+01	1.38E-01	5.54E-02	0.00E+00	1.94E-01	1.00E+00	2E-01	1
Lead	8.48E+00	1.09E-01	1.10E-01	0.00E+00	2.20E-01	1.60E+00	1E-01	1
Mercury	5.91E-02	7.61E-04	9.96E-03	0.00E+00	1.07E-02	3.90E-02	3E-01	1
Nickel	7.81E+00	1.01E-01	6.33E-02	0.00E+00	1.64E-01	1.38E+00	1E-01	1
Selenium	7.43E-01	9.56E-03	4.60E-02	0.00E+00	5.55E-02	2.30E-01	2E-01	1
Silver	2.00E+00	2.58E-02	3.52E-03	0.00E+00	2.93E-02	8.90E-01	3E-02	1
Vanadium	2.78E+01	3.59E-01	4.55E-03	0.00E+00	3.63E-01	1.14E+01	3E-02	1
Zinc	3.75E+01	4.83E-01	4.52E+00	0.00E+00	5.00E+00	1.72E+01	3E-01	1
Diethylphthalate	2.25E-01	2.90E-03	5.93E-01	0.00E+00	5.96E-01	1.10E+00	5E-01	1

E2 Table 8-5. Western Meadowlark Soil Pathway, Anomaly Area 3, Tier 2, Step 3A

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
2,3,7,8-TCDD TEQ	3.53E-06	3.39E-08	1.91E-08	7.22E-07	7.75E-07	1.43E-05	5E-02	1
Antimony	2.10E+00	2.02E-02	2.77E-03	2.76E-02	5.06E-02	6.00E-03	8E+00	1
Cadmium	7.42E-01	7.13E-03	1.85E-02	3.84E-01	4.09E-01	1.60E+00	3E-01	1
Chromium	1.07E+01	1.03E-01	1.55E-02	1.93E-01	3.12E-01	1.00E+00	3E-01	1
Lead	8.48E+00	8.16E-02	3.08E-02	2.65E-01	3.78E-01	1.60E+00	2E-01	1
Mercury	5.91E-02	5.68E-04	2.78E-03	2.12E-02	2.46E-02	3.90E-02	6E-01	1
Nickel	7.81E+00	7.52E-02	1.77E-02	4.86E-01	5.79E-01	1.38E+00	4E-01	1
Selenium	7.43E-01	7.14E-03	1.28E-02	4.38E-02	6.38E-02	2.30E-01	3E-01	1
Silver	2.00E+00	1.92E-02	9.82E-04	2.41E-01	2.61E-01	8.90E-01	3E-01	1
Vanadium	2.78E+01	2.68E-01	1.27E-03	3.66E-01	6.36E-01	1.14E+01	6E-02	1
Zinc	3.75E+01	3.61E-01	1.26E+00	1.65E+01	1.81E+01	1.72E+01	1E+00	1
Diethylphthalate	2.25E-01	2.16E-03	1.66E-01	7.65E-01	9.33E-01	1.10E+00	8E-01	1

E2 Table 8-6. Red-shouldered Hawk Soil Pathway, Anomaly Area 3, Tier 2, Step 3A

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
2,3,7,8-TCDD TEQ	3.53E-06	4.02E-10	0.00E+00	0.00E+00	3.66E-12	4.32E-11	4.48E-10	1.43E-05	3E-05	0.06
Antimony	2.10E+00	2.39E-04	0.00E+00	0.00E+00	2.70E-08	2.05E-08	2.39E-04	6.00E-03	4E-02	0.06
Cadmium	7.42E-01	8.44E-05	0.00E+00	0.00E+00	1.61E-06	1.53E-06	8.75E-05	1.60E+00	5E-05	0.06
Chromium	1.07E+01	1.22E-03	0.00E+00	0.00E+00	1.42E-07	1.59E-07	1.22E-03	1.00E+00	1E-03	0.06
Lead	8.48E+00	9.66E-04	0.00E+00	0.00E+00	2.36E-08	3.50E-08	9.66E-04	1.60E+00	6E-04	0.06
Mercury	5.91E-02	6.73E-06	0.00E+00	0.00E+00	6.29E-07	4.27E-07	7.78E-06	3.90E-02	2E-04	0.06
Nickel	7.81E+00	8.90E-04	0.00E+00	0.00E+00	1.29E-07	1.76E-07	8.90E-04	1.38E+00	6E-04	0.06
Selenium	7.43E-01	8.45E-05	0.00E+00	0.00E+00	1.62E-05	1.22E-05	1.13E-04	2.30E-01	5E-04	0.06
Silver	2.00E+00	2.28E-04	0.00E+00	0.00E+00	1.02E-06	8.23E-07	2.30E-04	8.90E-01	3E-04	0.06
Vanadium	2.78E+01	3.17E-03	0.00E+00	0.00E+00	2.42E-07	3.31E-07	3.17E-03	1.14E+01	3E-04	0.06
Zinc	3.75E+01	4.27E-03	0.00E+00	0.00E+00	2.26E-04	1.87E-04	4.68E-03	1.72E+01	3E-04	0.06
Diethylphthalate	2.25E-01	2.56E-05	0.00E+00	0.00E+00	2.65E-08	1.57E-08	2.57E-05	1.10E+00	2E-05	0.06

E2 Table 9-1. Ornate Shrew Sediment Pathway, Anomaly Area 3, Tier 2, Step 3A

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Mercury	6.00E-03	6.89E-05	0.00E+00	4.96E-02	4.97E-02	3.20E-01	2E-01	1
Cadmium	2.60E-01	2.98E-03	0.00E+00	5.10E-01	5.13E-01	5.50E-01	9E-01	1
Nickel	2.80E+00	3.21E-02	0.00E+00	5.33E-01	5.65E-01	1.67E-01	3E+00	1
Zinc	1.35E+01	1.55E-01	0.00E+00	3.61E+01	3.63E+01	1.05E+01	3E+00	1
Vanadium	1.39E+01	1.60E-01	0.00E+00	5.60E-01	7.19E-01	1.14E+00	6E-01	1

E2 Table 9-2. Deer Mouse Sediment Pathway, Anomaly Area 3, Tier 2, Step 3A

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Cadmium	2.60E-01	8.81E-04	2.48E-02	2.36E-01	2.61E-01	5.50E-01	5E-01	1
Mercury	6.00E-03	2.03E-05	1.90E-03	2.29E-02	2.48E-02	2.97E-01	8E-02	1
Nickel	2.80E+00	9.49E-03	1.94E-02	2.46E-01	2.75E-01	1.55E-01	2E+00	1
Vanadium	1.39E+01	4.71E-02	1.50E-03	2.59E-01	3.07E-01	1.06E+00	3E-01	1
Zinc	1.35E+01	4.58E-02	1.70E+00	1.67E+01	1.84E+01	9.76E+00	2E+00	1

E2 Table 9-3. Long-tailed Weasel Sediment Pathway, Anomaly Area 3, Tier 2, Step 3A

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Cadmium	2.60E-01	2.64E-05	0.00E+00	0.00E+00	4.20E-07	3.08E-07	2.71E-05	5.50E-01	5E-05	0.05583
Mercury	6.00E-03	6.09E-07	0.00E+00	0.00E+00	2.50E-07	1.87E-07	1.05E-06	2.54E-01	4E-06	0.05583
Nickel	2.80E+00	2.84E-04	0.00E+00	0.00E+00	2.77E-08	2.12E-08	2.84E-04	1.33E-01	2E-03	0.05583
Vanadium	1.39E+01	1.41E-03	0.00E+00	0.00E+00	7.10E-08	6.13E-08	1.41E-03	9.05E-01	2E-03	0.05583
Zinc	1.35E+01	1.37E-03	0.00E+00	0.00E+00	9.26E-05	6.81E-05	1.53E-03	8.35E+00	2E-04	0.05583

E2 Table 9-4. Mourning Dove Sediment Pathway, Anomaly Area 3, Tier 2, Step 3A

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Cadmium	2.60E-01	3.35E-03	3.74E-02	0.00E+00	4.08E-02	1.60E+00	3E-02	1
Mercury	6.00E-03	7.73E-05	2.87E-03	0.00E+00	2.95E-03	3.90E-02	8E-02	1
Nickel	2.80E+00	3.61E-02	2.94E-02	0.00E+00	6.54E-02	1.38E+00	5E-02	1
Vanadium	1.39E+01	1.79E-01	2.27E-03	0.00E+00	1.81E-01	1.14E+01	2E-02	1
Zinc	1.35E+01	1.74E-01	2.57E+00	0.00E+00	2.74E+00	1.72E+01	2E-01	1

E2 Table 9-5. Spotted Towhee Sediment Pathway, Anomaly Area 3, Tier 2, Step 3A

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Cadmium	2.60E-01	8.31E-04	2.75E-03	6.22E-02	6.58E-02	1.60E+00	4E-02	0.18
Mercury	6.00E-03	1.92E-05	2.11E-04	6.05E-03	6.28E-03	3.90E-02	2E-01	0.18
Nickel	2.80E+00	8.95E-03	2.16E-03	6.50E-02	7.61E-02	1.38E+00	6E-02	0.18
Vanadium	1.39E+01	4.44E-02	1.67E-04	6.83E-02	1.13E-01	1.14E+01	1E-02	0.18
Zinc	1.35E+01	4.31E-02	1.89E-01	4.40E+00	4.64E+00	1.72E+01	3E-01	0.18

E2 Table 9-6. Red-shouldered Hawk Sediment Pathway, Anomaly Area 3, Tier 2, Step 3A

Chemical	Exposure Concentration (mg/kg)	Soil Ingestion (mg/kg-day)	Plant Ingestion (mg/kg-day)	Invertebrate Ingestion (mg/kg-day)	Mouse Ingestion (mg/kg-day)	Shrew Ingestion (mg/kg-day)	Ingestion Sum (mg/kg-day)	TRV (mg/kg-day)	HQ	Site Use Factor
Cadmium	2.60E-01	9.53E-06	0.00E+00	0.00E+00	2.30E-07	1.69E-07	9.93E-06	1.60E+00	6E-06	0.02
Mercury	6.00E-03	2.20E-07	0.00E+00	0.00E+00	1.37E-07	1.02E-07	4.59E-07	3.90E-02	1E-05	0.02
Nickel	2.80E+00	1.03E-04	0.00E+00	0.00E+00	1.51E-08	1.16E-08	1.03E-04	1.38E+00	7E-05	0.02
Vanadium	1.39E+01	5.10E-04	0.00E+00	0.00E+00	3.89E-08	3.36E-08	5.10E-04	1.14E+01	4E-05	0.02
Zinc	1.35E+01	4.95E-04	0.00E+00	0.00E+00	5.07E-05	3.73E-05	5.83E-04	1.72E+01	3E-05	0.02

Document Title:

(1) Draft Screening Ecological Risk Assessment, Removal Site Evaluation, Anomaly Area 3, Former Marine Corps Air Station, El Toro, dated May, 2003

Reviewer: Mr. Andrew R. Yuen and Ms. Judy Gibson, United States Department of the Interior, Fish and Wildlife Service, 04 August 2003

Comment No.	Section/ Page No.	Comment	Response
SPECIFIC COMMENTS			
1.		Overall, we agree that based on the Screening Ecological Risk Assessment (SERA) a Baseline Ecological Risk Assessment (BERA) is warranted for Site AA 3. Model assumptions and calculations included in the document to support the conclusions reached in the SERA were helpful in reviewing the document. Our specific comments regarding the SERA are provided below.	Comment Noted.
SPECIFIC COMMENTS			
1.	Appendix B, Page 2.	We agree as acknowledged in the biological site reconnaissance (BSR) report that a single midwinter survey conducted to determine the species inventory for Site AA 3 is not likely to have captured all of the ecological receptors and representative feeding guilds present on site. Migratory birds may not be present at the site, plants may not be identifiable, and animals may be inactive at this time of the year. For your reference, we have attached a list of species observed on the former MCAS El Toro during a 1993 survey effort by the Service (U.S. Fish and Wildlife Service 1993). As discussed later in this letter, this list includes species such as the loggerhead shrike (*Lanius ludovicianus*), which occupies a higher trophic level and should be evaluated as a potential receptor.	A spring/summer habitat assessment was performed at AA 3 to identify plant and wildlife species that were not identified during the mid-winter survey. This data along with the species list for the entire facility was reviewed and used in selecting representative species. Based on the site habitat characteristics and the results of the two biological surveys, it was determined that the Loggerhead shrike is not likely to utilize the site on a regular basis. The red-shouldered hawk was selected as a representative raptor.
2.	Pages 3-7 and 3-8	We support the use of chemicals of potential ecological concern (COPECs) detected in surface soils at a depth of 0-1 foot below ground surface (bgs) in the ecological risk assessment. However, it is inappropriate to eliminate chemicals detected at depths greater than 1 foot bgs when evaluating COPECs for the SERA when ecological receptors occurring at Site AA 3 can burrow vertically to greater depths. For example, the California ground squirrel (*Spermophilus beecheyi*), known to occur on-site, can burrow up to depths of five feet (California Department of Toxic Substances Control (DTSC) 1998). In addition to the biotic zone, contaminants present at the depth profile to which species at the site may burrow should also be evaluated in the SERA. Please refer to the DTSC's recommended depths for soil sampling to	The COPECs from 0 – 1 feet bgs for the Ecological Risk Assessment will be revised to include all COPECs identified at depths ranging from 0 – 6 feet bgs. Comment Noted.

Docum... Title:

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Reviewer: Mr. Andrew R. Yuen and Ms. Judy Gibson, United States Department of the Interior, Fish and Wildlife Service, 04 August 2003

Comment No.	Section/ Page No.	Comment	Response
		set exposure point concentration for burrowing mammals and burrow-dwelling birds in an ecological risk assessment (California DTSC 1998).	
3.	Page 3-7	Based on the disposal history and the uncertainty of the wastes disposed at Site AA 3, we recommend that polychlorinated biphenyls (PCBs), and herbicides/pesticides be included in the list of COPECs selected for evaluation of the SERA. Site 3 was a former landfill. Reported wastes that could potentially be found in the Site 3 landfill include metals, incinerator ash, solvents, paint residues, hydraulic fluids, engine coolants, construction debris, oily wastes, and municipal solid wastes (U.S. Marine Corps 1999).	Pesticides and herbicides were not considered to be COPECs since the site was predominantly used for debris disposal. The suite of analysis that was used in the investigation was presented in the approved RSE Work Plan. The IRP Site 3 Draft Phase II RI report (BNI 1996) summarized the soil sampling results from Phase I RI, RFA and Phase II RI in order to provide COPC lists for the shallow (0 - 10 feet bgs) and subsurface (greater than 10 feet bgs) soils. The COPC list did not include pesticides/herbicide/PCBs for Unit 1, Unit 3 and Unit 4 (of the site even though they were low detections of few pesticides and herbicide compounds, since the concentrations of these compounds did not exceed their respective residential PRGs). Therefore, the sample analysis suite for AA 3 RSE investigation did not include herbicides, pesticides and PCBs.
4.	Page 3-9, Table 3-3	The unit of concentration for dioxins given in the table is "pg/g"; however, the footnote defines the unit of concentration as picograms per kilogram (pg/kg). The unit identified in the footnote should be consistent with the unit provided in the table.	Comment Noted and corrections were made as suggested.
5.	Page 3-10	Table 3-4 describes the assessment endpoint for mammals and birds as a decline in mammal populations and decline in local bird populations, respectively. Please explain the use of this assessment endpoint for mammals and birds when decrease in growth and reproduction was used as an assessment endpoint for invertebrates. The coastal California gnatcatcher (*Polioptila californica californica*) is a federally threatened species and is present at the site. In order to assess risk to the gnatcatcher, we recommend using individual-level endpoints (e.g., feeding behavior, survival, growth, and/or reproduction), rather than population-level endpoints (decline in local bird populations).	As described in Section 3.3, survival, growth and reproduction of birds and mammals are the SERA assessment endpoints used. These assessment endpoints are based on NOAEL measures of effect, thus individuals are protected. The table description was modified to be consistent with the text. The amount of good gnatcatcher habitat on the landfill site is very small compared to the area of habitat located in the surrounding hills. Also, the gnatcatcher feeds mainly on flying insects and not ground-dwelling insects. The spotted towhee and western meadowlark selected

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Reviewer: Mr. Andrew R. Yuen and Ms. Judy Gibson, United States Department of the Interior, Fish and Wildlife Service, 04 August 2003

Comment No.	Section/ Page No.	Comment	Response
			The spotted towhee and western meadowlark, selected as representative species, have feeding habits leading to greater soil exposure than the gnatcatcher. The selected species represent a more conservative exposure scenario than the gnatcatcher.
6.	Page 3-12	The following types of ecological receptors and feeding guilds are present at the former El Toro MCAS: terrestrial, plants, soil invertebrates, reptiles, amphibians, terrestrial mammals (herbivores, omnivores, and carnivores), and terrestrial birds (herbivores, omnivores, and carnivores). Representative species or taxa should be evaluated as target receptors from each guild for the SERA. The Service agrees that the selected species for the SERA represent the two feeding guilds for omnivorous mammals and omnivorous birds for the site, We recommend that other target receptors be included to represent additional potentially exposed feeding guilds and higher trophic levels likely present at the site. For example, carnivorous birds, such as the logger head shrike present at El Toro MCAS likely inhabits the Site AA 3. The shrike is a top predator and can devour large insects, reptiles, small mammals should also be evaluated in the SERA. The California ground squirrel is primarily a herbivorous mammal that can burrow to a depth greater than five feet and should be evaluated as a target receptor exposed to contaminants in deeper soils. Please consider expanding the target receptors to evaluate risk to all feeding guilds and higher trophic levels that have potentially complete pathways of exposure to contaminants at the site.	The list of representative species has been expanded to include more feeding guilds: A herbivorous bird and mammal, an insectivorous bird and mammal, and a predatory bird and mammal, in addition to lower trophic level receptors. Attached Tables 1 and 2 provide the representative species list for the SERA and the BERA. The use of the deer mouse (small body size), in combination with the assumption that it can burrow to a depth of 6 feet, is a more conservative exposure scenario than using the much larger California ground squirrel. By assuming that the deer mouse can burrow to a depth of 6 feet, the risk assessment goals for recommending the use of the ground squirrel are met and exceeded.
7.	Page 3-17	Figure 3-1 identifies the subsurface soil as an incomplete pathway. The subsurface soil pathway should be identified as a complete pathway for certain ecological receptors. As stated above, burrowing mammals may come in contact with and be exposed to COPECs in subsurface soils.	The Conceptual Site Model was revised to include soil down to a depth of 6 feet as a complete pathway due to the presence of burrowing animals. This will overestimate the exposure of other organisms at the site that do not have access to deep soils.
8.	Page 4-1	It is stated that maximum surface soil concentrations of aluminum, chromium, lead, selenium, vanadium, and zinc exceed plant and invertebrate screening concentrations. The Hazard Quotients (HQ) for these chemicals are greater than one and may potentially have an adverse effect on ecological receptors. It is further stated that eleven semivolatile organic compounds (SVOCs) and dioxins detected in surface soil did not have screening benchmarks for plants and invertebrates. Table 4-1 lists thirteen SVOCs that did not have	A sentence was added to the uncertainty section to clarify the potential risks posed by certain SVOCs and dioxins to plants and invertebrates due to lack of relevant effects levels.

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Reviewer: Mr. Andrew R. Yuen and Ms. Judy Gibson, United States Department of the Interior, Fish and Wildlife Service, 04 August 2003

Comment No.	Section/ Page No.	Comment	Response
		screening benchmark concentrations. Please revise and add a sentence to clarify that the potential risks posed by certain SVOCs and dioxins are unknown for plants and invertebrates due to lack of relevant effects levels.	
9.	Table A-3	Preliminary Remediation Goals (PRGs) are human health risk-based concentrations; therefore, PRGs are not appropriate for ecological receptors.	Reference to human health PRGs was deleted from the Table A-3.
10.	Table B-2	Status of the coastal California gnatcatcher should be identified as federally threatened.	Comment noted and Table B-2 was revised to identify California gnatcatcher as federally threatened species.
11.	Appendix C-3	In addition to soil to earthworm bioconcentration factors (BCF) from Beyer and Stafford (1993), BCFs from additional peer reviewed references should be considered for use in Appendix C. The soil –to-earthworm uptake factors for cadmium, lead, chromium, and dioxins may be as high as 190, 228.26, 11.42, and 42.07, respectively (Sample et al. 1999). The mean soil-to-earthworm uptake factors for cadmium, lead, chromium, and dioxins in earthworms reported by Sample et al. (1999) are 17.10, 3.34, 1.10, and 11.74. Median soil-to-earthworm uptake factors for cadmium and 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) reported by Sample et al. (1999) are 7.71 and 11.01, respectively. The lower BCFs used in Appendix C-3 for some of the metals and dioxins may underestimate the risk to ecological receptors at Site AA 3. At a minimum, the higher median BCFs reported in the literature should be used in the SERA.	The median BCF values for Cadmium and 2,3,7,8-TCDD from Sample et al., 1999 were used to replace the old lower values for uptake modeling.

Document Title:

(1) Draft Screening Ecological Risk Assessment, Removal Site Evaluation, Anomaly Area 3, Former Marine Corps Air Station, El Toro. May 2003

(2) Comments on Draft Screening Ecological Risk Assessment, Removal Site Evaluation, Anomaly Area 3, Former Marine Corps Air Station, El Toro Reviewer: Ms. Sonce DeVries, Environmental Protection Agency, 17 June 2003

(3) Responses to Navy's Responses to EPA Comments dated 17 June 2003. Mail Correspondence: Subject – Ecological Issues at Anomaly Area 3 and IRP Site 1 at the Former MCAS El Toro. *Reviewer: Ms. Nicole Moutoux, Project Manager, Environmental Protection Agency, Dated 18 September 2003*

Comment No.	Section/ Page No.	Comment	Response
I. General Comments on the Draft Screening ERA for AA 3			
Please note that comments on the Draft Screening ERA for AA 3 were provided by the U.S. Fish and Wildlife Service (August 4, 2003 letter to Mr. Andy Piskin, Department of the Navy from Andrew Yuen, US Fish and Wildlife Service). Response to these comments should be provided and in particular, the following issues should be addressed.			
1.		It is inappropriate to eliminate chemicals detected at depths greater than 1 foot bgs. The California ground squirrel can burrow up to five feet. We suggest that the Navy refer to DTSC's recommended depths for soil sampling to set exposure point concentrations for burrowing mammals and burrow dwelling birds in an ecological risk assessment. As per our June 10, 2003 BCT meeting minutes, we agreed that exposure to soil depths of 0-6 feet bgs would be evaluated. The conceptual site model should be revised to show that the subsurface may be a complete pathway for certain ecological receptors.	The exposure depth for soil has been changed to include all samples between the ground surface to 6 feet bgs. The conceptual site model is revised to show that complete pathway exists for certain ecological receptors, such as burrowing mammals, to come into contact with soil from 0-6 feet bgs. This will overestimate the exposure of other organisms at the site that do not have access to deep soils.
2.		More justification for the elimination of pesticides, herbicides and PCBs as COPECs at AA 3 must be provided. Please keep in mind that although these chemicals were below human health based PRGs during earlier studies they may still pose an ecological risk. At a minimum, any data regarding these chemicals should be presented.	Consistent with the approved work plan, pesticides, herbicides, and PCBs were not considered to be COPECs. Data collected during this RSE investigation strongly does not indicate anthropogenic influence. Therefore, there is low likelihood that these chemical groups are present at the site. As requested in Specific Comment #5, data from the Site 3 investigations is presented at the end of this document.
3.		Special status species should be protected at the individual level rather than at population-level endpoints.	For the SERA, all TRVs are adjusted to NOAEL equivalents, so protection is at the individual level.

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(3) Responses to Navy's Responses to EPA Comments dated 17 June 2003. Mail Correspondence: Subject – Ecological Issues at Anomaly Area 3 and IRP Site 1 at the Former MCAS El Toro. *Reviewer: Ms. Nicole Moutoux, Project Manager, Environmental Protection Agency, Dated 18 September 2003*

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			For the BERA, LOAEL-based TRVs may be used to assess non-endangered species populations.
4.		Bioaccumulation factors (BAFS) should be updated to include soil-to-earthworm BAFs for metals and dioxins reported by Sample et.al., (1999), and soil-to-plant and soil-to-small mammal BAFs for inorganics and organics provided by US EPA (2000; http://www.epa.gov/ecotox/ ecossl/ SOPs.htm).	Soil-to-earthworm BAFs for metals and dioxins reported by Sample et. al are currently included in the model used to calculate hazard quotients for this SERA. Soil-to-plant BAFs for inorganics and organics provided by US EPA (2000; http://www.epa.gov/ecotox/ ecossl/ SOPs.htm) have been updated. Soil-to-mammal BAFs are not used due to the inherent uncertainty associated with estimating soil-to-small mammal BAFs.

II. Response to the "Response to Review Comments" (responses to the Navy's response to US EPA comments on the Draft Screening ERA for AA 3), dated 17 June 2003

GENERAL COMMENTS

EPA Response to Navy response to General Comment **#1**		**EPA Response to Navy response to General Comment #1** Response accepted.	**Navy response** Noted.
EPA General Comment **#1** and Navy response		**EPA General Comment #1** A single midwinter survey does not yield a conservative estimate of the actual biota on site, particularly with regard to special status plants which can only be identified through the flowers and biota nesting and feeding young. A spring and early summer survey would be much	**Navy response** A spring/summer habitat assessment ~~will be~~ was performed at AA 3 to provide a more comprehensive evaluation of plant and wildlife species. This data along with the species list for the entire facility ~~will be~~ was

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		better particularly since some threatened and endangered species are listed as potentially or actually occurring on site.	reviewed and used in selecting additional representative species.
SPECIFIC COMMENTS			
EPA Response to Navy response to Specific Comment #1		**EPA Response to Navy response to Specific Comment #1** Response accepted.	**Navy response** Noted.
EPA Specific Comment #1 and Navy response	Page 3-5, Table 3-2	**EPA Specific Comment #1** Wildlife Species Observed or Likely to Occur in the Area of AA3 - what is the meaning of the Status (3,4) column?	**Navy response** The notes for this table were inadvertently left out. They will be added to the Draft Final version of the report. (1) Nomenclature from American Ornithologists' Union (1983); Collins (1990); Jones, et al. (1982). (2) Habitat acronyms: CHP - chaparral; W - woodland; RSS - sage scrub; G - non-native grassland; RP - riparian; D - disturbed; DEV - developed.

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			(3) Status acronyms: B - breeding on site; V - visitor, migrant, or transient; W - winter observation. (4) † = Sensitive species.
EPA Response to Navy response to Specific Comment #2		**EPA Response to Navy response to Specific Comment #2** The response is confusing in that it says "there is no coastal sage scrub on site or down-gradient of the site". Please see the map in the draft at Appendix B, Figure B-1 which shows both mulefat and mixed sage scrub and see the text on pages 3-6 and 3-7 which says " a small amount of the CSS, in the form of mixed sage scrub grassland (0.18 acres) is within the limits of AA 3..." and "There is a very limited area of this habitat (mulefat scrub) on site...". Therefore, according to the Navy's document, both of these habitats occur on site. The Navy needs to clarify whether or not there is coastal sage scrub and mulefat habitat within the boundaries of AA 3. However, the thrust of the EPA comment was that if there is such habitat either within or close to AA 3, thee is a possibility there are sensitive species nearby which may forage on site and they must be considered in the risk assessment.	**Navy response** Open patches of Mulefat scrub extend onto the project site in a few areas along the southeastern boundary. The area of Mulefat Scrub within AA 3 is 0.08 acre. Degraded CSS, mixed with non-native grassland, occurs on a fill slope to the east, crossing the northeastern corner of the site and extending offsite to the south and southeast. The limited area of habitat that the Mulefat scrub and CCS occupy onsite suggests that species that require this habitat are unlikely to utilize the ruderal vegetation found on the site for feeding or nesting. Thus, they are less likely to be exposed to site contamination. However, the selected representative species will be assessed on an individual basis as a conservative approach.
EPA Specific Comment #2 and Navy response	Page 3-6, Section 3.1.3	**EPA Specific Comment #2** Sensitive Resources: The Navy describes the occurrence of mulefat scrub and coastal sage scrub in and adjacent to the site. Both are of	**Navy response** Comment Noted.

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response	3.1.3	special significance since they support threatened and endangered species. While it is understood there is very little of this habitat actually on site, the fact that it does exist there and close by means that it may be attracting and supporting these sensitive species. That means those species are more likely to be breeding and feeding on the site and must be addressed on an individual basis during the SERA. It should not be considered of "limited significance".	~~A riparian~~ Riparian habitat (mulefat scrub) and coastal sage scrub ~~species~~ habitat were delineated as part of ~~delineation activity will be performed along with~~ the spring/summer habitat assessment. A record of all the plant and wildlife species that these ~~riparian~~ habitats supports was developed ~~will be maintained~~ during the assessment. ~~The results of this riparian habitat delineation and habitat assessment, including the type of and number of species that are attracted and supported by this riparian habitat and the number of individual species that are breeding and feeding on the site will be presented in the Draft Final version of the report for your comments and review.~~ Open patches of Mulefat scrub extend onto the project site in a few areas along the southeastern boundary. The area of Mulefat Scrub within AA 3 is 0.08 acre. Degraded CSS, mixed with non-native grassland, occurs on a fill slope to the east, crossing the northeastern corner of the site and extending offsite to the south and southeast. ~~Also, the fact that there is no coastal sage scrub on site or down gradient of the site.~~ The limited area of habitat that the Mulefat scrub and CCS occupy onsite suggests that species that require this habitat are unlikely to utilize the ruderal vegetation found on the site for feeding or nesting. Thus they are less likely to be exposed to site

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			contamination. However, the selected representative species will be assessed on an individual basis as a conservative approach.
EPA Response to Navy response to Specific Comment #3		**EPA Response to Navy response to Specific Comment #3** Response accepted.	**Navy response** Noted.
EPA Specific Comment #3 and Navy response	Page 3-7, Section 3.1.3	**EPA Specific Comment #3** Potential Wetlands and Waters of the United States: With regard to the wetland, its jurisdictional status has nothing to do with ecological significance.	**Navy response** Comment Noted. The reference to jurisdictional status of potential wetlands and water of United States ~~will be~~ has been removed from the text.
EPA Response to Navy response to Specific Comment #4		**EPA Response to Navy response to Specific Comment #4** As noted in Specific Comments #2 above, the Navy must clarify whether there are sensitive habitats on site or close to the site and include in the risk assessment the species which may be found nesting and feeding in this sensitive habitat.	**Navy response** A limited area of sensitive habitats (Mulefat scrub and CSS) exist on site and close to the site.
EPA Specific Comment #4 and Navy response	Page 3-7, Section 3.1.2	**EPA Specific Comment #4** Wildlife: Please clarify whether the sensitive species occur on site or not according to the survey. Each is listed on Table 3-2 as if they were observed on site.	**Navy response** The Notes at the bottom of the table state that the species with "***" are likely to occur at the site.

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			The habitat on site is ruderal in an early successional state. Only species that utilize such disturbed habitat are expected to use the site regularly. Since there is better habitat in the area (mixed sage scrub and riparian mulefat scrub), the sensitive species that require or prefer these habitats are likely attracted away from regular use of the site. The report text ~~will be~~ was revised to include species identified in the spring/early summer survey. Those species likely to forage or nest on the site ~~will be~~ are distinguished from those likely to utilize the better adjacent habitats.
EPA Response to Navy response to Specific Comment #5		**EPA Response to Navy response to Specific Comment #5** The response is accepted contingent on the Navy providing supporting evidence that the previous sampling was sufficient to assure that pesticides/herbicides are not a consideration on this site. Please present a map showing sampling locations on Site 3 to, the sample results, and discussion of the sampling and the data. We understand the BCT approved the draft (Final) RSE work plan and the COPECs included. However, given that such landfills frequently included miscellaneous debris not found on any manifest, a conservative eco risk assessment includes a full spectrum analytical scheme regardless of what was found in other landfills in the area.	**Navy response** Data to support the elimination of these COPECs is presented at the end of this document. In addition, trenching data shows that predominantly inert construction debris was placed at this site.
EPA Specific Comment #5	Page 3-7,	**EPA Specific Comment #5**	**Navy response**

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and Navy response	Section 3.2	Identification of Chemicals of Potential Ecological Concern: Given there is no way to know exactly what may have been disposed of at this site, please justify why pesticides and herbicides were not included in the screening.	Previous investigation at AA 3 (subsurface soil sampling during trenching) did not include pesticides and herbicides in the sampling analysis suite. The suite of analysis that was used in the RSE investigation was presented in the Draft RSE Work Plan and was approved by the BCT members. ~~And,~~ Also, pesticides and herbicides were not considered to be COPECs since the site was predominantly used for debris disposal. AA 3 ~~site~~ is associated with ~~the~~ IRP Site 3 per the personnel interview records (construction debris generated during the construction of the investigation-derived waste management area at IRP Site 3 were disposed of at AA 3 site). The shallow and subsurface soil sampling analysis suite for Phase I and II RI of IRP Site 3 included pesticides and herbicides. An evaluation of the soil sampling results indicated that even though ~~they~~ there were low detections of few pesticides and herbicide compounds, their concentrations did not exceed their respective background concentrations ~~residential PRGs~~. Herbicides and pesticides were not considered chemicals of potential concern for Unit 1, Unit 3 and Unit 4 of the IRP Site 3. Therefore, the sample analysis suite for AA 3 RSE investigation did not include herbicides and pesticides.

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EPA Response to Navy response to Specific Comment **#6**		**EPA Response to Navy response to Specific Comment #6** Response accepted.	**Navy response** Noted.
EPA Specific Comment **#6** and Navy response	Page 3-8, Table 3-3	**EPA Specific Comment #6** Maximum COPEC Concentrations Detected in Surface Soil: Please explain the meaning of the distinction between dioxins (bird) and dioxins (mammal).	**Navy response** The distinction between the dioxin (bird) and dioxin (mammal) values is the use of bird- and mammal-specific Toxicity Equivalency Factors (TEF) to calculate specific bird and mammal 2.3.7.8-TCDD toxicity equivalency quotients (TEQs). These bird and mammal TEFs are from Van den Berg et al., 1998. A footnote ~~will be~~ was added to Table 3-3 explaining that the maximum concentrations for bird and mammal were calculated based on TEFs for birds and mammals, respectively. A discussion was added to the uncertainty section regarding the use of Bird TEFs for food-chain intake estimations.
EPA Response to Navy response to Specific Comment **#7**		**EPA Response to Navy response to Specific Comment #7** **Navy Response paragraph 1**: Since the reviewers of this document were not a party to the discussions regarding methodology in this response, please provide either meeting minutes or at a minimum a date as well as who was present for the discussions with EPA Region 9	**Navy response** This comment has been addressed.

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		concerning the methodology to be used to estimate the risk-based soil benchmark concentrations for higher trophic level receptors. **Navy response paragraphs 2 and 3**: No response required. We understand that the BTAG TRVs are doses, not soil concentrations but we do not agree that using soil concentrations as doses is not "appropriate". EPA Guidance (EPA, 1997) includes this method as one of the possible methods for calculating HQs. It is a method which may be used during the preliminary screening when site-specific data sufficient to calculate doses for the appropriate receptors is not available. It is understood this is very conservative and the assumption is made that better site-specific data can be provided during the BERA when exposure is calculated. **Navy response paragraph 6**: We do not agree that "if the SBC is exceeded (HQ>1), further evaluation **may** (emphasis added) be required." If the HQ is greater than 1, further evaluation is **always** required.	Noted. **Navy response paragraph 6**: Text revised to state "...further evaluation is required."
EPA Specific Comment **#7** and Navy response	Page 3-9, Section 3.3	**EPA Specific Comment #7** Assessment Endpoints: The calculation of food chain based ecological soil benchmark concentrations should be reserved for the BERA when everyone has agreed on the need for these calculations and has discussed the specific inputs. It is customary in the SERA to perform the screening by simply comparing the soil concentration of the contaminant to the Navy/BTAG TRV unless actual on-site data exists for computing BCFs.	**Navy response** The revised estimates of ~~methodology that was used to estimate the~~ ecological risk ~~based soil benchmark concentrations (SBCs)~~ for higher trophic level ecological receptors ~~is based on previous discussions with EPA Region IX~~ was revised based on hazard quotient calculations. The Navy TRVs are acceptable doses (mg/kg-day)

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			based on laboratory toxicity studies. They are not soil benchmark concentrations (mg/kg soil) and it is not appropriate to compare soil concentrations to doses. Comparing only to lower trophic level soil benchmarks ignores food chain risks. The bioconcentration values (plant root uptake from soil – BCFp and earthworm uptake from soil – BCFi) ~~that were used in the calculation of the SBCs were derived from peer-reviewed toxicology literature~~ were updated per comment General comment #4 of this document. Appendix C3 presents the BCF values. ~~Since the EPA and the Navy guidance documents for conducting Tier 1 screening ecological risk assessments (SERA) recommend the use of existing data and literature, the BCFi and BCFp values were used.~~ ~~These SBCs were~~ HQs were calculated using the EPA EcoSSL TRVs ~~published~~ (i.e., BTAG TRV-lows) (Appendix C4-1) and the representative species specific values of minimum body weight, maximum food intake, a diet consisting entirely of the presumed most contaminated fraction (soil invertebrates), and assuming site use factor (SUF) ~~and hazard quotient of 1~~. If the ~~SBC (dependent on BTAG TRV values)~~ HQ for a COPEC at the site ~~is not exceeded~~ does not exceed 1 ~~by COPEC maximum concentration (this comparison is equivalent to the HQ method)~~, further evaluation is not

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			required. Conversely, if ~~SBC~~ the HQ ~~is exceeded (HQ>1),~~ 1 or greater, further evaluation ~~may be~~ is required. Therefore, even though this process may seem extraneous in the SERA, it is in fact a comparison ~~with the Navy/BTAG~~ of conservative TRV values specific for representative species with the site soil COPEC ~~concentrations~~ chronic daily intake.
EPA Response to Navy response to Specific Comment #8		**EPA Response to Navy response to Specific Comment #8** No response required. We understand that the selection of the representative species is required to convert TRVs into screening values if the Navy chooses to include Tier 2 exposure estimates in the Tier 1 screening. Selection of target receptors is not necessary to perform the type of screening where the low TRV is simply compared to the COPEC concentration. This does not apply to the bioaccumulative compounds where it would be appropriate to estimate the risk to higher trophic level receptors in Tier 1. We also agree that the factors described in Section 3.4 are appropriate and conservative with the exception of the discussion regarding the elimination of the red-tailed hawk as a target receptor. Use of a higher trophic-level receptor such as the hawk with a small home range in the screening guarantees the process will be properly conservative. We do note for this site that using another receptor such as the logger head shrike (which has been observed in the area) would be more	**Navy response** Noted.

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		conservative in that the home range would be much smaller.	
EPA Specific Comment #8 and Navy response	Page 3-11, Section 3.4	**EPA Specific Comment #8** Selection of Representative Species: The selection of representative species is probably premature at this point. As noted above, one mid-winter survey does not provide a conservative estimate of on-site species. In addition, the discussion concerning the use of raptors seems to miss the point of screening. The use of the raptor does not "defeat the purpose of screening" as stated in the text. If the raptor is screened against the site and no risk is detected, then we may be confident there is no risk.	**Navy response** Representative species are required to ~~convert TRVs doses~~ calculate chronic daily intake in order to calculate hazard quotients. The selection of the representative species for the SERA was based on conservative factors described in Section 3.4 of the report and exposure assumptions provided in the response to comment 7. ~~However, t~~ This list of representative species ~~list~~ was ~~is being~~ revised to include more species from various feeding guilds. The results of the spring/summer survey ~~will also be~~ were used to help identify appropriate representative species. Special status species in the area of the site include the cactus wren and the coastal California gnatcatcher, both species that utilize coastal sage scrub. No special status species were observed in the Mulefat scrub habitat. Both special status birds are leaf gleaners with the wren also eating fruits and berries in season. Neither species has a direct exposure to soil contamination. The representative species selected (Western meadowlark for open areas and the Spotted tohee for thickets) both forage on the ground and represent a maximum exposure to site COPECs. Thus, their exposure is greater than that of special status birds and is protective of them. Wetlands have not been

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			identified in the area of the site, only streambed with riparian habitat. The text that refers to raptors has been removed from the discussion.
EPA Response to Navy response to Specific Comment #9		**EPA Response to Navy response to Specific Comment #9** Response accepted.	**Navy response** Noted.
EPA Specific Comment #9 and Navy response	Page 3-12, Table 3-5	**EPA Specific Comment #9** Selected Representative Terrestrial Species for the SERA: The two selected species are acceptable but the list is incomplete. The sensitive species listed for the site must also be assessed and given the lack of a comprehensive species survey on site (as discussed above), this list could be incomplete.	**Navy response** This draft version of the representative list of species ~~is being~~ was revised to include more species from various feeding guilds and those that are supported by the riparian habitat ~~(See attachment)~~. The results of the spring/summer survey ~~will also be~~ were incorporated if the species identified during this survey ~~would~~ provided more conservative values for the SERA and BERA.
EPA Response to Navy response to Specific Comment #10		**EPA Response to Navy response to Specific Comment #10** Response not accepted. There is evidence in the document (as noted above) that there is enough good habitat on site that we may expect sensitive species to be nesting and/or feeding on site. Please include sediment as a pathway.	**Navy response** Sediment was included as complete pathway for birds and mammals in the final SERA.

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EPA Specific Comment **#10** and Navy response	Page 3-13, Section 3.5	**EPA Specific Comment #10** Exposure Pathway Analysis: Considering there is wetland identified on site, it seems sediment should be included as a pathway. If there are sensitive species on site which would congregate in the wetlands, this would be a pathway of concern.	**Navy response** There are no sensitive species regularly using the site ~~because~~ however, ~~they will tend to avoid the ruderal vegetation found there and spend the majority of their time foraging in the coastal sage scrub and riparian mulefat scrub.~~ Rrecent sediment samples were collected during the spring rain event and ~~will be~~ were used to assess the potential for adverse effects to wildlife using the mulefat scrub. Also, please see response to Specific Comment #2.
EPA Response to Navy response to Specific Comment **#11**		**EPA Response to Navy response to Specific Comment #11** No response required. We wished to see the results of the preliminary unadjusted screening results for the non-bioaccumulative compounds before adjusting for exposure. Appendix C1-1 only presents the results for the lower trophic level receptors. It does not present preliminary screening for the higher trophic level receptors **before** adjusting for exposure.	**Navy response** Conservative exposure assumptions are used in the SERA. No adjustments are made to exposure assumptions until the BERA.
EPA Specific Comment **#11** and Navy response	Page 3-13, Section 3.5.1	**EPA Specific Comment #11** Species-Specific Exposure Factors: It would be helpful if the Navy would include a discussion of the results of preliminary screening of the contaminants versus the low BTAG TRVs and the ORNL benchmarks before refining the exposure factors. That would provide a clear picture of what the results are prior to beginning the BERA.	**Navy response** Appendix C1-1 presents the preliminary screening comparison of the maximum reporting limits of all chemicals analyzed to the ORNL Soil benchmarks. The ~~SBCs~~HQs are based on EcoSSL TRVs BTAG-low TRVs and other TRVs from the literature. A brief discussion of

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		of what the results are prior to beginning the BERA.	~~this comparison is~~ these calculations ~~are~~ is also presented in Section 3.2.
EPA Response to Navy response to Specific Comment **#12**		**EPA Response to Navy response to Specific Comment #12** No response required.	**Navy response** Noted.
EPA Specific Comment **#12** and Navy response	Page 3-14, 3-15, Section 3.5.2	**EPA Specific Comment #12** Chemical-Specific Exposure Factors: Since we have no site-specific data on BCFs, the results of these calculations are very uncertain at best. What were the results of the screening?	**Navy response** The BCFp values were ~~obtained from the literature or derived from a chemical specific octanol/water partition coefficient by the method of Travis and Arms (1988)~~ updated using EPA, 2003 (per general comment #4 above). The BCFi values are derived from studies of earthworm uptake. These BCF values were used in the calculation of ~~the COPEC specific SBCs and the result of the comparison of these estimated SBC values to the maximum soil concentration is~~ HQs for each soil and sediment COPEC and the results are presented in ~~Table 4-2 of the report~~Appendices L5 and L6 of the report. This is the screening that was performed for the site.
EPA Response to Navy response to Specific Comment **#13**		**EPA Response to Navy response to Specific Comment #13** Response accepted.	**Navy response** Noted.

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EPA Specific Comment **#13** and Navy response	Page 3-15, Section 3.6	**EPA Specific Comment #13** Development of Conceptual Site Model: Since no cognizance has been taken of the wetlands on the site, this model is incomplete.	**Navy response** Comment Noted. The conceptual site model was revised to include the sediment and surface water pathways. Agua Chinon wash is a seasonal wash that is fed by rain from storm events and typically does not have sustained flows for more than two weeks. Wetlands are not present. Stream bottom and riparian habitat are present and have been added to the conceptual site model.
EPA Response to Navy response to Specific Comment **#14**		**EPA Response to Navy response to Specific Comment #14** Response not accepted. The Sample, 1996 reference and adjustments is outdated. Please use the Sample and Arenal, 1999, paper as reference below.	**Navy response** The ecological risk assessment was revised to include equations from Sample and Arenal, 1999 to update allometric adjustments in mammals. Based on empirical data from 10 species of birds and 37 chemicals, an average scaling factor of 1.14 is estimated for birds. However, scaling factors for the majority of chemicals evaluated (29 of 37) were not significantly different from 1. Therefore, a scaling factor of 1 was considered most appropriate for interspecies extrapolation among birds.
EPA Specific Comment **#14** and Navy response	Page 3-19, Section 3.6.5,	**EPA Specific Comment #14** Allometric Conversions of TRVs: The Region 9 BTAG recommends against using allometric conversions in screening.	**Navy response** The Navy/BTAG document states that the TRVs MUST be converted using an allometric scaling factor to account for weight differences. Excerpts from DTSC

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			HERD EcoNOTE 2 June 9, 1999 Page 4): "The Human and Ecological Risk Division (HERD) does not recommend allometric conversion of TRVs for body weights which differ by less than 2 orders of magnitude. However, if the generalized BTAG mammalian TRVs are allometrically adjusted for differences in body weight, the allometric adjustment of the generalized mammal and avian TRVs should use a mammalian allometric relationships of body weight 0.66 or body weight 0.75 (Sample, 1996) with sufficient written justification. An avian allometric relationship of body weight 1.15 (Mineau, et al., 1996) should be used. The result should indicate that smaller mammals are less sensitive if the mammal tested had a higher body weight, while smaller birds should be fairly similar in sensitivity to birds with higher body weights." This EcoNote 2 does not say that allometric conversions should not be done in the screening stages, but provides a rationale to allometrically adjust the TRV values. Section 3.6.5 of the report provides a justification for the use of allometric conversions of the TRV and uses the equations from Sample (1996) as suggested by the HERD EcoNote 2. <u>However, these have been updated as discussed in Response to Comment #14.</u> ~~Past discussions with EPA Region 9 (Clarence~~

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			~~Callahan) lead to the use of allometric adjustments for mammals and no allometric adjustment for birds for Navy Clean projects.~~
EPA Response to Navy response to Specific Comment **#15**		**EPA Response to Navy response to Specific Comment #15** No response required. We understand how the Navy calculated the hazard quotients. We would have preferred to see them presented as we described in the original document. Adjustments to the screening hazard quotients should be presented in the BERA after the screening is completed, the results discussed and the problem formulation for the BERA completed.	**Navy response** Noted.
EPA Specific Comment **#15** and Navy response	Page 4-1, Section 4.2.1	**EPA Specific Comment #15** Hazard Quotients: Hazard quotients should be calculated and presented using the maximum soil/sediment concentration and the ORNL benchmarks or BTAG low TRVs, as appropriate before presenting the "adjusted" values.	**Navy response** Hazard quotients were calculated by dividing the maximum soil/sediment concentration by the ORNL benchmarks (Table 4-1) and ~~Eco SBCs~~TRVs (calculated from the species-specific and chemical-specific factors ~~values including TRVs from toxicology publications)~~ ~~(Table 4-2~~Appendices L5 and L6). ~~These tables do not present the complete list of all chemicals, but only those preliminary COPECs that were detected in surface soils.~~ Conservative exposure factors were used (EPA 1997, Pgs. 2-2 to 2-4).
EPA Response to Navy		**EPA Response to Navy response to Specific Comment #16**	**Navy response**

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response to Specific Comment **#16**		Response accepted with the caveat that (1) sensitive species must be included if there is any riparian habitat on site (as document and the Navy's response seems to indicate) and (2) the expanded sampling discussion (see comment 5 above) supports lack of pesticide/herbicide detections.	(1) Sensitive species are represented for all habitats on site. See Response to Comment #9. (2) See response to General Comment #2.
EPA Specific Comment **#16** and Navy response	Page 5-1, Table 5-1	**EPA Specific Comment #16** Retained COPECs List for Tier 2, Step 3A BERA: This list is premature as discussed above. A more comprehensive biotic survey of the site and sediment and surface water samples should be provided, the list of receptors must be expanded to include sensitive species, and the list of COPECs should include pesticides and herbicides.	**Navy response** Comprehensive biotic survey – A spring/summer survey was conducted at ~~is planned for~~ the site. Results of the surface water and sediment water samples ~~will be~~ were presented in the ~~Draft Final~~ revised report and the CSM ~~will~~ was also ~~be~~ updated to reflect the results from these samples. List of receptors – The representative list of species ~~is being~~ was revised to include more species from various feeding guilds. The results of the spring/summer survey ~~will also be~~ were incorporated if the species identified during this survey would provide more conservative values for the SERA and BERA. Inclusion of herbicides/pesticides – Please see response to Comment #5.
EPA Response to Navy response to Specific		**EPA Response to Navy response to Specific Comment #17** --	**Navy response** --

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Comment **#17**			
EPA Specific Comment **#17** and Navy response	Appendix D-2	**EPA Specific Comment #17** Working Draft Tier 2, Step 3A of the BERA Process: As noted above, these conclusions have been reached based on insufficient evidence.	**Navy response** Comment Noted. It is Navy's opinion that a better understanding of regulatory agency concerns was developed based on discussions during the ~~last~~ June 10 BCT meeting. This understanding ~~will be~~ is incorporated into the ~~next~~ revised ~~version of the working draft of~~ Tier 2, Step 3A of the BERA process and is presented to the BCT members for their review and comments.
III. Comments on the "Tier 1, animal species-specific exposure factors for Anomaly Area 3" and the "Tier 2 animal species-specific exposure factors for Anomaly Area 3"			
1.		According to the BCT Meeting Minutes from June 10, 2003, it is presumed that the same representative species will be used at Site 1 and AA 3. Final selection of the representative species cannot be completed until complete species lists have been developed for these sites (pending the spring/summer habitat assessment). These species lists should provide the basis for providing the rationale for receptor selection from the various feeding guilds potentially present at the two sites. However, the species listed in Tables 1 and 2 are in concordance with the agreements reached at our June 10, 2003 meeting, with one exception. The loggerhead shrike was proposed as a tertiary trophic level bird species for Site 1 but it is not listed in the tables. Please provide rationale for why the red-shouldered hawk is a conservative	A spring/summer habitat assessment was performed and a representative species list was prepared in coordination with the BCT for the final version of the SERA. Logger head shrike was identified at IRP Site 1, MCAS El Toro. This species was not found at AA 3 and therefore, was not used as a representative species for the site.

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		representative receptor for this feeding guild.	
2.		ERA documents should clearly detail how the Tier 1 and Tier 2 exposure and risk estimates will be calculated for each site. Final acceptance of the approach for incorporating foraging area into the Tier 2 assessment cannot be provided until methods are detailed.	The methods used have been clarified in the text. Site use is defined only spatially (area of site vs. foraging area). Temporal partitioning (site use based on how much of the year a receptor uses the site [for example, migration, hibernation] of site use was not used in either the SERA or BERA [i.e., all animals were assumed to be present at the facility throughout the year].
3.		As stated previously in the June 4, 2003 memorandum from Regina Donohoe, Department of Fish and Game, to Rafat Abbasi, Department of Toxic Substances Control, (Comment 11), food ingestion rates should be based on the updated equations of Nagy (2001), not the older Nagy equations provided by USEPA (1993).	Food ingestion rates from updated equation of Nagy (2001) were incorporated into the exposure model.
4.		References for all the cited exposure factor literature in the tables should be provided so that values can be verified and/or evaluated for their applicability to the habitat at El Toro. The ERA documents should provide rationale for the selection of foraging area values, comparing the relevance of the habitat studied to that at Site 1 or AA 3.	References for cited exposure factors are now listed in tables.
5.		For each of the receptors, please distinguish whether the animal diet partition factor is for invertebrates or vertebrates to clarify what trophic level is being modeled.	Animal diet partition for each receptor was revised to clarify what trophic level is being modeled. Only the predators, the red-shouldered hawk and long-tailed weasel, are assumed to eat vertebrate prey (100% mice for the SERA).
6.		A soil ingestion rate of 3-6%, based on the short-tailed shrew (USEPA, 2000; http://www.epa.gov/ecotox/ecossl/SOPs.htm), indicates the 2% ingestion rate for the ornate shrew is underestimated.	The soil ingestion rate for the shrew will be revised to 6%.

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		ingestion rate for the ornate shrew is underestimated.	
7.		The listed maximum body weight for the western meadowlark, 3 kg, is erroneous.	This value was revised with the correct weight: 0.114 (kg) (Lanyon, 1962).
8.		As stated previously (June 4, 2003 memorandum from Regina Donohoe to Rafat Abbasi; Comment 11), the soil ingestion rate for the ground feeding birds (i.e., western meadowlark, spotted towhee and mourning dove) should be increased. Higher values based on the American woodcock (i.e., 10.4%; Beyer et al., 1994) are recommended.	The woodcock probes deep into soils to extract earthworms. None of the birds at El Toro feed in this manner, therefore the Navy used the original soil ingestion rates for the ground feeding birds.
9.		Three studies on home range of the short-tailed shrew are provided by USEPA (1993). Home ranges for Michigan blue-grass (0.1-0.36 ha) and New York old field (0.03-0.22 ha) habitats are lower than the selected mean value (0.39 ha) for Manitoba tamarack bog habitat. Please justify why the Manitoba study more accurately reflects the conditions at El Toro given that other studies in the U.S. have reported smaller home ranges.	None of the studies adequately represents the foraging area for an arid habitat. Since food is not assumed to be as easy to find as in the mesic New York old field, a value of 0.22 ha (upper end of NY field but lower than other 2 habitats) is used. Please note that the SUF discussed were not used. In the SERA. A more conservative SUF value of 1 was used in the SERA.
10.		As stated previously, (June 4, 2003 memorandum from Regina Donohoe to Rafat Abbasi; Comment 11), the foraging area (0.6 ha) for the deer mouse should be lowered to be more reflective of the values reported in exposure factor reviews (e.g., USEPA, 1993; <0.1 ha or Cal/Ecotox; http:// www.oehha.org /cal_ecotox /report /peromef.pdf). These reviews indicate that the Wolff 91985) study reported values lower than 0.6 ha (e.g., 0.05 ha).	Bowers and Smith (1979) report mean home ranges of 0.128 and 0.094 ha for male and female deer mice, respectively, for the Idaho high desert. This is the most similar to site habitat, so a value of 0.1 ha was assumed for use in estimating exposure. The exposure model was revised to incorporate a smaller home range for use in Tier 2, Step 3a (SUF assumed to be 1 for all receptors in Tier 1). This comment is inconsequential to the SERA.

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11.		Please provide justification as to why the Tier 2 screen involves alteration of the diet partition factors, compared to the Tier 1 table, for the deer mouse, meadowlark and spotted towhee.	Tier 1 diet partition factors use conservative values to estimate diet intake values ("...the diet is composed entirely of whichever type of food is most contaminated." [EPA 1997, Pg 2-3]). In Tier 2, these values are revised to more realistically estimate diet intake values based on field studies reported in the literature.

References:

EPA, 1997. Ecological Risk Assessment Guidance fro Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final. EPA 540-R-97-006.

Sample, B.E. and C.A. Arenal, 1999. 1999. Allometric Models for inter-species Extrapolation for Wildlife Toxicity Data. Bull. Environ. Contam. Tox. 62:653-663.

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IRP Site 3 Surface and Subsurface Soil Sampling Results – Pesticides/PCBs and Herbicides

Since interviews with former station personnel indicate that construction debris generated during the construction of the investigation-derived waste (IDW) management area at IRP Site 3 was placed at AA 3, the pesticides/polychlorinated biphenyls and herbicides sampling results from IRP Site 3 surface and subsurface soil samples were reviewed.

Surface and subsurface soils samples collected from Unit 1 of IRP Site 3 as part of Phase I RI and Phase II RI were analyzed for TPH, benzene, toluene, ethylbenzene and xylenes (BTEX), VOCs, SVOCs, pesticides/polychlorinated biphenyls, herbicides, polyaromatic hydrocarbons, radionuclides, total kjedahl nitrogen, total organic carbon, biochemical oxygen demand, chemical oxygen demand, metals and dioxins.

From all investigations, 6 surface soil samples were collected and analyzed for pesticides/polychlorinated biphenyls and 7 surface soil samples were analyzed for herbicides. Detected analytes include 4,4'-dichlorodiphenyldichloroethane (4,4'-DDD), 4,4'-dichlorodiphenyldichloroethene (4,4'-DDE), 4,4'-dichlorodiphenyltrichloroethane (4,4'-DDT) and 2,4,5-trichlorophenoxyproprionic acid (2,4,5-TP). A summary of their frequency of detection, maximum, minimum concentrations, and their respective PRGs and MCAS El Toro background concentrations are presented in the Table 1 below.

All the pesticides/polychlorinated biphenyls and herbicides detected were below their respective PRG concentrations and all were also less than the MCAS El Toro background concentrations with the exception of 4,4'-DDD.

Table 1: Summary Table for Detected Pesticide/Polychlorinated biphenyls and Herbicides

Analyte	Number of Analyses	Number of Detections	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	USEPA PRG (mg/kg)	MCAS El Toro Background Concentrations (mg/kg)
Pesticides/PCBs						
4,4'-DDD	6	1	0.293J	0.293J	1.9	0.0586
4,4'-DDE	6	2	0.0102J	0.0477J	1.3	0.233
4,4'-DDT	6	3	0.0105J	0.209J	1.3	0.272
Herbicides						
2,4,5-TP	7	1	0.0496	0.0496	520	–

From all investigations, 15 subsurface soil samples were collected and analyzed for

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pesticides/polychlorinated biphenyls and 16 subsurface soil samples were analyzed for herbicides. Detected analytes include endosulfan II, 2,4,5-TP, 2,4,5-trichlorophenoxyacetic acid, 2,4-dichlorophenoxyproprionic acid (2,4-DB), 2-methyl-4-chlorophenoxyproprionic acid (MCPP). A summary of their frequency of detection, maximum, minimum concentrations, and their respective PRGs and MCAS El Toro background concentrations are presented in the Table 2 below.

Endosulfan II was detected at a concentration that is below the MCAS El Toro background concentrations. With the exception of MCPP, all other detected herbicides were four orders of magnitude less than their corresponding residential PRGs.

Table 2: Summary Table for Detected Pesticide/Polychlorinated biphenyls and Herbicides

Analyte	Number of Analyses	Number of Detections	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	USEPA PRG (mg/kg)	MCAS El Toro Background Concentrations (mg/kg)
Pesticides/PCBs						
Endosulfan II	15	1	0.00018J	0.00018J	–	0.0106
Herbicides						
2,4,5-TP	16	1	0.0613J	0.0613J	520	–
2,4,5-trichlorophenoxy acetic acid	16	1	0.0418J	0.0418J	650	–
2,4-DB	16	1	0.098N	0.098N	520	–
MCPP	16	3	35	62.7	65	–

NOTES:
N - presumptive evidence to tentatively identify organic compound

LIST OF ACRONYMS AND ABBREVIATIONS

AA	Anomaly Area
BAFS	bioaccumulation factors
BCF	bioconcentration factor
BCF_i	soil to invertebrate bioconcentration factor
BCF_p	soil to plant bioconcentration factor
BCT	Base Realignment and Closure Cleanup Team
BERA	baseline ecological risk assessments
Bgs	below ground surface
CCS	coastal sage scrub
COPEC	chemical of potential ecological concern

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CSM	conceptual site model
CSS	coastal sage scrub
DTSC	Department of Toxic Substances Control
EPA	Environmental Protection Agency
ERA	Ecological Risk Assessment
ha	hectare
HERD	Human and Ecological Risk Division
HQ	hazard quotient
IRA	Interim Removal Action
IRP	Installation Restoration Program
kg	kilogram
LOAEL	lowest observed adverse effect level
MCAS	Marine Corps Air Station
mg/kg	milligrams per kilogram
NOAEL	no observed adverse effect level
NY	New York
ORNL	Oak Ridge National Laboratory
PCB	polychlorinated biphenyl
PRG	preliminary remediation goal
RI	remedial investigation
RSE	removal site evaluation
SBC	soil based concentrations
SERA	screening ecological risk assessment
SSL	soil screening levels
SUF	site use factor
TEF	toxicity equivalency factor
TEQ	toxicity equivalency quotient
TRV	toxicity reference value
U.S.	United States
USEPA	United States Environmental Protection Agency

Appendix F
Geotechnical Laboratory Reports

Table H-1: Details of Near Surface Geotechnical Soil Sampling – RSE Investigation

Location ID	EPA ID	Earth Tech ID	Depth Interval (feet)	Analysis Type								
				Moisture Content ASTM D 2216	Dry Density	Particle Size Distribution ASTM D 422	Percent Passing No. 200 Sieve ASTM D 1140	Atterberg Limits ASTM D 4318	Modified Proctor Compaction		Specific Gravity ASTM D 854	Soil Classification/ Identification ASTM D2487/ ASTM D 2488
									Maximum Dry Density ASTM D 1557	Optimum Moisture Content (ASTM D 1557)		
TR01	LK141	AA 3-TR01SS-S01-D002	0–2	√	√	√	—	√	—	—	—	√
	LK142	AA 3-TR01SS-S02-D010	4–10	√	—	—	√	—	—	—	—	√
	LK143	AA 3-TR01SS-S03-D008	2–8	√	—	√	—	—	√	√	√	√
	LK144	AA 3-TR01SS-S04-D012	8–12	√	—	—	√	√	—	—	—	√
TR03	LK145	AA 3-TR03SS-S01-D004	0–4	√	—	√	—	—	—	—	—	√
	LK146	AA 3-TR03SS-S02-D007	0–7	√	—	√	—	—	—	—	—	√
TR04	LK147	AA 3-TR04SS-S01-D003	0–3	√	—	√	—	—	—	—	—	√
	LK148	AA 3-TR04SS-S02-D006	3–6	√	—	—	—	—	—	—	—	√
TR06	LK149	AA 3-TR06SS-S01-D008	0–8	√	—	√	—	—	—	—	—	√
TR07	LK150	AA 3-TR07SS-S01-D003	2–3	√	—	√	—	—	—	—	—	√
TR08	LK151	AA 3-TR08SS-S01-D002	1–2	√	√	—	√	√	√	√	√	√
	LK152	AA 3-TR08SS-S02-D005	4–5	√	—	√	—	—	—	—	—	√
TR09	LK153	AA 3-TR09SS-S01-D002	1–2	√	—	—	√	—	—	—	—	√
TR11	LK154	AA 3-TR11SS-S01-D004	0–4	√	√	—	√	—	—	—	—	√
HA02	LK155	AA 3-HA02SS-S02-D001	0–1	√	—	√	—	√	—	—	—	√
	LK156	AA 3-HA02SS-S03-D004	3.5–4.0	√	√	—	—	—	—	—	—	√
HA07	LK157	AA 3-HA07SS-S02-D000	0–0.5	√	—	—	—	—	—	—	—	√
	LK158	AA 3-HA07SS-S03-D005	4.5–5.0	√	√	—	—	—	—	—	—	√
HA15	LK159	AA 3-HA15SS-S02-D000	0–0.5	√	—	—	√	—	—	—	—	√
	LK160	AA 3-HA15SS-S03-D004	3.5–4.0	√	—	√	—	—	—	—	—	√
HA17	LK161	AA 3-HA17SS-S02-D000	0–0.5	√	—	√	—	—	—	—	—	√
	LK162	AA 3-HA17SS-S03-D004	3.7–4.2	√	—	—	—	—	—	—	—	√
HA25	LK163	AA 3-HA25SS-S02-D000	0–0.5	√	—	—	√	—	—	—	—	√
	LK164	AA 3-HA25SS-S03-D004	3.5–4.0	√	—	—	√	—	—	—	—	√
HA27	LK165	AA 3-HA27SS-S02-D000	0–0.5	√	—	—	√	—	—	—	—	√
	LK166	AA 3-HA27SS-S03-D004	3.5–4.0	√	—	√	—	—	—	—	—	√

Table H-2: Details of Subsurface Geotechnical Soil Samples – RSE Investigation

Location ID	EPA ID	Earth Tech ID	Depth Interval (feet bgs)	Analysis Type					
				Soil Classification/ Identification ASTM D2487/ ASTM D 2488*	Moisture Content ASTM D 2216	Dry Unit Weight - Drive Cylinder ASTM D2937	Percent Passing No. 200 Sieve ASTM D 1140	Particle Size Distribution ASTM D 422	Atterberg Limits ASTM D 4318
MW05	LK169	AA 3-MW05SS-S01-D002	2.0–2.5	√	√	√	—	√	—
	LK170	AA 3-MW05SS-S02-D006	6.0–6.5	√	√	√	—	—	—
	LK171	AA 3-MW05SS-S03-D010	10.5–11.0	√	√	√	—	√	—
	LK172	AA 3-MW05SS-S04-D015	15.5–16.0	√	√	√	—	√	—
	LK173	AA 3-MW05SS-S05-D020	20.0–20.5	√	√	√	—	—	—
	LK174	AA 3-MW05SS-S06-D025	25.5–26.0	√	√	√	—	√	—
	LK175	AA 3-MW05SS-S07-D030	30.5–31.0	√	√	√	—	—	—
	LK176	AA 3-MW05SS-S08-D035	35.0–5.5	√	√	√	—	—	—
	LK177	AA 3-MW05SS-S09-D040	40.0–41.5	√	√	—	—	√	—
	LK178	AA 3-MW05SS-S10-D045	45.0–46.5	√	√	—	√	—	√
	LK179	AA 3-MW05SS-S11-D055	55.0–56.5	√	√	—	—	—	—
	LK180	AA 3-MW05SS-S12-D057	57.0–57.5	√	√	√	√	—	—
MW06	LK181	AA 3-MW06SS-S01-D001	1.5–2.0	√	√	√	√	—	—
	LK182	AA 3-MW06SS-S02-D005	6.0–6.5	√	√	√	—	—	—
	LK183	AA 3-MW06SS-S03-D010	11.0–11.5	√	√	√	—	—	—
	LK184	AA 3-MW06SS-S04-D015	16.0–16.5	√	√	√	√	—	√
	LK185	AA 3-MW06SS-S05-D020	21.0–21.5	√	√	√	—	√	—
	LK186	AA 3-MW06SS-S06-D025	26.0–26.5	√	√	√	—	—	—
	LK187	AA 3-MW06SS-S07-D030	31.0–31.5	√	√	√	—	√	—
	LK188	AA 3-MW06SS-S08-D035	36.0–36.5	√	√	√	√	—	—
	LK189	AA 3-MW06SS-S09-D040	40.0–41.5	√	√	—	√	—	√
MW07	LK190	AA 3-MW07SS-S01-D002	2.0–2.5	√	√	√	—	—	—
	LK191	AA 3-MW07SS-S02-D006	6.0–6.5	√	√	√	—	√	—
	LK192	AA 3-MW07SS-S03-D010	10.5–11.0	√	√	√	—	—	—
	LK193	AA 3-MW07SS-S04-D015	15.5–16.0	√	√	√	—	√	—
	LK194	AA 3-MW07SS-S06-D025	25.0–25.5	√	√	√	—	√	—
	LK195	AA 3-MW07SS-S07-D031	31.0–31.5	√	√	√	√	—	—
	LK196	AA 3-MW07SS-S08-D035	36.0–36.5	√	√	√	—	—	√
	LK197	AA 3-MW07SS-S09-D040	40.5–41.0	√	√	—	√	—	—
	LK198	AA 3-MW07SS-S10-D046	46.0–46.5	√	√	√	—	—	—
	LK199	AA 3-MW07SS-S11-D050	50.0–50.5	√	√	√	—	√	—
MW08	LK200	AA 3-MW08SS-S01-D001	1.0–1.5	√	√	√	—	—	—
	LK201	AA 3-MW08SS-S02-D006	6.0–6.5	√	√	√	√	—	—
	LK202	AA 3-MW08SS-S03-D011	11.0–11.5	√	√	√	—	√	—
	LK203	AA 3-MW08SS-S04-D016	16.0–16.5	√	√	√	—	√	—

Table H-2: Details of Subsurface Geotechnical Soil Samples – RSE Investigation

Location ID	EPA ID	Earth Tech ID	Depth Interval (feet bgs)	Analysis Type					
				Soil Classification/ Identification ASTM D2487/ ASTM D 2488*	Moisture Content ASTM D 2216	Dry Unit Weight - Drive Cylinder ASTM D2937	Percent Passing No. 200 Sieve ASTM D 1140	Particle Size Distribution ASTM D 422	Atterberg Limits ASTM D 4318
	LK204	AA 3-MW08SS-S05-D021	21.0–21.5	√	√	√	—	—	—
	LK205	AA 3-MW08SS-S06-D026	26.0–26.5	√	√	√	—	√	—
MW09	LK206	AA 3-MW09SS-S01-D001	1.0–1.5	√	√	√	—	—	—
	LK207	AA 3-MW09SS-S02-D006	6.0–6.5	√	√	√	—	√	—
	LK208	AA 3-MW09SS-S03-D010	10.5–11.0	√	√	√	—	—	—
	LK209	AA 3-MW09SS-S04-D016	16.0–16.5	√	√	√	—	√	—
	LK210	AA 3-MW09SS-S05-D021	21.0–21.5	√	√	√	√	—	—
	LK211	AA 3-MW09SS-S06-D026	26.0–26.5	√	√	√	—	—	—
	LK212	AA 3-MW09SS-S07-D031	31.0–31.5	√	√	√	—	√	—
	LK213	AA 3-MW09SS-S08-D035	35.0–36.5	√	√	—	—	—	—
	LK214	AA 3-MW09SS-S09-D040	40.0–41.5	√	√	—	—	√	—
	LK215	AA 3-MW09SS-S10-D045	45.0–46.5	√	√	—	—	—	—
	LK216	AA 3-MW09SS-S11-D050	50.0–51.5	√	√	—	—	√	—
	LK217	AA 3-MW09SS-S12-D055	55.0–56.5	√	√	—	—	—	—
	LK218	AA 3-MW09SS-S13-D060	60.0–61.5	√	√	—	—	—	—
	LK219	AA 3-MW09SS-S14-D065	65.0–66.5	√	√	—	—	√	—
	LK220	AA 3-MW09SS-S15-D070	70.0–71.5	√	√	—	—	—	—
	LK221	AA 3-MW09SS-S16-D075	75.0–76.5	√	√	—	—	—	—
	LK222	AA 3-MW09SS-S17-D080	80.0–81.5	√	√	—	—	√	—
MW10	LK223	AA 3-MW10SS-S01-D002	2.0–2.5	√	√	√	—	—	—
	LK224	AA 3-MW10SS-S02-D006	6.0–6.5	√	√	√	—	√	—
	LK225	AA 3-MW10SS-S03-D011	11.0–11.5	√	√	√	—	—	—
	LK226	AA 3-MW10SS-S04-D016	16.0–16.5	√	√	√	√	—	√
	LK227	AA 3-MW10SS-S05-D020	20.5–21.0	√	√	√	—	√	—
	LK228	AA 3-MW10SS-S06-D026	26.0–26.5	√	√	√	—	—	—
	LK229	AA 3-MW10SS-S07-D031	31.0–31.5	√	√	√	—	√	—
	LK230	AA 3-MW10SS-S08-D036	36.0–36.5	√	√	√	√	—	—
	LK231	AA 3-MW10SS-S09-D041	41.0–41.5	√	√	√	—	√	—
	LK232	AA 3-MW10SS-S10-D044	44.5–45.0	√	√	—	—	√	—

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

November 12, 2002

Earth Tech, Inc.
100 West Broadway, Suite 240
Long Beach, CA 90802-4443

Attention: Mr. Crispin Wanyoike

Subject: **Report/Laboratory Testing Results**
Project Name: Anomaly Area 3, Former MCAS El Toro, California
Project No.: 37380 / CTO 0078
Subcontract No.: 02S-2831-HI09 / CTO No.: 0078
TERATEST No.: 015230

Dear Mr. Wanyoike:

Enclosed please find laboratory testing results for the soil samples from the above referenced project. The requested tests were conducted in essential accordance with the standard test methods listed below.

TYPE OF TEST	TEST METHOD
Laboratory Determination of Water (Moisture) Content of Soil and Rock	ASTM D 2216
"Chunk" Dry Unit Weight	Displacement Method
Amount of Material in Soils Finer Than the No. 200 Sieve	ASTM D 1140
Particle-Size Analysis of Soils	ASTM D 422
Liquid Limit, Plastic Limit and Plasticity Index of Soils	ASTM D 4318
Specific Gravity of Soils	ASTM D 854
Direct Shear Test of Soils Under Consolidated Drained Conditions	ASTM D 3080
Laboratory Compaction Characteristics of Soil Using Modified Effort	ASTM D 1557

Test results are presented Table 1 and the attached Data Sheets.

ASTM: American Society for Testing and Materials, Annual Book of ASTM Standards, Section 4 Construction, Volume 04.08 Soil and Rock (I), 2000.

17781 Cowan ▪ Irvine, CA 92614-6009
949.253.5922 ▪ Fax 949.263.8843 ▪ www.teratest.com

Thank you for selecting Teratest Labs, Inc. to provide laboratory testing services to Earth Tech, Inc. Please feel free to contact us if you should have any questions concerning these results.

Very truly yours,

TERATEST LABS, INC.
Laboratory Testing Services

REGISTERED PROFESSIONAL ENGINEER
MOHAMMAD H. FAKHARPOUR
No. C049035
Exp. 9-30-04
CIVIL
STATE OF CALIFORNIA

Lester Fruth, Ph.D.
Soils Laboratory Supervisor

Mohammad Fakharpour, P.E.
Registered Civil Engineer

Enclosures

Teratest Labs, Inc.

17781 Cow[illegible] Suite 150, Irvine, CA 92614 TERATEST LABS, INC. Tel.No. (949) 253-5922 Fax. No. (949) 724-1557

Project Name: Anomaly Area 3, Former MCAS El Toro, CA **Teratest No.:** 015[illegible]

Project No.: 37380 / CTO 0078 **Tabulated By:** LF

Client: Earth Tech, Inc. **Date:** 11/12/02

TABLE 1

SUMMARY of LABORATORY TEST RESULTS

EPA ID	Sample No.	Depth (ft.)	Moisture Content ASTM D 2216 (%)	Dry Density Displacement Method / Wax coated Specimen (pcf)	Particle - Size Distribution ASTM D 422 GR:SA:FI[2] (%)	Percent Passing No. 200 Sieve ASTM D 1140 (%)	Atterberg Limits ASTM D 4318 LL,PL,PI[1]	Modified Proctor Compaction ASTM D 1557 Maximum Dry Density / Proc. (pcf / A,B,C)	Modified Proctor Compaction ASTM D 1557 Optimum Moisture Content (%)	Specific Gravity ASTM D 854	Soil Classification / Identification ASTM D 2487 / ASTM D 2488* (group symbol)
LK141	AA3-TR01-S1	0 - 2	3.9	118.9	2:58:40		25,18,7				SC-SM
LK142	AA3-TR01-S2	4 - 10	3.3			12.5					SM
LK143	AA3-TR01-S3	2 - 8	4.5		2:71:27			125.0 / A	9.5	2.65	SM
LK144	AA3-TR01-S4	8 - 12	19.0			43.0	48,30,18				SM
LK145	AA3-TR03-S1	0 - 4	3.9		1:70:29						SM
LK146	AA3-TR03-S2	0 - 7	4.6		0:84:16						SM
LK147	AA3-TR04-S1	0 - 3	2.0		8:72:20						SM
LK148	AA3-TR04-S1	3 - 6	11.3								SM*
LK149	AA3-TR06-S1	0 - 8	6.7		6:66:28						SM
LK150	AA3-TR07-S1	2 - 3	5.1		9:65:26						SM
LK151	AA3-TR08-S1	1 - 2	3.6	115.5		37.0	31,19,12	118.5 / A	11.5	2.64	SC
LK152	AA3-TR08-S2	4 - 5	3.9		2:79:22						SM
LK153	AA3-TR09-S1	1 - 2	6.8			50.7					s(ML)
LK154	AA3-TR11-S1	0 - 4	4.5	112.3		49.1					SM

[1] LL,PL,PI = Liquid Limit, Plastic Limit, Plasticity Index

[2] GR:SA:FI = Gravel: Sand: Fines (Percent Passing #200 Sieve)

Project Name: Anomaly Area 3, Former MCAS El Toro, CA **Teratest No.:** 015230

Project No.: 37380 / CTO 0078 **Tabulated By:** LF

Client: Earth Tech, Inc. **Date:** 11/12/02

TABLE 1 (Continued)

SUMMARY of LABORATORY TEST RESULTS

EPA ID	Sample No.	Depth (ft.)	Moisture Content ASTM D 2216 (%)	Dry Density Displacement Method / Wax coated Specimen (pcf)	Particle - Size Distribution ASTM D 422 GR:SA:FI[2] (%)	Percent Passing No. 200 Sieve ASTM D 1140 (%)	Atterberg Limits ASTM D 4318 LL,PL,PI[1]	Modified Proctor Compaction ASTM D 1557 Maximum Dry Density / Proc. (pcf / A,B,C)	Modified Proctor Compaction ASTM D 1557 Optimum Moisture Content (%)	Specific Gravity ASTM D 854	Soil Classification Identification ASTM D 2487 / ASTM D 2488* (group symbol)
LK155	AA3-HA02	0 - 1	1.5		4:74:22		Nonplastic				SM
LK156	AA3-HA02	3.5 - 4.0	11.2	128.0							SC*
LK157	AA3-HA07	0 - 0.5	2.0								SM*
LK158	AA3-HA07	4.5 - 5.0	20.9	125.0							CL*
LK159	AA3-HA15	0 - 0.5	2.8			31.5					SM
LK160	AA3-HA15	3.5 - 4.0	3.9		1:77:22						SM
LK161	AA3-HA17	0 - 0.5	3.2		0:61:39						SM
LK162	AA3-HA17	3.7 - 4.2	7.5								SM*
LK163	AA3-HA25	0 - 0.5	3.1			32.6					SM
LK164	AA3-HA25	3.5 - 4.0	5.3			17.4					SM
LK165	AA3-HA27	0 - 0.5	3.8			32.7					SM
LK166	AA3-HA27	3.5 - 4.0	8.8		1:66:33						SM

[1] LL,PL,PI = Liquid Limit, Plastic Limit, Plasticity Index
[2] GR:SA:FI = Gravel: Sand: Fines (Percent Passing #200 Sieve)

GEOTECHNICAL LABORATORY TESTING - EXISTING COVER MATERIALS AND NEAR-SURFACE FILL SOILS

EL TORO MCAS - ANOMALY AREA 3 (AA3)

EPA ID	Sample Number	Exploration Location	Depth (feet)	Type	Field Classification (ASTM D2488)	Moisture Content (ASTM D2216)	Dry Unit Weight - Drive Cylinder (ASTM D2937)	"Chunk" Dry Unit Weight	Fines Fraction (ASTM D1140)	Grain Size Distribution - Sieve Analysis (ASTM D422)	Grain Size Distribution - Hydrom. Analysis (ASTM D422)	Atterberg Limits (ASTM D4318)	Compaction (ASTM D1557)	Specific Gravity (ASTM D854)	Direct Shear (ASTM D3080)	Sulfate (Cal 417)	Chlorides (Cal 422)	pH (Cal 643)	Minimum Resistivity (Cal 532)	REMARKS
LK141	AA3-TR01-S1	TR-01	0 - 2	Bucket	ML	√		√		√		√								
LK142	AA3-TR01-S2	TR-01	4 - 10	Bucket	SP-SM	√			√											
LK143	AA3-TR01-S3	TR-01	2 - 8	Bucket	SM	√				√			√	√	√					Direct Shear at RC = 85% w = w_{opt} +2%, and 90% Saturated, 1, 2, and 4 ksf CD
LK144	AA3-TR01-S4	TR-01	8 - 12	Bucket	SC / CL	√			√			√								Per Ernesto Shear Rates
LK145	AA3-TR03-S1	TR-03	0 - 4	Bucket	SM	√				√										for Drained Conditions
LK146	AA3-TR03-S2	TR-03	0 - 7	Bucket	SP-SM	√				√										Required/Varies with
LK147	AA3-TR04-S1	TR-04	0 - 3	Bucket	SM	√				√										Soil Type
LK148	AA3-TR04-S1	TR-04	3 - 6	Bucket	SM	√														
LK149	AA3-TR06-S1	TR-06	0 - 8	Bucket	SM	√				√										
LK150	AA3-TR07-S1	TR-07	2 - 3	Bucket	SM	√				√										
LK151	AA3-TR08-S1	TR-08	1 - 2	Bucket	ML	√		√	√			√	√	√	√					Direct Shear at RC = 85% w = w_{opt} +2%, and 90% Saturated, 1, 2, and 4 ksf, shearing rate = ~~0.001 inch/min~~ CD
LK152	AA3-TR08-S2	TR-08	4 - 5	Bucket	SM	√				√										
LK153	AA3-TR09-S1	TR-09	1 - 2	Bucket	ML	√			√											
LK154	AA3-TR11-S1	TR-11	0 - 4	Bucket	ML	√		√	√											
LK155	AA3-HA02	HA-02	0 - 1	Plastic Tube	ML / SM	√					√	√								
LK156	AA3-HA02	HA-02	3.5 - 4.0	Plastic Tube	SC / CL	√		√												
LK157	AA3-HA07	HA-07	0 - 0.5	Plastic Tube	SM	√														
LK158	AA3-HA07	HA-07	4.5 - 5.0	Plastic Tube	SC / CL	√		√												
LK159	AA3-HA15	HA-15	0 - 0.5	Plastic Tube	ML / SM	√			√											
LK160	AA3-HA15	HA-15	3.5 - 4.0	Plastic Tube	SM	√				√										
LK161	AA3-HA17	HA-17	0 - 0.5	Plastic Tube	SM	√				√										
LK162	AA3-HA17	HA-17	3.7 - 4.2	Plastic Tube	ML / SM	√														
LK163	AA3-HA25	HA-25	0 - 0.5	Plastic Tube	ML / SM	√			√											
LK164	AA3-HA25	HA-25	3.5 - 4.0	Plastic Tube	ML / SM	√			√											
LK165	AA3-HA27	HA-27	0 - 0.5	Plastic Tube	ML / SM	√			√											
LK166	AA3-HA27	HA-27	3.5 - 4.0	Plastic Tube	SM / ML	√				√										
						26		5	9	11	1	4	2	2	4					

Chain of Custody Record

1 of 2.

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY

MCAS-El TORO · AA3

Project Number	Project Name/Client
37380-02-30-02	MCAS. EL TORO · AA3

Sample Custodian: (Signature)

Custody Seal #

Rust E&I Cooler #

Item No.	EPA ID ~~Sample Description (Field ID Number)~~	Date	Time	Grab	Comp.	PID Reading (ppm)	Label Number	Moisture Content (ASTM D2216)	Unit Weight (ASTM D1140)	Fines Fraction (ASTM D422)	G.S.D. S. Analysis	G.S.D. Hydrom. Anly (ASTM D422)	Atterberg Limits (ASTM D4318)	Compaction (ASTM D1557)	Sp Gravity (ASTM D854)	D. Shear (ASTM D3080)	Matrix: Sample Type	Sample Container: 5 gal Bkt.	Sample Container: 4 Tube
1	LK141	10-22		✓				✓	✓		✓		✓				ML	✓	
2	LK142			✓				✓		✓							SP-SM	✓	
3	LK143			✓				✓			✓			✓	✓	✓	SM	✓	
4	LK144			✓				✓		✓	✓		✓				SC/CC	✓	
5	LK145	10-22		✓				✓			✓						SM	✓	
6	LK146	10-21		✓				✓			✓						SP-SM	✓	
7	LK147			✓				✓			✓						SM	✓	
8	LK148			✓				✓									SM	✓	
9	LK149	10-21		✓				✓			✓						SM	✓	
10	LK150	10-23		✓				✓			✓						SM	✓	
11	LK151			✓				✓	✓	✓			✓	✓	✓	✓	ML	✓	
12	LK152			✓				✓			✓						SM	✓	
13	LK153	10-23		✓				✓		✓							ML	✓	
14	LK154	10-22		✓				✓	✓	✓							ML	✓	
15	LK155	10-15		DP				✓				✓	✓				MLS		✓
16	LK156							✓	✓								SC/CLS		✓
17	LK157							✓									SM		✓
18	LK158	10-15		DP				✓	✓								SC/CLS		✓

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Disposed of by: (Signature)	Items:	Date / Time
Rod Lobo	10-28 1/3:18	Les Frazier			
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Disposed of by: (Signature)	Items:	Date / Time

Send Lab Results To: C. Wanyoike
100. W. Broadway - 240
Long Beach. CA - 90802
(562) 951-2057

Remarks:

Federal Express Airbill No.:
Lab:

Check Delivery Method:
☐ Samples delivered in person
☐ Common carrier

Laboratory Receiving Notes:
Custody Seal Intact?
Temp. of Shipping Container:
Sample Condition:

ARTH TECH

A tyco INTERNATIONAL LTD. COMPANY

Chain of Custody Record

2 of 2.

MCAS-El Toro. AA-3

Project Number	Project Name/Client
37380-02.30.02	MCAS. El Toro. AA3.

Sample Custodian: (Signature)

Custody Seal #

Rust E&I Cooler #

Item No.	EPA ID ~~Sample Description (Field ID Number)~~	Date	Time	Grab	Comp.	PID Reading (ppm)	Label Number	Moisture Cont. (ASTM D2216)	Wet/Dry Unit Weight	Fines Fraction (ASTM D422)	G.S.D. Sieve Analysis (ASTM D422)	G.S.D. Hydrom. Analy. (ASTM D422)	Atterberg Limits (ASTM D4318)	Compaction (ASTM D1557)	Sp. Gravity (ASTM D854)	D-Shear (ASTM D3080)	Matrix: Sample Type	Matrix: Sample Container
1	LK159	10.15		DP				✓		✓							~~MCS~~ MCS/SM	
2	LK160	↓		↓				✓			✓						~~SM~~.	
3	LK161							✓			✓						SM	
4	LK162							✓									MCS/SM	
5	LK163							✓		✓							MCS/SM	
6	LK164							✓		✓							MCS/SM	
7	LK165	↓		↓				✓		✓							MCS/SM.	
8	LK166.	10.15		DP				✓			✓						SM/MCS	
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Disposed of by: (Signature)	Items:	Date / Time
Rod Lowe	10-28 / 1312	Lea Frith			
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Disposed of by: (Signature)	Items:	Date / Time

Send Lab Results To: C. Wanyoike.
100 W. Broadway - 240
Long Beach Ca. 90802.
(562) 951-2057.

Remarks:

Federal Express Airbill No.:
Lab:

Check Delivery Method:
- ☐ Samples delivered in person
- ☐ Common carrier

Laboratory Receiving Notes:
Custody Seal Intact?
Temp. of Shipping Container:
Sample Condition:

Rev. 10/98 White Copy - Lab Yellow Copy - File Pink Copy - Client F514/Earth.Sci

EPA ID	LK141	LK142	LK143	LK144	LK145	LK146	LK147	LK148
Sample No.	AA3-TR01-S1	AA3-TR01-S2	AA3-TR01-S3	AA3-TR01-S4	AA3-TR03-S1	AA3-TR03-S2	AA3-TR04-S1	AA3-TR04-S1
Depth (ft.)	0 - 2	4 - 10	2 - 8	8 - 12	0 - 4	0 - 7	0 - 3	3 - 6
Sample Type	Bucket	Bucket	Bucket	Bucket	Bucket	Bucket	Bucket	Bucket
Visual Soil Classification	Dark brown silty, clayey sand (SC-SM)	Brown silty sand (SM)	Brown silty sand (SM)	Olive silty sand (SM)	Brown silty sand (SM)	Brown silty sand (SM)	Brown silty sand (SM)	Brown silty sand (SM)
Pocket Penetrometer								
Weight Soil + Rings / Tube (gm.								
Weight of Rings / Tube (gm.								
Average Length (in.)								
Average Diameter (in.)								
Wet. Wt. of Soil + Cont. (gm.	353.87	827.22	2259.65	861.26	1001.08	777.48	3768.90	728.42
Dry Wt. of Soil + Cont. (gm.)	342.51	803.00	2166.60	735.90	966.40	746.40	3694.10	662.00
Weight of Container (gm)	52.47	77.62	107.25	74.68	76.70	74.48	0.00	74.29
Container No.:								
Wet Density								
Moisture Content (%)	**3.9**	**3.3**	**4.5**	**19.0**	**3.9**	**4.6**	**2.0**	**11.3**
Dry Density (pcf)								
Degree of Saturation (%)								

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

MOISTURE CONTENT of SOILS

ASTM D 2216

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Project No.: 37380 / CTO 0078
Client Name: Earth Tech, Inc.
Tested By: ACS Date: 11/01/02

EPA ID	LK149	LK150	LK151	LK152	LK153	LK154	LK155	LK156
Sample No.	AA3-TR06-S1	AA3-TR07-S1	AA3-TR08-S1	AA3-TR08-S2	AA3-TR09-S1	AA3-TR11-S1	AA3-HA02	AA3-HA02
Depth (ft.)	0 - 8	2 - 3	1 - 2	4 - 5	1 - 2	0 - 4	0 - 1	3.5 - 4.0
Sample Type	Bucket	Bucket	Bucket	Bucket	Bucket	Bucket	Plastic Tube	Plastic Tube
Visual Soil Classification	Brown silty sand (SM)	Brown silty sand (SM)	Brown clayey sand (SC)	Brown silty sand (SM)	Brown sandy silt s(ML)	Brown silty sand (SM)	Olive silty sand (SM)	Brown clayey sand (SC)
Pocket Penetrometer								
Weight Soil + Rings / Tube (gm.								
Weight of Rings / Tube (gm.								
Average Length (in.)								
Average Diameter (in.)								
Wet. Wt. of Soil + Cont. (gm.	2728.50	3580.50	282.37	1683.95	532.74	483.10	801.98	126.72
Dry Wt. of Soil + Cont. (gm.)	2562.80	3405.60	274.48	1624.30	504.00	464.72	792.50	119.31
Weight of Container (gm)	107.87	0.00	54.02	108.79	82.06	52.77	159.81	52.91
Container No.:								
Wet Density								
Moisture Content (%)	**6.7**	**5.1**	**3.6**	**3.9**	**6.8**	**4.5**	**1.5**	**11.2**
Dry Density (pcf)								
Degree of Saturation (%)								

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

MOISTURE CONTENT of SOILS
ASTM D 2216

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Project No.: 37380 / CTO 0078
Client Name: Earth Tech, Inc.
Tested By: ACS Date: 11/01/02

EPA ID	LK157	LK158	LK159	LK160	LK161	LK162	LK163	LK164
Sample No.	AA3-HA07	AA3-HA07	AA3-HA15	AA3-HA15	AA3-HA17	AA3-HA17	AA3-HA25	AA3-HA25
Depth (ft.)	0 - 0.5	4.5 - 5.0	0 - 0.5	3.5 - 4.0	0 - 0.5	3.7 - 4.2	0 - 0.5	3.5 - 4.0
Sample Type	Plastic tube	Plastic tube	Plastic tube	Plastic tube	Plastic tube	Plastic tube	Plastic tube	Plastic tube
Visual Soil Classification	Brown silty sand (SM)	Olive lean clay (CL)	Brown silty sand (SM)	Olive silty sand (SM)	Olive silty sand (SM)	Olive silty sand (SM)	Brown silty sand (SM)	Brown silty sand (SM)
Pocket Penetrometer								
Weight Soil + Rings / Tube (gm.								
Weight of Rings / Tube (gm.								
Average Length (in.)								
Average Diameter (in.)								
Wet. Wt. of Soil + Cont. (gm.	449.36	86.39	485.32	371.48	417.26	422.69	407.74	507.35
Dry Wt. of Soil + Cont. (gm.)	441.93	80.62	474.04	360.20	406.67	398.43	397.94	485.49
Weight of Container (gm)	76.73	53.05	75.83	72.10	76.82	76.98	79.17	76.65
Container No.:								
Wet Density								
Moisture Content (%)	**2.0**	**20.9**	**2.8**	**3.9**	**3.2**	**7.5**	**3.1**	**5.3**
Dry Density (pcf)								
Degree of Saturation (%)								

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

MOISTURE CONTENT of SOILS

ASTM D 2216

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Project No.: 37380 / CTO 0078
Client Name: Earth Tech, Inc.
Tested By: ACS Date: 11/01/02

Moistu[illegible]nt.xls

EPA ID	LK165	LK166						
Sample No.	AA3-HA27	AA3-HA27						
Depth (ft.)	0 - 0.5	3.5 - 4.0						
Sample Type	Plastic Tube	Plastic Tube						
Visual Soil Classification	Brown silty sand (SM)	Olive silty sand (SM)						
Pocket Penetrometer								
Weight Soil + Rings / Tube (gm.								
Weight of Rings / Tube (gm.								
Average Length (in.)								
Average Diameter (in.)								
Wet. Wt. of Soil + Cont. (gm.	517.46	411.89						
Dry Wt. of Soil + Cont. (gm.)	501.40	384.71						
Weight of Container (gm)	74.36	76.66						
Container No.:								
Wet Density								
Moisture Content (%)	**3.8**	**8.8**						
Dry Density (pcf)								
Degree of Saturation (%)								

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

MOISTURE CONTENT of SOILS

ASTM D 2216

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Project No.: 37380 / CTO 0078
Client Name: Earth Tech, Inc.
Tested By: ACS Date: 11/01/02

Boring No.	LK 151	LK 141	LK 154	LK 158	LK 156		
Sample No.	AA3-TR08-S1	AA3-TR01-S1	AA3-TR11-S1	AA3-HA07	AA3-HA02		
Depth (ft.)	1.0-2.0	0.0-2.0	0.0-4.0	4.5-5.0	3.5-4.0		
Sample Type	Chunk	Chunk	Chunk	Chunk	Chunk		
Visual Soil Classification	Brown clayey sand (SC)	Dark brown silty, clayey sand (SC-SM)	Brown silty sand (SM)	Olive lean clay (CL)	Brown clayey sand (SC)		
Weight of Sample (g)	306.03	564.27	804.66	43.75	94.82		
Weight of Waxed Sample (g)	313.92	575.92	822.49	45.23	96.79		
Weight of Waxed Sample in Water (g	145.50	277.80	374.40	25.50	53.00		
Specific Gravity of Wax (g/cm³)	0.89	0.89	0.89	0.89	0.89		
Wet Weight of Soil + Container (g)	282.37	353.87	483.10	86.39	126.72		
Dry Weight of Soil + Container (g)	274.48	342.51	464.72	80.62	119.31		
Weight of Container (g)	54.02	52.47	52.77	53.05	52.91		
Container No.							
Wet Density	119.68	123.53	117.30	151.10	142.31		
Moisture Content (%)	**3.58**	**3.92**	**4.46**	**20.93**	**11.16**		
Dry Density (pcf)	**115.5**	**118.9**	**112.3**	**125.0**	**128.0**		

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

MOISTURE & DENSITY of "UNDISTURBED" CHUNK SAMPLES

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Project No.: 37380 / CTO 0078
Client Name: Earth Tech, Inc. - Honolulu, HI
Tested By: ESS Date: 11/08/02

EPA ID	LK142	LK144	[illegible]151	LK153	LK154	LK159	LK163	[illegible]
Sample No.	AA3-TR01-S2	AA3-TR01-S4	AA3-TR08-S1	AA3-TR09-S1	AA3-TR11-S1	AA3-HA15	AA3-HA25	AA3-HA25
Depth (ft.)	4-10	8-12	1-2	1-2	0-4	0-0.5	0-0.5	3.25-4.0
Sample Type	Bucket	Bucket	Bucket	Bucket	Bucket	Plastic Tube	Plastic Tube	Plastic Tube
Visual Soil Classification	Brown silty sand (SM)	Olive silty sand (SM)	Brown clayey sand (SC)	Brown sandy silt s(ML)	Brown silty sand (SM)	Brown silty sand (SM)	Brown silty sand (SM)	Brown silty sand (SM)
Moisture Correction								
Wet Weight of Soil + Container (gm.)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dry Weight of Soil + Container (gm.)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weight of Container (gm)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Moisture Content (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Container No.:								
Sample Dry Weight Determination								
Weight of Sample + Container (gm.)	803.00	525.09	297.02	507.09	487.02	474.04	397.94	485.49
Weight of Container (gm.)	77.62	74.68	76.06	82.06	74.60	75.83	79.17	76.65
Weight of Dry Sample (gm.)	725.38	450.41	220.96	425.03	412.42	398.21	318.77	408.84
Container No.:								
After Wash								
Dry Weight of Sample + Container (gm)	712.60	331.52	215.23	291.41	284.50	348.49	293.98	414.43
Weight of Container (gm)	77.62	74.68	76.06	82.06	74.60	75.83	79.17	76.65
Dry Weight of Sample (gm)	634.98	256.84	139.17	209.35	209.90	272.66	214.81	337.78
% Passing No. 200 Sieve	**12.5**	**43.0**	**37.0**	**50.7**	**49.1**	**31.5**	**32.6**	**17.4**
% Retained No. 200 Sieve	87.5	57.0	63.0	49.3	50.9	68.5	67.4	82.6

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

PERCENT PASSING No. 200 SIEVE
ASTM D 1140

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Project No.: 37380 / CTO 0078
Client Name: Earth Tech, Inc.
Tested By: ACS Date: 11/01/02

EPA ID	LK165							
Sample No.	AA3-HA27							
Depth (ft.)	0-0.5							
Sample Type	Plastic Tube							
Visual Soil Classification	Brown silty sand (SM)							
Moisture Correction								
Wet Weight of Soil + Container (gm.)	0.00							
Dry Weight of Soil + Container (gm.)	0.00							
Weight of Container (gm)	1.00							
Moisture Content (%)	0.00							
Container No.:								
Sample Dry Weight Determination								
Weight of Sample + Container (gm.)	501.40							
Weight of Container (gm.)	74.36							
Weight of Dry Sample (gm.)	427.04							
Container No.:								
After Wash								
Dry Weight of Sample + Container (gm)	361.73							
Weight of Container (gm)	74.36							
Dry Weight of Sample (gm)	287.37							
% Passing No. 200 Sieve	**32.7**							
% Retained No. 200 Sieve	67.3							

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

PERCENT PASSING No. 200 SIEVE
ASTM D 1140

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Project No.: 37380 / CTO 0078
Client Name: Earth Tech, Inc.
Tested By: ACS Date: 11/01/02

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Teratest Labs, Inc.

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	11/01/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	11/11/02
EPA ID	LK141	Depth (ft.):	0-2		
Sample No.:	AA3-TR01-S1				

Visual Sample Description: Dark brown silty, clayey sand (SC-SM)

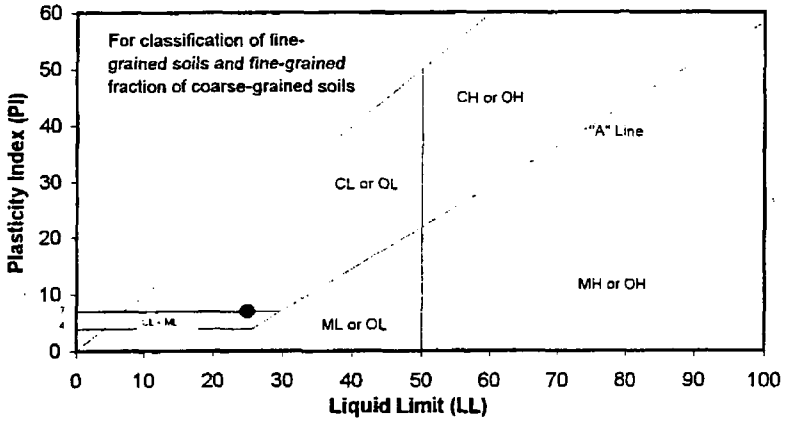
		Moisture Content of Total Air - Dry Soil	
Container No.:	788	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	365.46	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	75.35	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	290.11	Moisture Content (%)	0.00

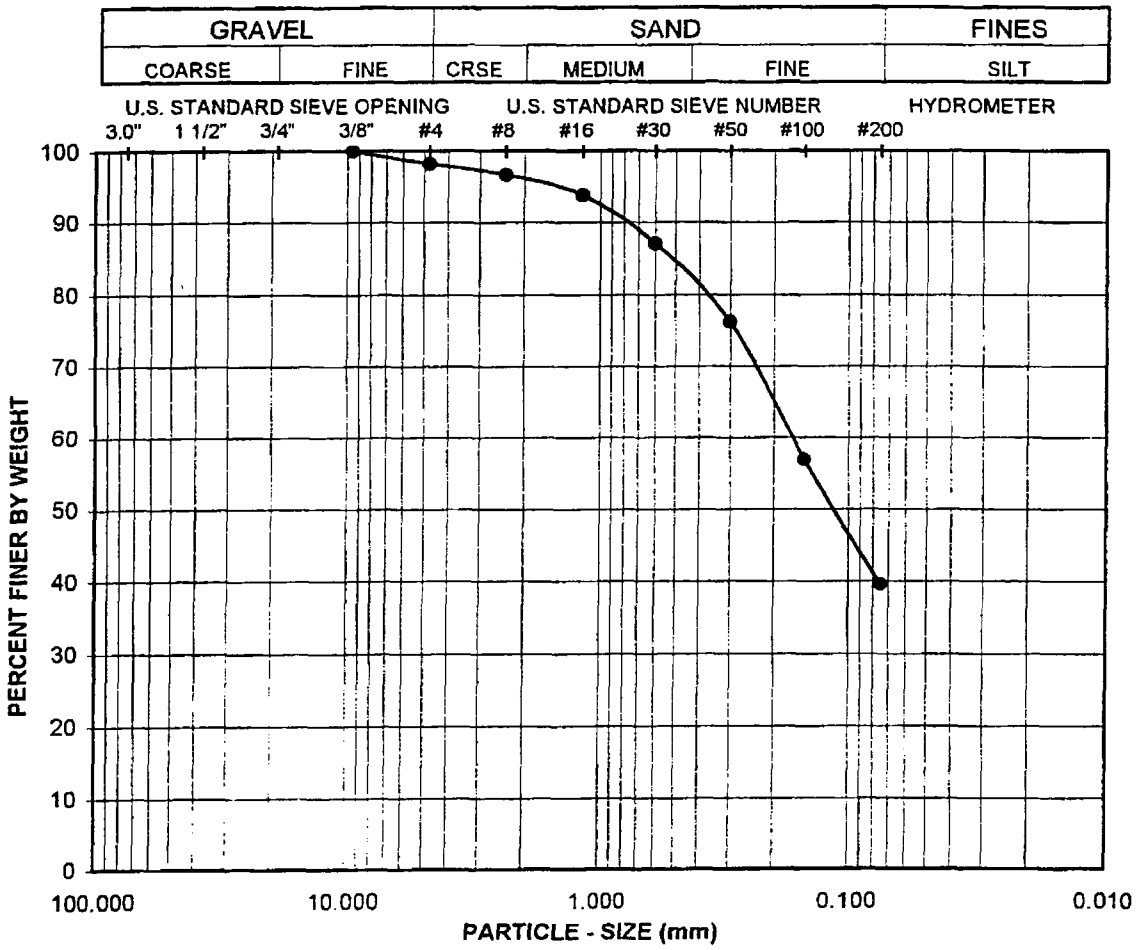
After Wet Sieve	Container No.	788
	Wt. of Dry Soil + Container (gm.)	252.48
	Wt. of Container (gm.)	75.35
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	177.13

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	5.11	98.2
#8	2.360	9.60	96.7
#16	1.180	18.09	93.8
#30	0.600	37.35	87.1
#50	0.300	69.04	76.2
#100	0.150	124.91	56.9
#200	0.075	175.19	39.6
PAN			

GRAVEL:	2 %	Liquid Limit:	25
SAND:	58 %	Plastic Limit	18
FINES:	40 %	Plasticity Index:	7
GRP. SYMBOL:	SC-SM	Cu = D60/D10 =	
		Cc = $(D30)^2/(D60*D10)$ =	

Remarks:





EPA ID	Sample No.:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK141	AA3-TR01-S1	0-2	SC-SM	2 : 58 : 40	25 , 18 , 7

Visual Sample Description:
Dark brown silty, clayey sand (SC-SM)

Teraxion Labs, Inc.

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

11-02

SA LK141.xls

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Teralast Labs, Inc.

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	11/01/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	11/08/02
EPA ID:	LK143	Depth (ft.):	2-8		
Sample No.:	AA3-TR01-S3				

Visual Sample Description: Brown silty sand (SM)

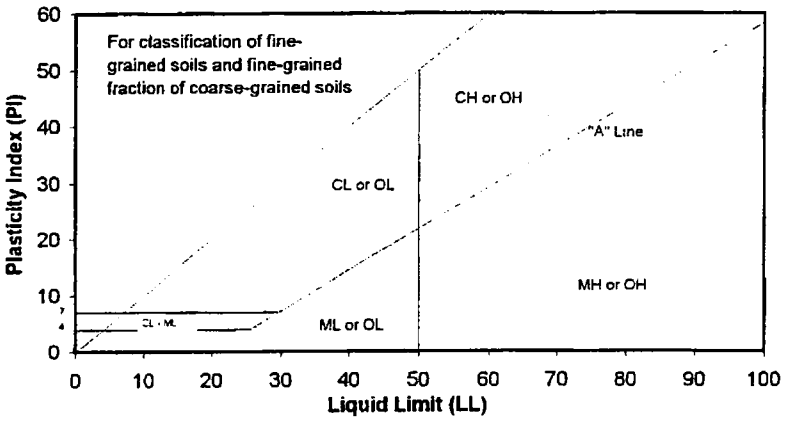
		Moisture Content of Total Air - Dry Soil	
Container No.:	936	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	2166.60	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	107.25	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	2059.35	Moisture Content (%)	0.00

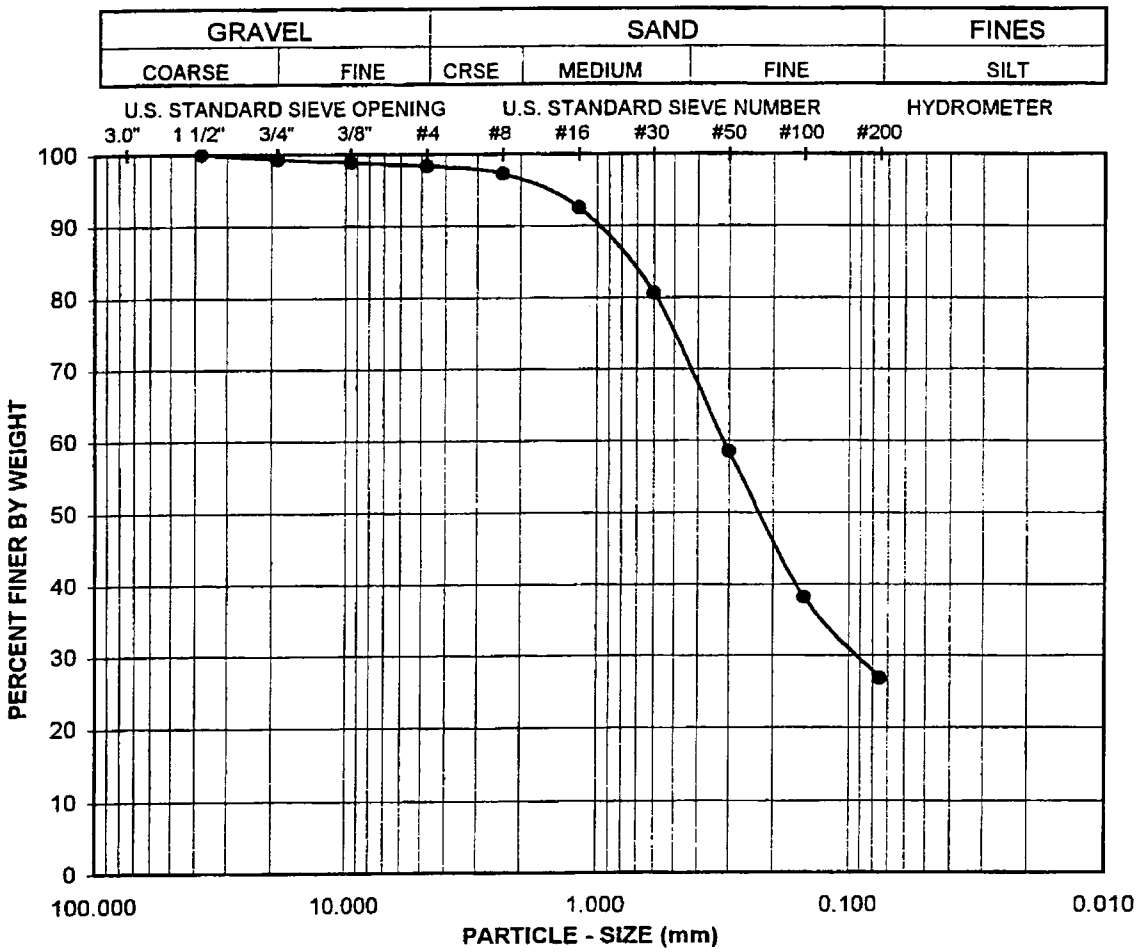
After Wet Sieve	Container No.	936
	Wt. of Dry Soil + Container (gm.)	1619.40
	Wt. of Container (gm.)	107.25
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	1512.15

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	100.0
3/4"	19.000	13.39	99.3
3/8"	9.500	22.23	98.9
#4	4.750	33.08	98.4
#8	2.360	55.24	97.3
#16	1.180	152.62	92.6
#30	0.600	400.26	80.6
#50	0.300	854.64	58.5
#100	0.150	1275.65	38.1
#200	0.075	1508.30	26.8
PAN			

GRAVEL:	2 %	Liquid Limit:	
SAND:	71 %	Plastic Limit	
FINES:	27 %	Plasticity Index:	
GRP. SYMBOL:	SM	Cu = D60/D10 =	
		Cc = $(D30)^2/(D60*D10)$ =	

Remarks: Insufficient sample mass available to meet the ASTM specification for this material





EPA ID:	Sample No.:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK143	AA3-TR01-S3	2-8	SM	2 : 71 : 27	, N/A,

Visual Sample Description:
Brown silty sand (SM)

Terrasat Labs, Inc

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former
MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

11-02

SA LK143.xls

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Teratest Labs, Inc.

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	11/01/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	11/07/02
EPA ID:	LK145	Depth (ft.):	0-4		
Sample No.:	AA3-TR03-S1				

Visual Sample Description: Brown silty sand (SM)

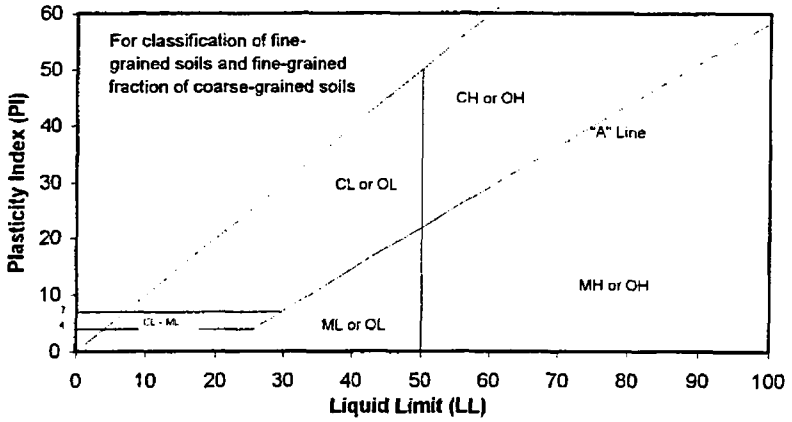
		Moisture Content of Total Air - Dry Soil	
Container No.:	V-1	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	1000.22	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	108.96	Wt. of Container No.____ (gm.)	1.00
Dry Wt. of Soil (gm.)	891.26	Moisture Content (%)	0.00

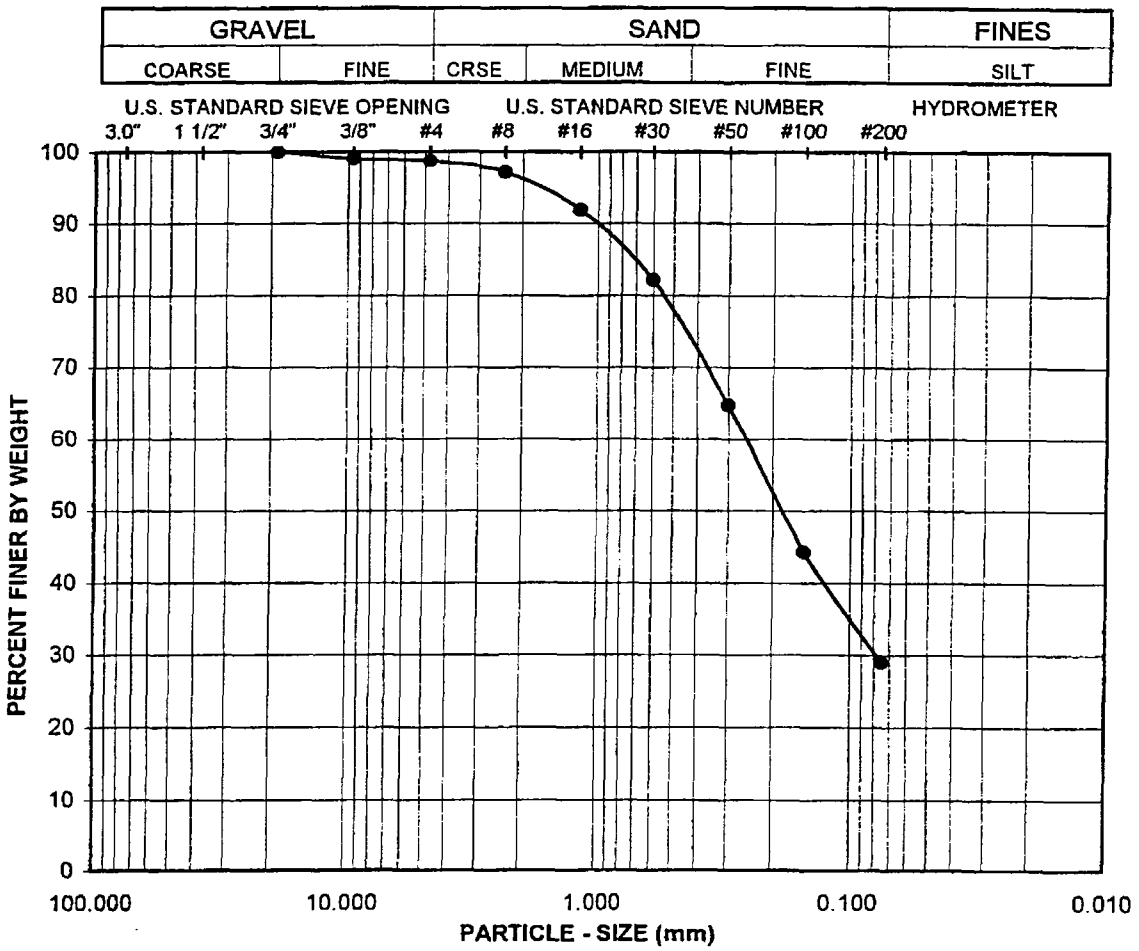
After Wet Sieve	Container No.	V-1
	Wt. of Dry Soil + Container (gm.)	745.50
	Wt. of Container (gm.)	108.96
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	636.54

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	8.02	99.1
#4	4.750	11.23	98.7
#8	2.360	26.15	97.1
#16	1.180	72.36	91.9
#30	0.600	158.51	82.2
#50	0.300	314.51	64.7
#100	0.150	497.60	44.2
#200	0.075	632.72	29.0
PAN			

GRAVEL:	1 %	Liquid Limit:	
SAND:	70 %	Plastic Limit	
FINES:	29 %	Plasticity Index:	
GRP. SYMBOL:	SM	Cu = D60/D10 =	
		Cc = $(D30)^2/(D60*D10)$ =	

Remarks:





EPA ID:	Sample No.:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK145	AA3-TR03-S1	0-4	SM	1 : 70 : 29	, N/A,

Visual Sample Description:
Brown silty sand (SM)

Terrasat Labs, Inc.

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

11-02

SA LK145.xls

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	11/01/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	11/07/02
EPA ID:	LK146	Depth (ft.):	0-7		
Sample No.:	AA3-TR03-S2				

Visual Sample Description: Brown silty sand (SM)

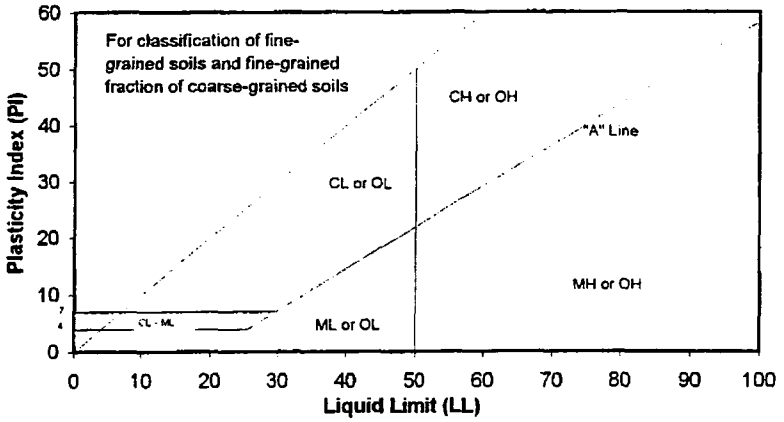
		Moisture Content of Total Air - Dry Soil	
Container No.:	910	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	746.40	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	74.48	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	671.92	Moisture Content (%)	0.00

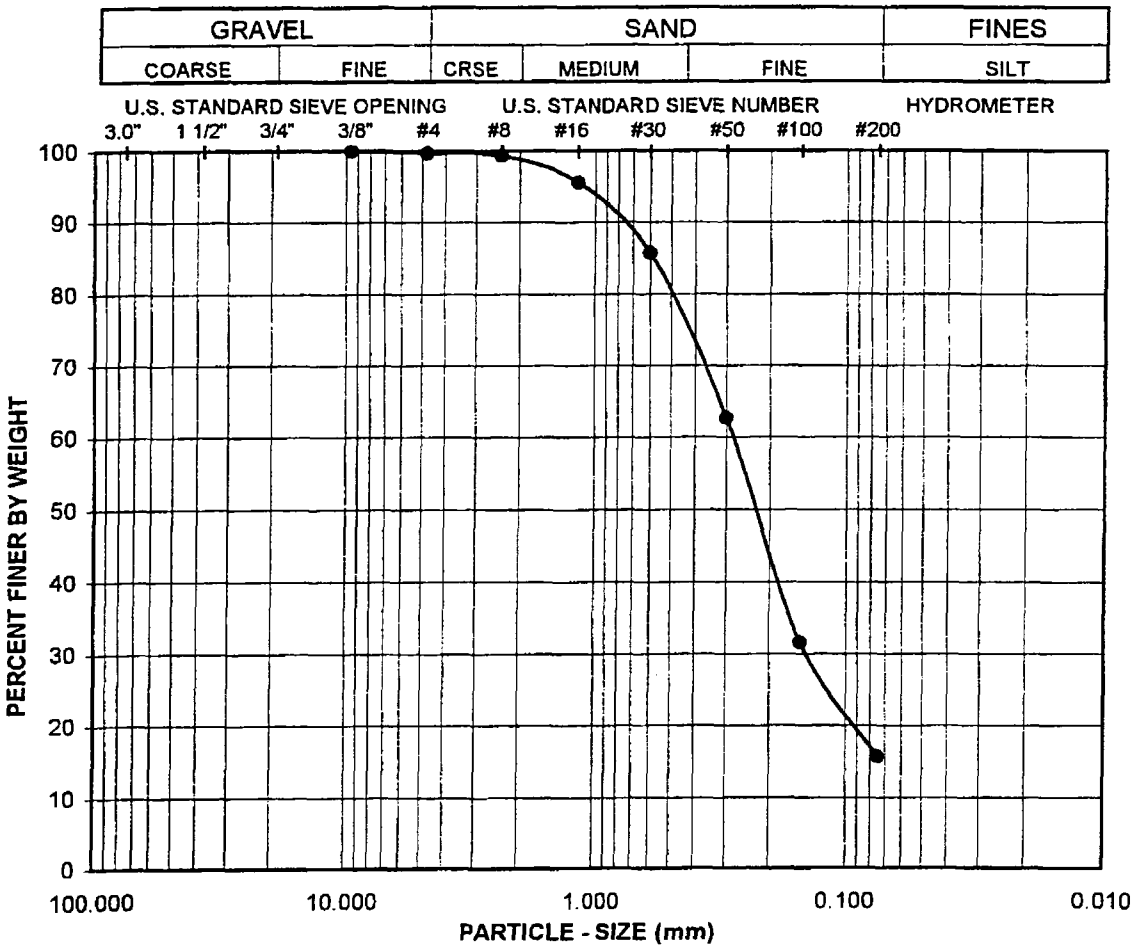
After Wet Sieve	Container No.	910
	Wt. of Dry Soil + Container (gm.)	643.70
	Wt. of Container (gm.)	74.48
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	569.22

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	1.97	99.7
#8	2.360	4.80	99.3
#16	1.180	29.55	95.6
#30	0.600	96.25	85.7
#50	0.300	251.60	62.6
#100	0.150	460.26	31.5
#200	0.075	566.18	15.7
PAN			

GRAVEL:	**0 %**	Liquid Limit:	
SAND:	**84 %**	Plastic Limit	
FINES:	**16 %**	Plasticity Index:	
GRP. SYMBOL:	**SM**	Cu = D60/D10 =	
		Cc = $(D30)^2/(D60*D10)$ =	

Remarks:





EPA ID:	Sample No.:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK146	AA3-TR03-S2	0-7	SM	0 : 84 : 16	, N/A,

Visual Sample Description:
Brown silty sand (SM)

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

11-02

SA LK146.xls

Teratest Labs, inc

PARTICLE - SIZE ANALYSIS of SOILS

ASTM D 422

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By: ACS	Date: 11/04/02
Project No.:	37380 / CTO 0078	Input By: RA	Date: 11/07/02
EPA ID:	LK147	Checked By: LF	Date: 11/07/02
Sample No.:	AA3-TR04-S1	Depth (ft):	0.0-3.0
Sample Description:	Brown silty sand (SM)		

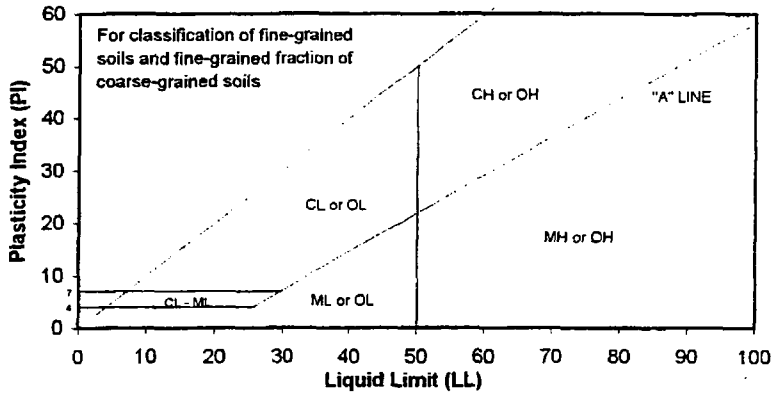
Calculation of Dry Weights	Whole Sample	Sample -#4	Moisture Contents	+#4	-#4
Container No.:	EZ-8	738	Wt. Air-Dry Soil + Container	0.00	0.00
Wt. Air-Dry Soil + Container	3768.90	804.54	Wt. Dry Soil + Container	0.00	0.00
Wt. of Container	0.00	75.64	Wt. of Container	1.00	1.00
Dry Wt. of Soil	3768.90	728.90	Moisture Content (%)	0.00	0.00

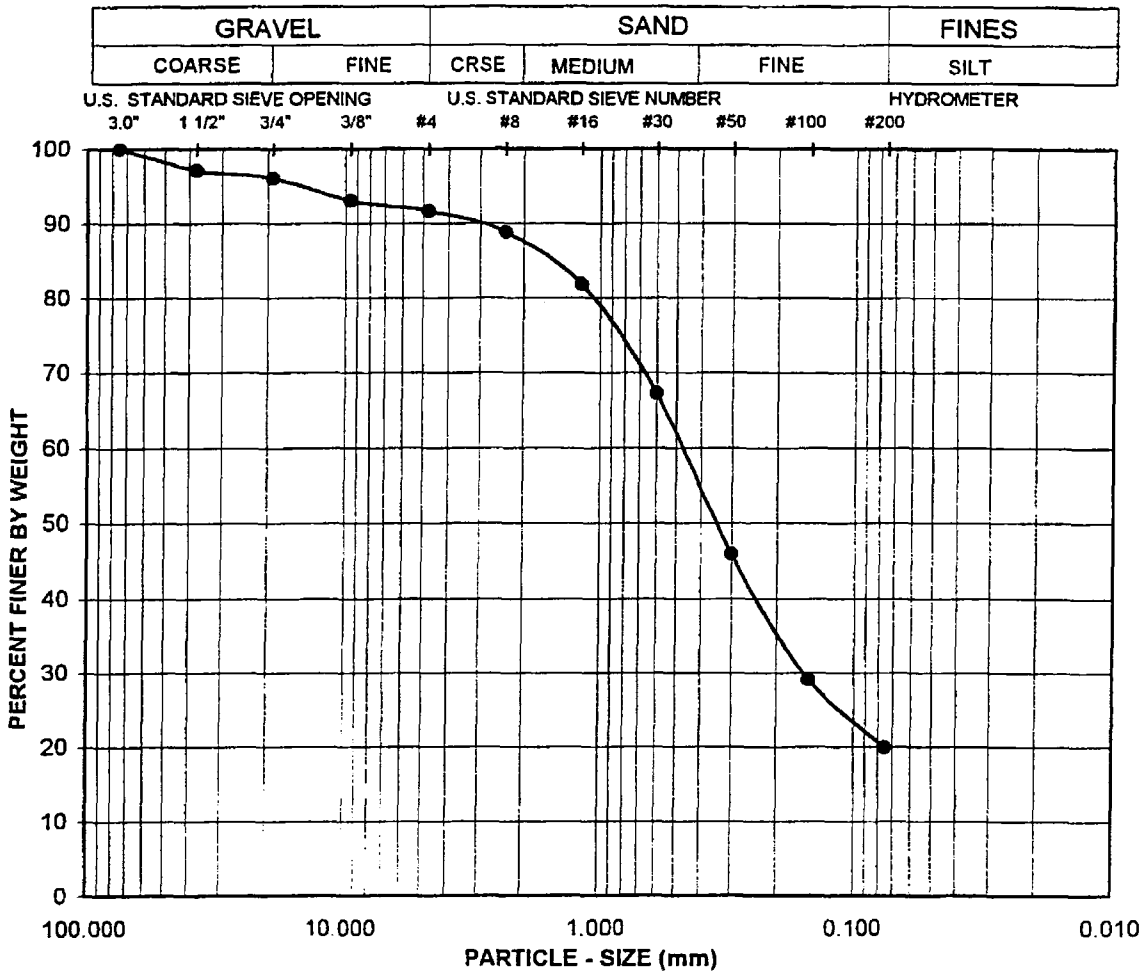
Smaller Sample -#4 Material After Wet Sieve	Container No.:	738
	Wt. of Dry Soil + Cont. (gm.)	647.20
	Wt. of Container (gm.)	75.64
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	571.56

U. S. Sieve Size		Cumulative Weight of Dry Soil Retained		Percent Passing
(in.)	(mm)	Whole Sample	Small Sample -#4	(%)
6"	152.400			
3"	75.000	0.0		100.0
1 1/2	37.500	110.44		97.1
3/4"	19.000	151.75		96.0
3/8"	9.500	265.24		93.0
#4	4.750	318.32		91.6
#8	2.360		22.22	88.8
#16	1.180		77.95	81.8
#30	0.600		194.49	67.2
#50	0.300		363.32	45.9
#100	0.150		497.35	29.1
#200	0.075		570.94	19.9
PAN				

GRAVEL:	8 %	Liquid Limit:	
SAND:	72 %	Plastic Limit	
FINES:	20 %	Plasticity Index:	
GRP. SYMBOL:	SM	Cu = D60/D10	
		$Cc = (D30)^2/(D60*D10)$	

Remarks: Insufficient sample mass available to meet the ASTM specification for this material.





EPA ID	Sample No.	Depth (ft.)	Soil Type	GR:SA:FI (%)	LL,PL,PI
LK147	AA3-TR04-S1	0.0-3.0	SM	8:72:20	N/A

Sample Description:

Brown silty sand (SM)

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

11-02

Teratest Labs, Inc

PARTICLE - SIZE ANALYSIS of SOILS

ASTM D 422

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By: ACS	Date: 11/05/02
Project No.:	37380 / CTO 0078	Input By: RA	Date: 11/07/02
EPA ID:	LK149	Checked By: LF	Date: 11/07/02
Sample No.:	AA3-TR06-S1	Depth (ft):	0.0-8.0
Sample Description:	Brown silty sand (SM)		

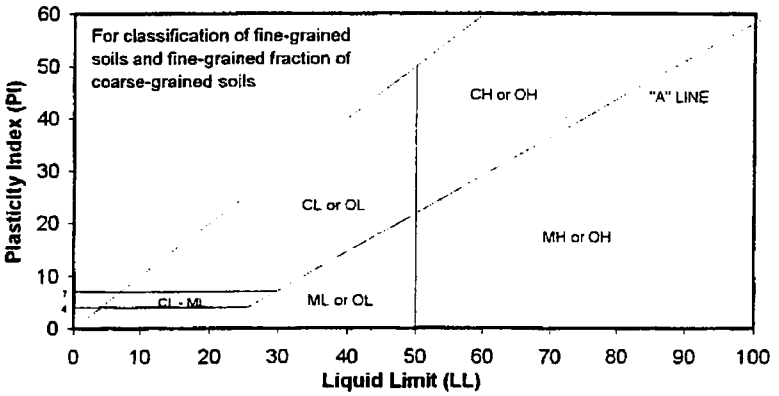
Calculation of Dry Weights	Whole Sample	Sample -#4	Moisture Contents	+#4	-#4
Container No.:	4-6	741	Wt. Air-Dry Soil + Container	0.00	0.00
Wt. Air-Dry Soil + Container	2562.80	621.92	Wt. Dry Soil + Container	0.00	0.00
Wt. of Container	107.87	76.50	Wt. of Container	1.00	1.00
Dry Wt. of Soil	2454.93	545.42	**Moisture Content (%)**	0.00	0.00

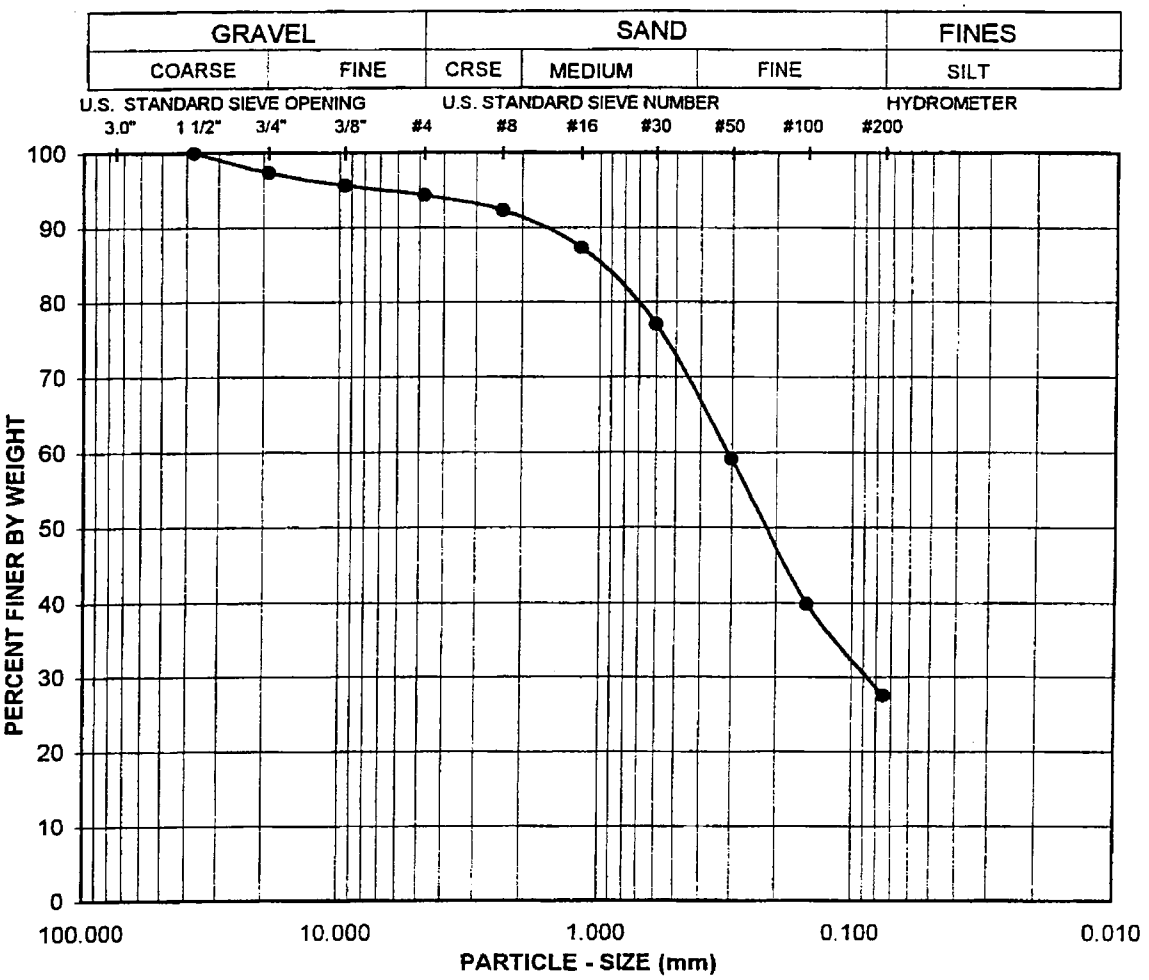
Smaller Sample -#4 Material After Wet Sieve	Container No.:	741
	Wt. of Dry Soil + Cont. (gm.)	465.03
	Wt. of Container (gm.)	76.50
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	388.53

U. S. Sieve Size		Cumulative Weight of Dry Soil Retained		Percent Passing
(in.)	(mm)	Whole Sample	Small Sample -#4	(%)
6"	152.400			
3"	75.000	0.0		
1 1/2	37.500	0.00		100.0
3/4"	19.000	67.28		97.3
3/8"	9.500	107.00		95.6
#4	4.750	139.71		94.3
#8	2.360		11.45	92.3
#16	1.180		40.89	87.2
#30	0.600		99.81	77.0
#50	0.300		203.34	59.1
#100	0.150		315.35	39.8
#200	0.075		386.25	27.5
PAN				

GRAVEL:	6 %	Liquid Limit:	
SAND:	66 %	Plastic Limit	
FINES:	28 %	Plasticity Index:	
GRP. SYMBOL:	SM	Cu = D60/D10	
		Cc = $(D30)^2/(D60*D10)$	

Remarks: Insufficient sample mass available to meet the ASTM specification for this material.





EPA ID	Sample No.	Depth (ft.)	Soil Type	GR:SA:FI (%)	LL,PL,PI
LK149	AA3-TR06-S1	0.0-8.0	SM	6:66:28	N/A

Sample Description:

Brown silty sand (SM)

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

11-02

Teraleet Labs, inc.

PARTICLE - SIZE ANALYSIS of SOILS

ASTM D 422

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By: ACS	Date: 11/05/02
Project No.:	37380 / CTO 0078	Input By: RA	Date: 11/07/02
EPA ID:	LK150	Checked By: LF	Date: 11/07/02
Sample No.:	AA3-TR07-S1	Depth (ft):	2.0-3.0
Sample Description:	Brown silty sand (SM)		

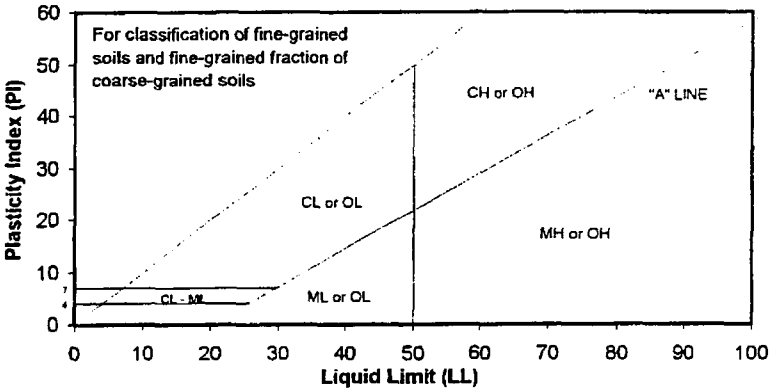
Calculation of Dry Weights	Whole Sample	Sample -#4	Moisture Contents	+#4	-#4
Container No.:	E-1	750	Wt. Air-Dry Soil + Container	0.00	0.00
Wt. Air-Dry Soil + Container	3405.60	527.64	Wt. Dry Soil + Container	0.00	0.00
Wt. of Container	0.00	75.86	Wt. of Container	1.00	1.00
Dry Wt. of Soil	3405.60	451.78	**Moisture Content (%)**	0.00	0.00

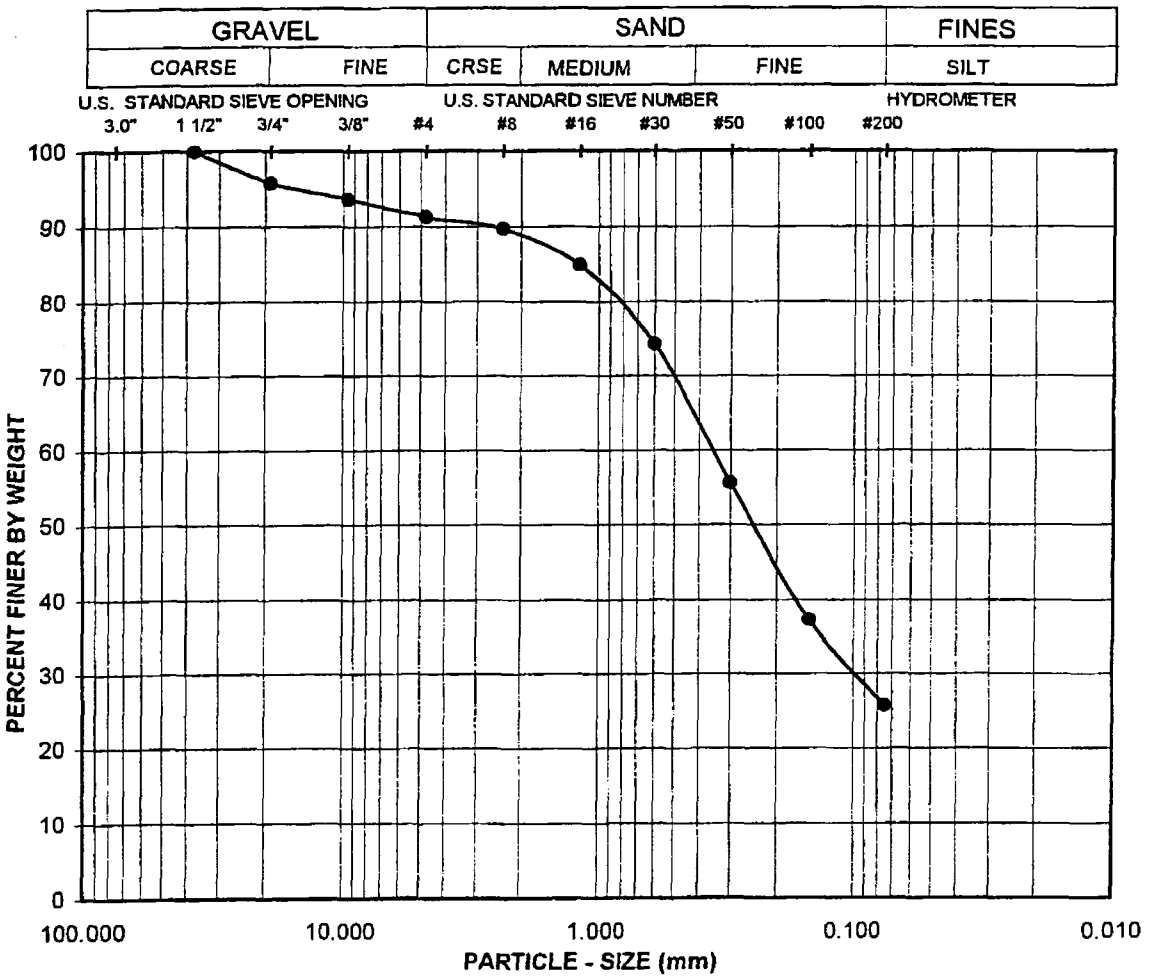
Smaller Sample -#4 Material After Wet Sieve	Container No.:	750
	Wt. of Dry Soil + Cont. (gm.)	402.17
	Wt. of Container (gm.)	75.86
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	326.31

U. S. Sieve Size		Cumulative Weight of Dry Soil Retained		Percent Passing
(in.)	(mm)	Whole Sample	Small Sample -#4	(%)
6"	152.400			
3"	75.000	0.0		
1 1/2	37.500	0.00		100.0
3/4"	19.000	142.18		95.8
3/8"	9.500	219.07		93.6
#4	4.750	299.45		91.2
#8	2.360		7.66	89.7
#16	1.180		31.27	84.9
#30	0.600		63.71	74.3
#50	0.300		176.21	55.6
#100	0.150		267.74	37.2
#200	0.075		324.63	25.7
PAN				

GRAVEL:	9 %	Liquid Limit:	
SAND:	65 %	Plastic Limit	
FINES:	26 %	Plasticity Index:	
GRP. SYMBOL:	SM	Cu = D60/D10	
		Cc = $(D30)^2/(D60*D10)$	

Remarks: Insufficient sample mass available to meet the ASTM specification for this material.





EPA ID	Sample No.	Depth (ft.)	Soil Type	GR:SA:FI (%)	LL,PL,PI
LK150	AA3-TR07-S1	2.0-3.0	SM	9:65:26	N/A

Sample Description:

Brown silty sand (SM)

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

11-02

Teratest Labs, Inc.

PARTICLE - SIZE ANALYSIS of SOILS

ASTM D 422

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By: ACS	Date: 11/05/02
Project No.:	37380 / CTO 0078	Input By: RA	Date: 11/07/02
EPA ID:	LK152	Checked By: LF	Date: 11/07/02
Sample No.:	AA3-TR08-S2	Depth (ft):	4.0-5.0
Sample Description:	Brown silty sand (SM)		

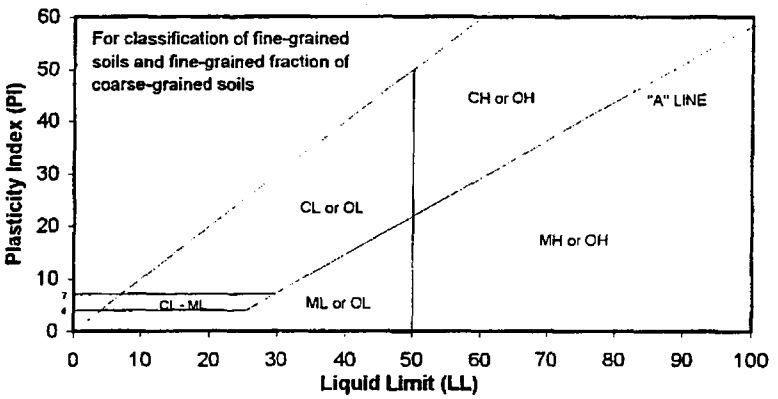
Calculation of Dry Weights	Whole Sample	Sample -#4	Moisture Contents	+#4	-#4
Container No.:	954	731	Wt. Air-Dry Soil + Container	0.00	0.00
Wt. Air-Dry Soil + Container	1624.30	499.18	Wt. Dry Soil + Container	0.00	0.00
Wt. of Container	108.79	76.82	Wt. of Container	1.00	1.00
Dry Wt. of Soil	1515.51	422.36	**Moisture Content (%)**	0.00	0.00

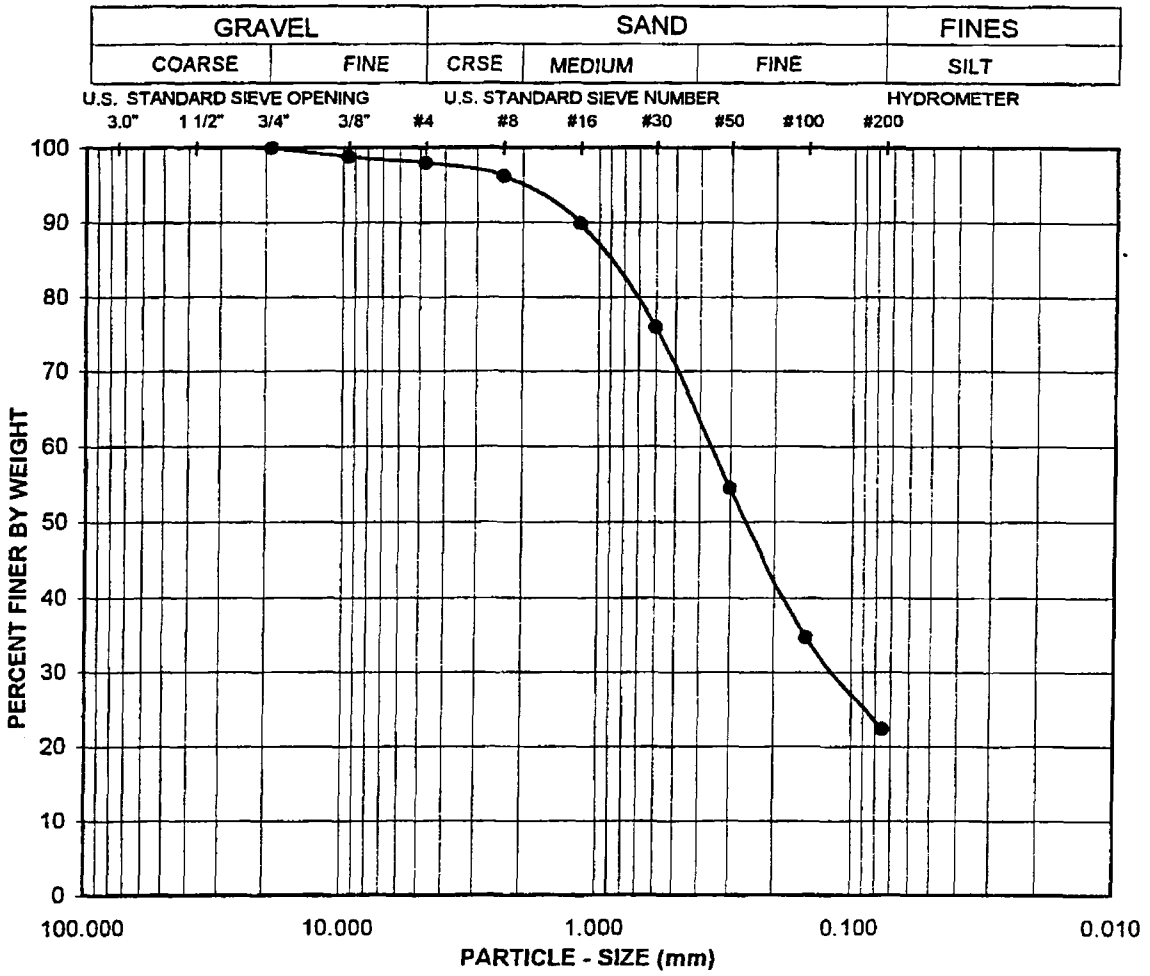
Smaller Sample -#4 Material After Wet Sieve	Container No.:	731
	Wt. of Dry Soil + Cont. (gm.)	403.98
	Wt. of Container (gm.)	76.82
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	327.16

U. S. Sieve Size		Cumulative Weight of Dry Soil Retained		Percent Passing
(in.)	(mm)	Whole Sample	Small Sample -#4	(%)
6"	152.400			
3"	75.000	0.0		
1 1/2	37.500	0.00		
3/4"	19.000	0.00		100.0
3/8"	9.500	18.59		98.8
#4	4.750	30.38		98.0
#8	2.360		7.85	96.2
#16	1.180		35.32	89.8
#30	0.600		95.35	75.9
#50	0.300		188.08	54.4
#100	0.150		273.33	34.6
#200	0.075		326.12	22.3
PAN				

GRAVEL:	2 %	Liquid Limit:	
SAND:	76 %	Plastic Limit	
FINES:	22 %	Plasticity Index:	
GRP. SYMBOL:	SM	Cu = D60/D10	
		$Cc = (D30)^2/(D60*D10)$	

Remarks:





EPA ID	Sample No.	Depth (ft.)	Soil Type	GR:SA:FI (%)	LL,PL,PI
LK152	AA3-TR08-S2	4.0-5.0	SM	2:76:22	N/A

Sample Description:

Brown silty sand (SM)

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

11-02

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Terratest Labs, Inc.

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By :	ACS	Date:	11/05/02
Project No. :	37380 / CTO 0078	Data Input By:	RA	Date:	11/07/02
EPA ID	LK155	Checked By:	LF	Date:	11/07/02
Sample No.:	AA3-HA02	Depth (ft.) :	0-1		

Visual Sample Description: Olive silty sand (SM)

				Moisture Content of Total Air-Dry Soils	Moisture Content of Air-Dry Soils Passing # 10	After Hydrometer & wet sieve ret. on #200 sieve
Liquid Limit:		LL,PL,PI:	Nonplastic			
Plastic Limit:		GR:SA:FI:	4:74:22			
Plasticity Index:		Grp. Symbol:	SM			
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(gm.)		0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (gm.)		0.00	0.00	152.86
Wt.of Air-Dry Soil + Cont. (gm.)	792.50	Wt. of Container No.___ (gm.)		1.00	1.00	75.68
Wt. of Container	159.81	Moisture Content (%)		0.00	0.00	
Dry Wt. of Soil (gm.)	632.69	Wt. of Dry Soil (gm.)				77.18

Coarse Sieve

U.S. Sieve Size	Cumulative Wt.of Dry Soil Retained(gm)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	13.70	97.8
No. 4	24.48	96.1
No. 10	50.79	92.0
Pan		

Sieve after Hydrometer & Wet Sieve

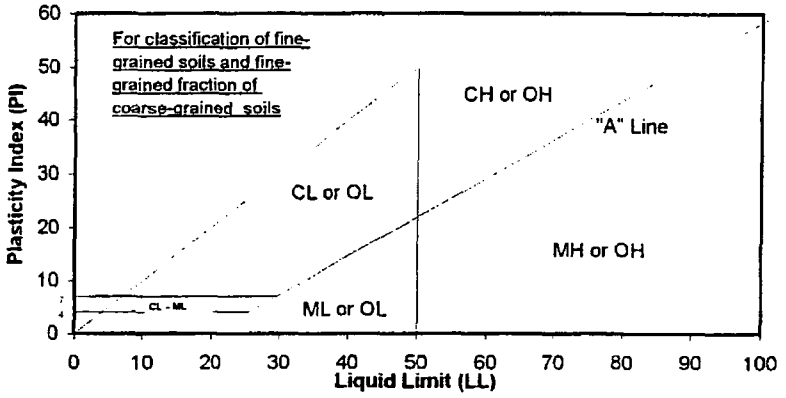
U.S. Sieve Size	Cumulative Wt. of Dry Soil Retained (gm)	% Passing	% Total Sample
No. 10	0.00	100.0	92.0
No. 16	3.93	96.1	88.4
No. 30	17.00	83.0	76.4
No. 50	39.24	60.8	55.9
No. 100	61.32	38.7	35.6
No. 200	76.40	23.6	21.7
Pan			

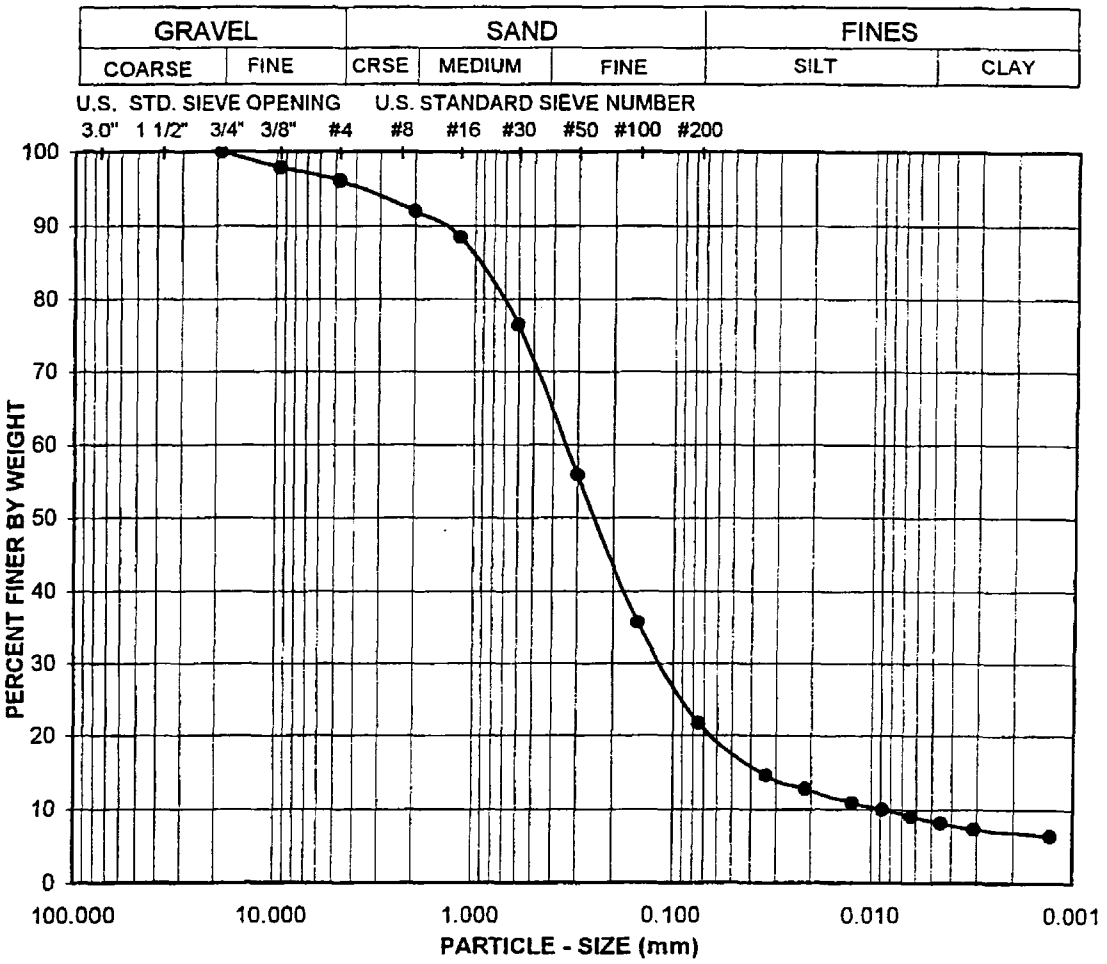
Hydrometer

Wt. of Air-Dry Soil (gm) 100.01 Wt. of Dry Soil (gm) 100.01

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature °C	Composite Correction 152 H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
06-Nov-02	9:30	0		6.0			
	9:32	2	21.8	6.0	22.0	14.6	0.0335
	9:35	5	21.8	6.0	20.0	12.7	0.0214
	9:45	15	21.9	6.0	18.0	10.9	0.0125
	10:00	30	22.2	6.0	17.0	10.0	0.0088
	10:30	60	22.6	6.0	16.0	9.1	0.0063
	11:30	120	22.5	6.0	15.0	8.2	0.0045
	13:40	250	23.0	6.0	14.0	7.3	0.0031
07-Nov-02	9:30	1440	21.4	6.0	13.0	6.4	0.0013





EPA ID	Sample No.	Depth (ft.)	Soil Type	GR:SA:FI (%)	LL,PL,PI
LK155	AA3-HA02	0-1	SM	4:74:22	Nonplastic

Sample Description:

Olive silty sand (SM)

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

11-02

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Teralest Labs, Inc.

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	11/05/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	11/07/02
EPA ID:	LK160	Depth (ft.):	3.5-4.0		
Sample No.:	AA3-HA15				

Visual Sample Description: Olive silty sand (SM)

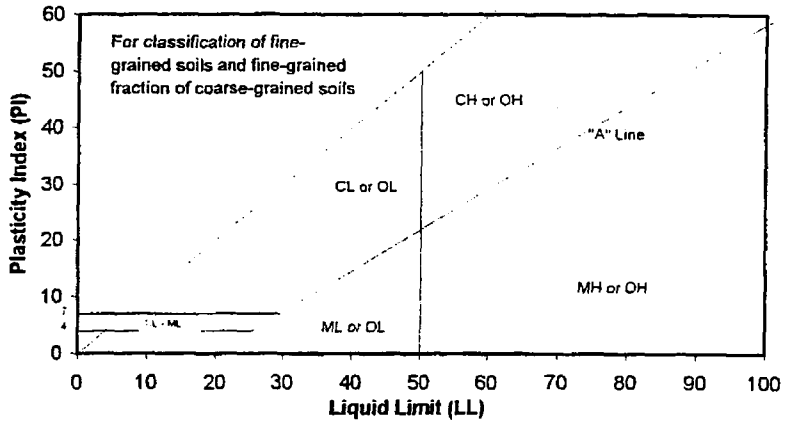
		Moisture Content of Total Air - Dry Soil	
Container No.:	1955	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	360.20	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	72.10	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	288.10	Moisture Content (%)	0.00

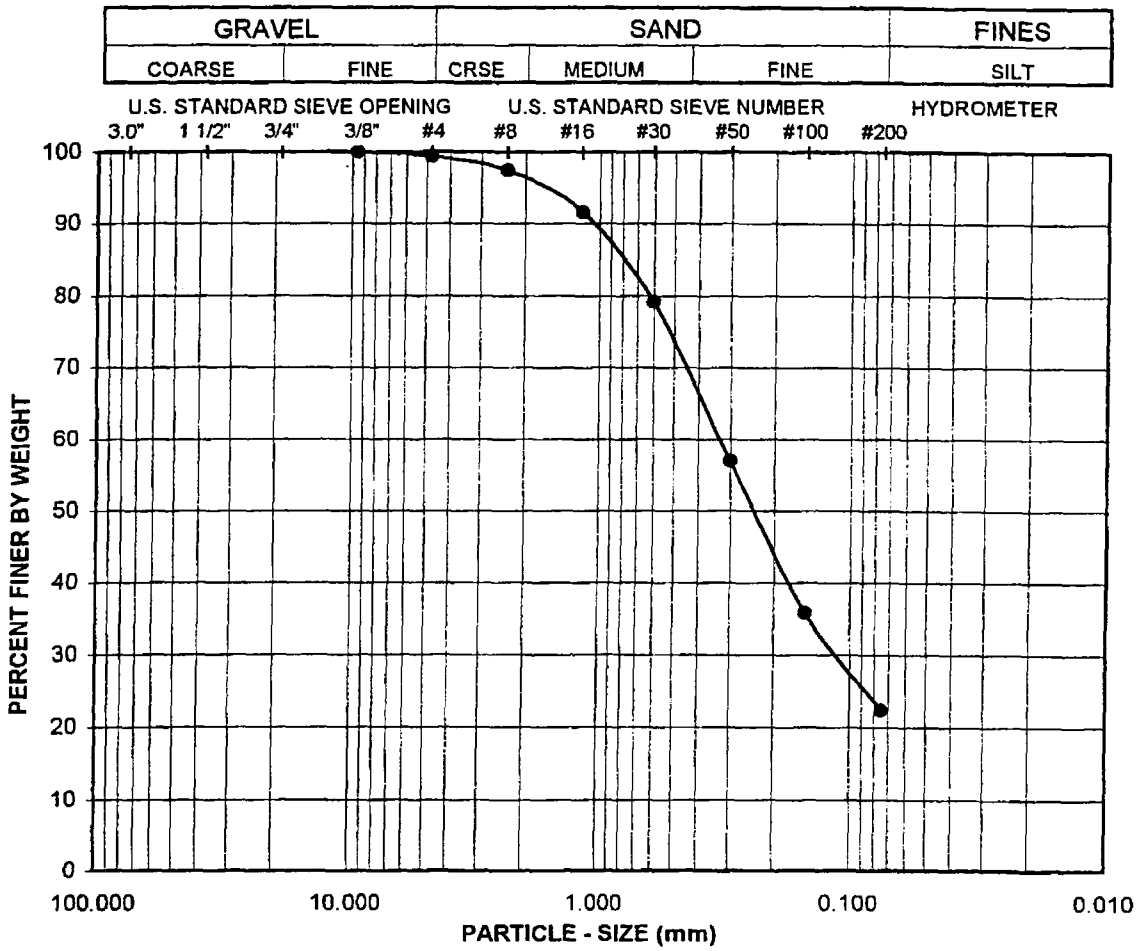
After Wet Sieve	Container No.	N/A
	Wt. of Dry Soil + Container (gm.)	N/A
	Wt. of Container (gm.)	N/A
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	N/A

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	1.73	99.4
#8	2.360	7.29	97.5
#16	1.180	24.18	91.6
#30	0.600	60.17	79.1
#50	0.300	123.85	57.0
#100	0.150	185.03	35.8
#200	0.075	223.69	22.4
PAN			

GRAVEL:	1 %	Liquid Limit:	
SAND:	77 %	Plastic Limit	
FINES:	22 %	Plasticity Index:	
GRP. SYMBOL:	SM	Cu = D60/D10 =	
		Cc = $(D30)^2/(D60*D10)$ =	

Remarks:





EPA ID:	Sample No.:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK160	AA3-HA15	3.5-4.0	SM	1 : 77 : 22	, N/A,

Visual Sample Description:
Olive silty sand (SM)

Terrasist Labs, Inc.

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

11-02

SA LK160.xls

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Teratest Labs, Inc.

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	11/05/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	11/07/02
EPA ID:	LK161	Depth (ft.):	0-0.5		
Sample No.:	AA3-HA17				

Visual Sample Description: Olive silty sand (SM)

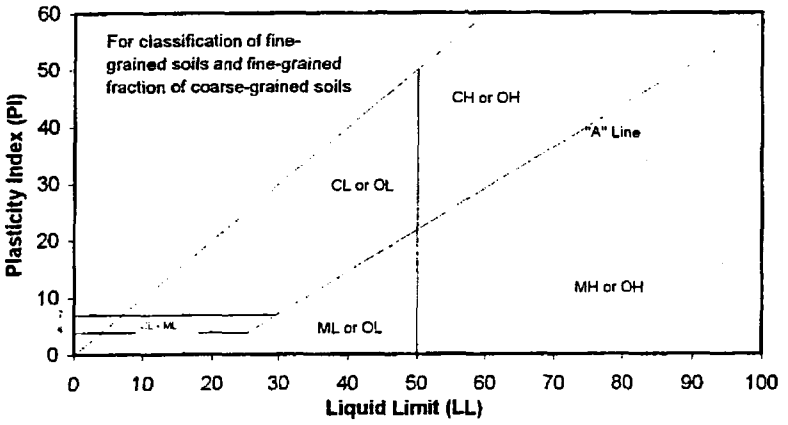
		Moisture Content of Total Air - Dry Soil	
Container No.:	1490	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	406.67	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	76.82	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	329.85	Moisture Content (%)	0.00

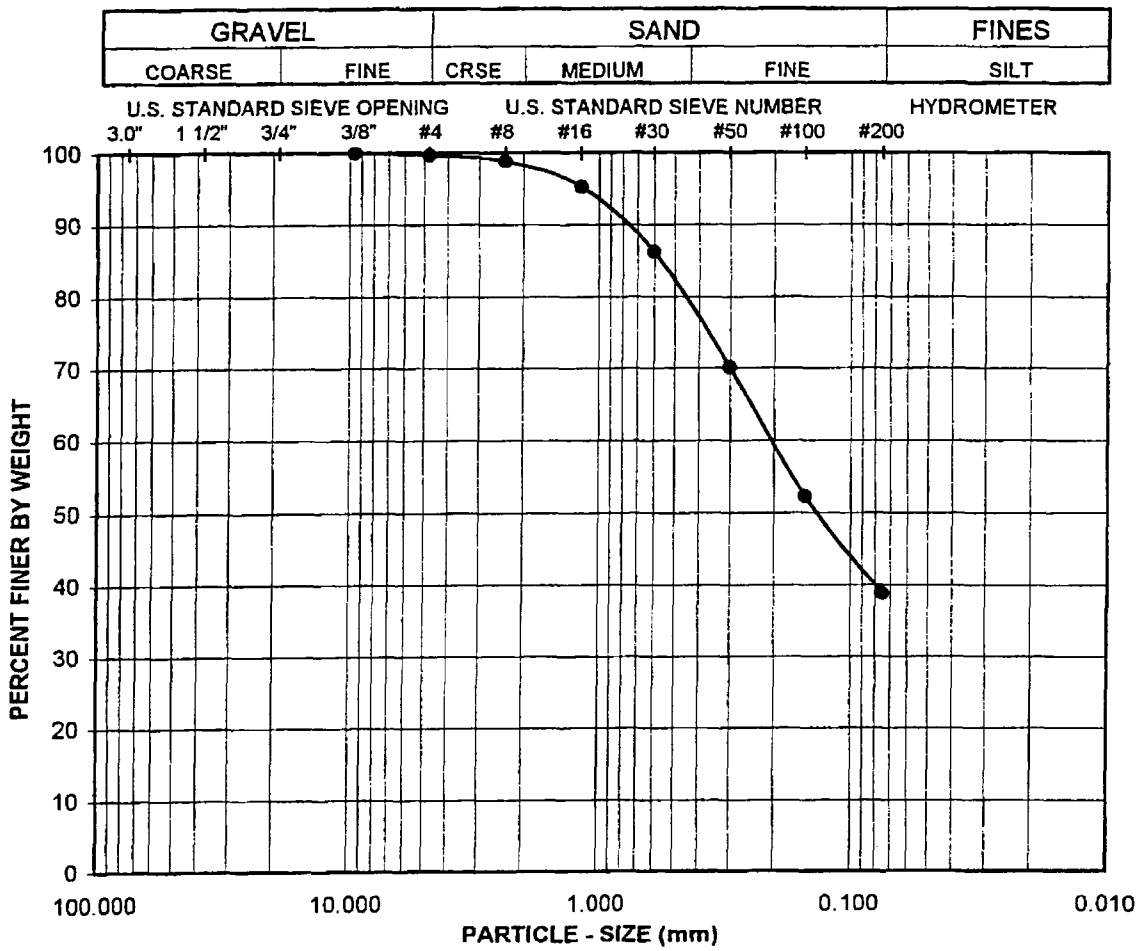
After Wet Sieve	Container No.	N/A
	Wt. of Dry Soil + Container (gm.)	N/A
	Wt. of Container (gm.)	N/A
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	N/A

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	1.02	99.7
#8	2.360	4.12	98.8
#16	1.180	15.63	95.3
#30	0.600	45.49	86.2
#50	0.300	98.66	70.1
#100	0.150	157.71	52.2
#200	0.075	201.77	38.8
PAN			

GRAVEL:	0 %	Liquid Limit:	
SAND:	61 %	Plastic Limit	
FINES:	39 %	Plasticity Index:	
GRP. SYMBOL:	SM	Cu = D60/D10 =	
		Cc = $(D30)^2/(D60*D10)$ =	

Remarks:





EPA ID:	Sample No.:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK161	AA3-HA17	0-0.5	SM	0 : 61 : 39	,N/A,

Visual Sample Description:
Olive silty sand (SM)

Terratest Labs, Inc.

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

11-02

SA LK161.xls

Teratest Labs, Inc.

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	11/05/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	11/07/02
EPA ID:	LK166	Depth (ft.):	3.5-4.0		
Sample No.:	AA3-HA27				

Visual Sample Description: Olive silty sand (SM)

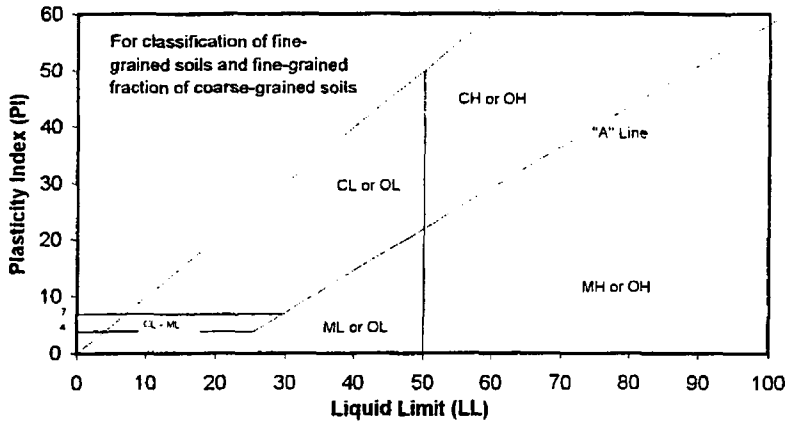
		Moisture Content of Total Air - Dry Soil	
Container No.:	750	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	384.71	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	76.66	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	308.05	Moisture Content (%)	0.00

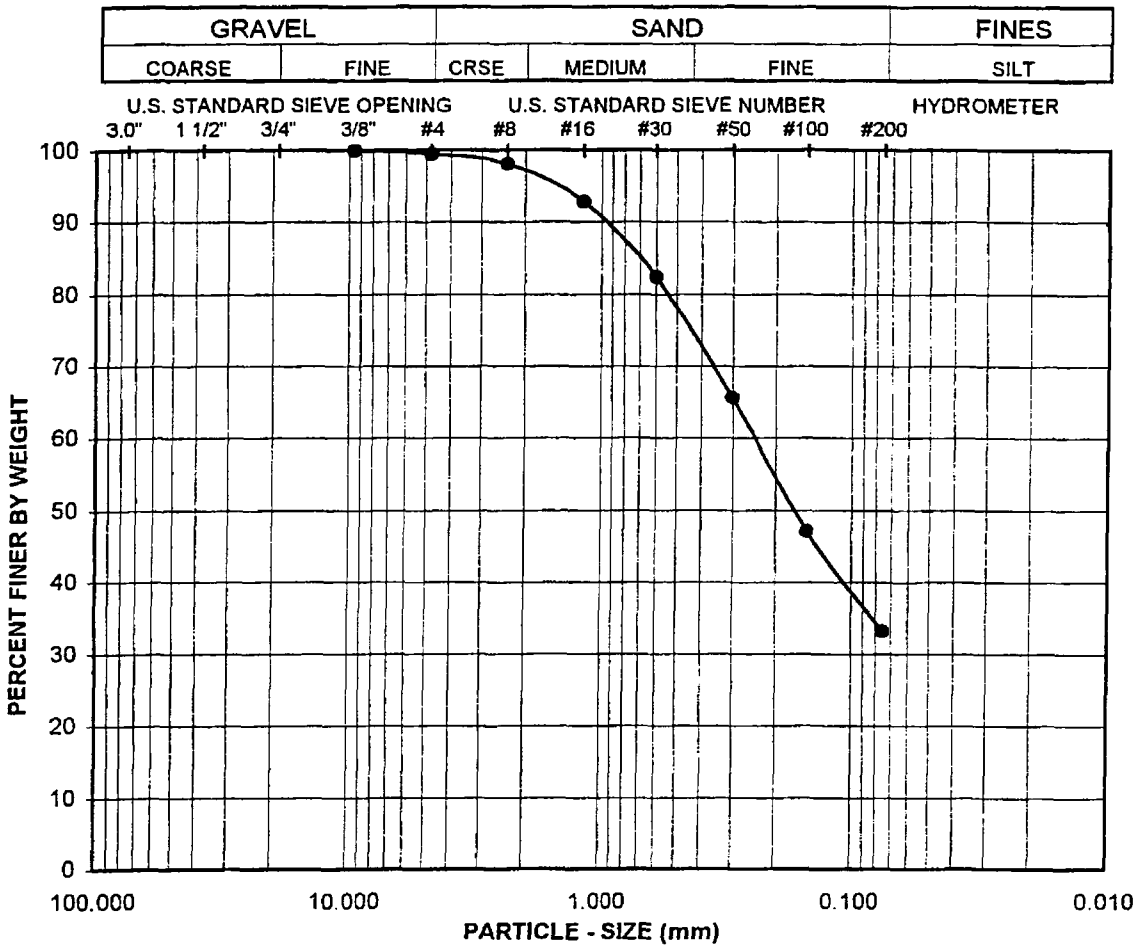
After Wet Sieve	Container No.	N/A
	Wt. of Dry Soil + Container (gm.)	N/A
	Wt. of Container (gm.)	N/A
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	N/A

U. S. Sieve Size (in.)	(mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	1.41	99.5
#8	2.360	5.99	98.1
#16	1.180	22.27	92.8
#30	0.600	54.41	82.3
#50	0.300	106.14	65.5
#100	0.150	163.01	47.1
#200	0.075	205.95	33.1
PAN			

GRAVEL:	1 %	Liquid Limit:	
SAND:	66 %	Plastic Limit	
FINES:	33 %	Plasticity Index:	
GRP. SYMBOL:	SM	Cu = D60/D10 =	
		Cc = $(D30)^2/(D60*D10)$ =	

Remarks:





EPA ID:	Sample No.:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK166	AA3-HA27	3.5-4.0	SM	1 : 66 : 33	, N/A,

Visual Sample Description:
Olive silty sand (SM)

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

11-02

SA LK166.xls

ATTERBERG LIMITS

ASTM D 4318

Teratest Labs, Inc.

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	11/01/02
Project No. :	37380 / CTO 0078	Input By:	RA	Date:	11/11/02
EPA ID:	LK141	Checked By:	LF	Date:	11/11/02
Sample No.:	AA3-TR01-S1	Depth (ft.)	0 - 2		

Visual Sample Description: Dark brown silty, clayey sand (SC-SM)

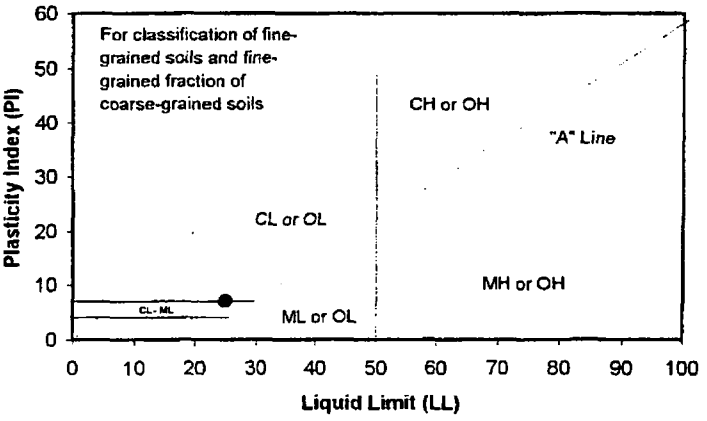
	PLASTIC LIMIT		LIQUID LIMIT		
TEST NO.	1	2	1	2	3
Number of Blows [N]			35	23	13
Wet Wt. of Soil + Cont. (gm)	9.81	9.43	18.63	17.57	21.44
Dry Wt. of Soil + Cont. (gm)	8.45	8.15	15.22	14.21	17.09
Wt. of Container (gm)	1.07	1.09	1.08	1.10	1.02
Moisture Content (%) [Wn]	18.43	18.13	24.12	25.63	27.07

Liquid Limit	**25**
Plastic Limit	**18**
Plasticity Index	**7**
USCS Classification	**CL-ML**

PI at "A" - Line = 0.73(LL-20) = 3.65

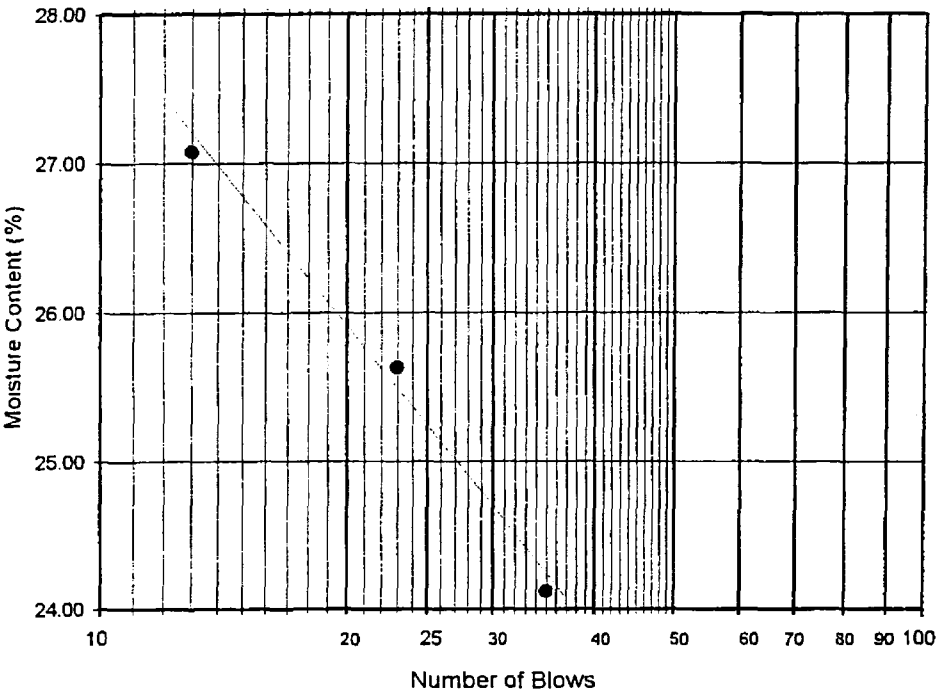
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



Teratest Labs, Inc.

ATTERBERG LIMITS

ASTM D 4318

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	11/04/02
Project No. :	37380 / CTO 0078	Input By:	RA	Date:	11/11/02
EPA ID:	LK144	Checked By:	LF	Date:	11/11/02
Sample No.:	AA3-TR01-S4	Depth (ft.)	8 - 12		

Visual Sample Description: Olive silty sand (SM)

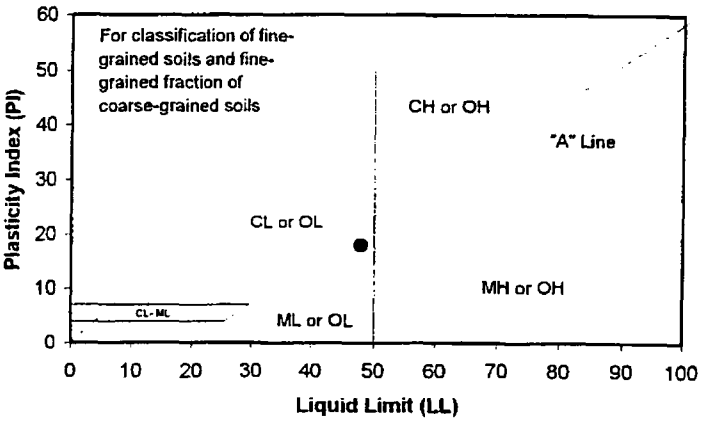
	PLASTIC LIMIT		LIQUID LIMIT			
TEST NO.	1	2	1	2	3	
Number of Blows [N]			36	24	19	
Wet Wt. of Soil + Cont. (gm)	8.81	8.34	17.31	17.18	18.13	
Dry Wt. of Soil + Cont. (gm)	7.02	6.68	12.17	11.96	12.46	
Wt. of Container (gm)	1.00	1.12	1.10	1.08	1.03	
Moisture Content (%) [Wn]	29.73	29.86	46.43	47.98	49.61	

Liquid Limit	**48**
Plastic Limit	**30**
Plasticity Index	**18**
USCS Classification	**ML**

PI at "A" - Line = 0.73(LL-20) = 20.44

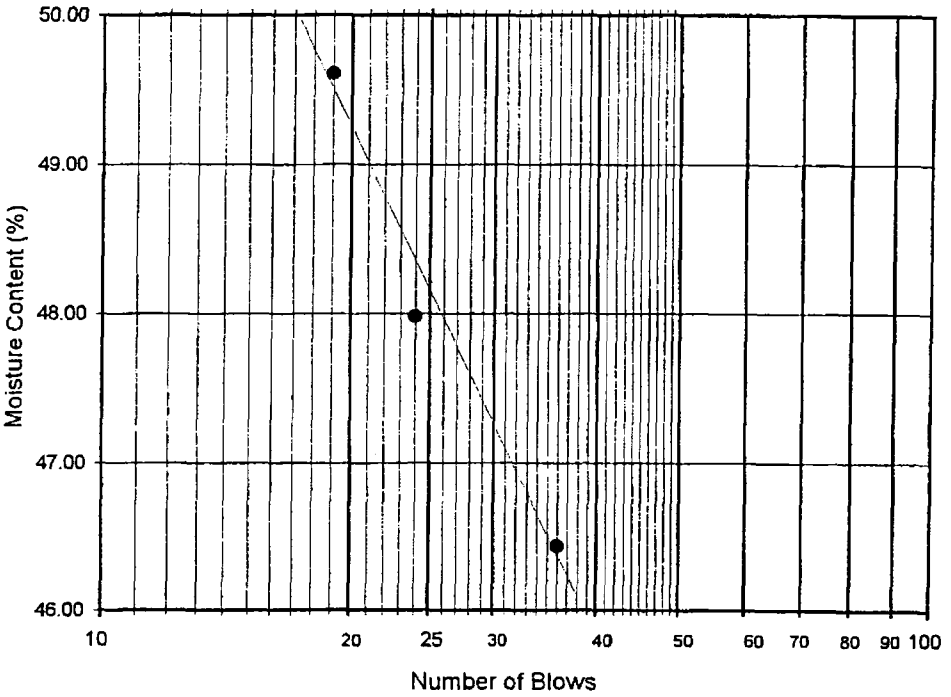
One - Point Liquid Limit Calculation

LL =Wn(N/25) $^{0.121}$



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



Teratest Labs, Inc.

ATTERBERG LIMITS

ASTM D 4318

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	11/01/02
Project No. :	37380 / CTO 0078	Input By:	RA	Date:	11/11/02
EPA ID:	LK151	Checked By:	LF	Date:	11/11/02
Sample No.:	AA3-TR08-S1	Depth (ft.)	1 - 2		

Visual Sample Description: Brown clayey sand (SC)

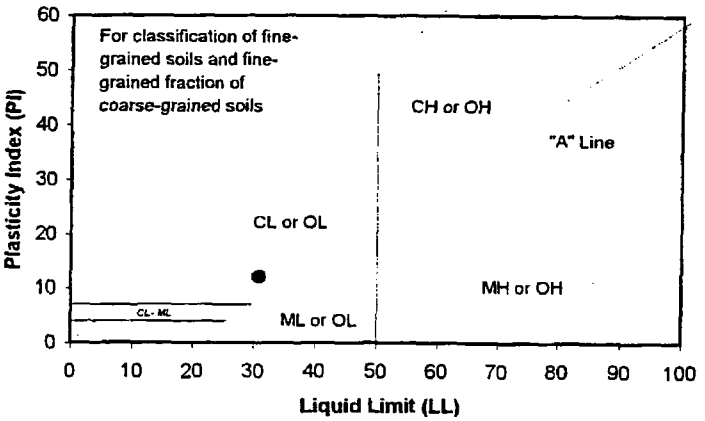
	PLASTIC LIMIT		LIQUID LIMIT			
TEST NO.	1	2	1	2	3	
Number of Blows [N]			28	22	18	
Wet Wt. of Soil + Cont. (gm)	10.01	9.77	17.98	17.19	19.30	
Dry Wt. of Soil + Cont. (gm)	8.60	8.39	14.10	13.34	14.86	
Wt. of Container (gm)	1.07	1.00	1.14	1.06	1.10	
Moisture Content (%) [Wn]	18.73	18.67	29.94	31.35	32.27	

Liquid Limit	**31**
Plastic Limit	**19**
Plasticity Index	**12**
USCS Classification	**CL**

PI at "A" - Line = 0.73(LL-20) = 8.03

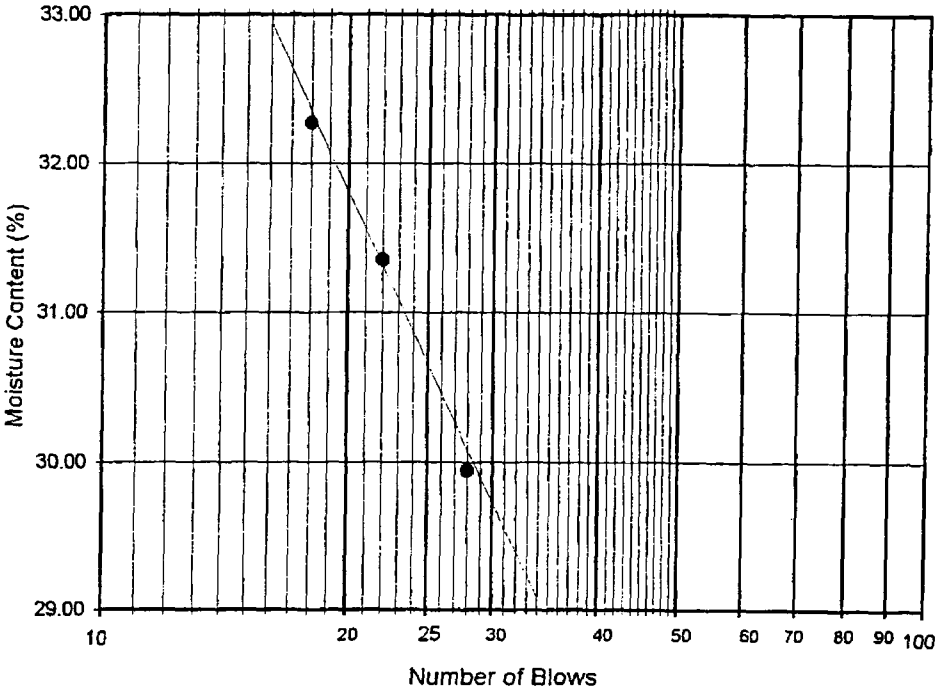
One - Point Liquid Limit Calculation

LL =Wn(N/25) $^{0.121}$



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



Teratest Labs, Inc.

ATTERBERG LIMITS

ASTM D 4318

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	VJ	Date:	11/05/02
Project No. :	37380 / CTO 0078	Input By:	RA	Date:	11/08/02
EPA ID:	LK155	Checked By:	LF	Date:	11/08/02
Sample No.:	AA3-HA02	Depth (ft.)	0-1.0		

Visual Sample Description: Olive silty sand (SM)

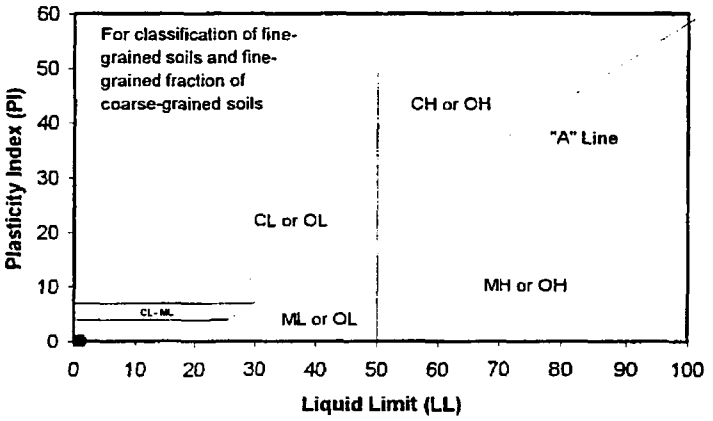
	PLASTIC LIMIT		LIQUID LIMIT			
TEST NO.	1	2	1	2	3	
Number of Blows [N]			14			
Wet Wt. of Soil + Cont. (gm)			17.80	Cannot get >14 blows		
Dry Wt. of Soil + Cont. (gm)	Cannot be rolled		15.10	NONPLASTIC		
Wt. of Container (gm)	NONPLASTIC		1.12			
Moisture Content (%) [Wn]			19.31			

Liquid Limit	NP
Plastic Limit	#DIV/0!
Plasticity Index	#DIV/0!
USCS Classification	NP

PI at "A" - Line = 0.73(LL-20) = -14.6

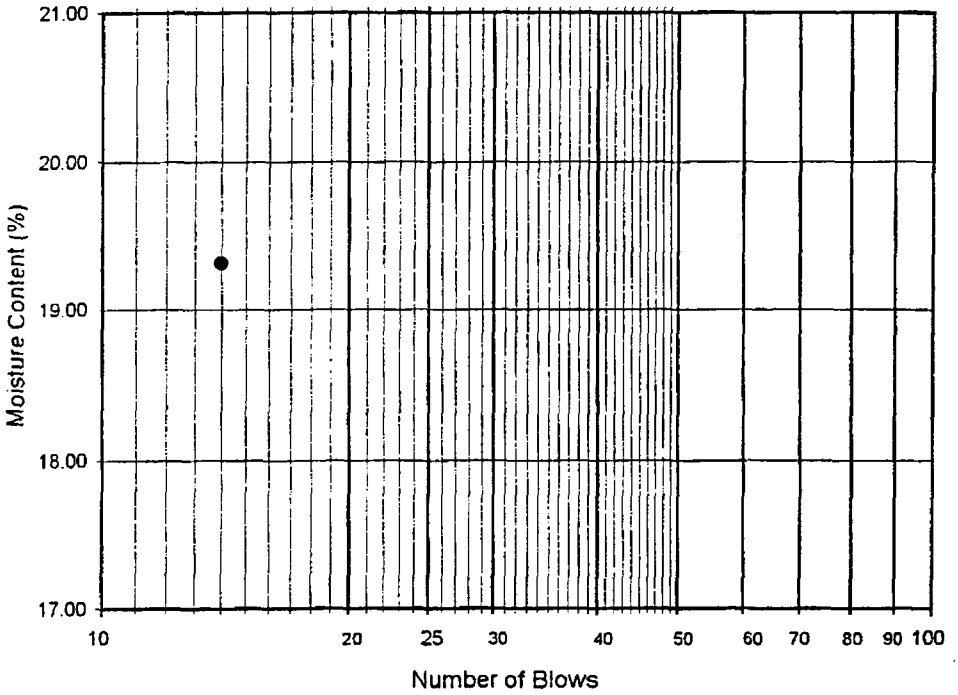
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



Teratest Labs, Inc.

COMPACTION TEST

ASTM D 1557

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By :	MTR	Date:	11/01/01
Project No.:	37380 / CTO 0078	Calculated By :	ESS	Date:	11/05/02
EPA ID:	LK143	Depth (ft.)	2.0-8.0		
Sample No. :	AA3-TR01-S3				

Visual Sample Description: Brown silty sand (SM)

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03322 *Ram Weight 10 LBS Drop 18 inches*

	0	2.5	5	7.5		
TEST NO.	1	2	3	4	5	6
Wt. Comp. Soil + Mold (gm.)	3545.0	3689.0	3771.0	3764.0		
Wt. of Mold (gm.)	1707.0	1707.0	1707.0	1707.0		
Net Wt. of Soil (gm.)	1838.0	1982.0	2064.0	2057.0		
Wet Wt. of Soil + Cont. (gm.)	469.90	377.60	418.10	319.10		
Dry Wt. of Soil + Cont. (gm.)	450.10	353.90	384.40	290.00		
Wt. of Container (gm.)	49.10	50.70	53.00	52.80		
Moisture Content (%)	4.94	7.82	10.17	12.27		
Wet Density (pcf)	122.0	131.5	137.0	136.5		
Dry Density (pcf)	116.2	122.0	124.3	121.6		

Maximum Dry Density (pcf) 125.0 **Optimum Moisture Content(%)** 9.5

PROCEDURE USED

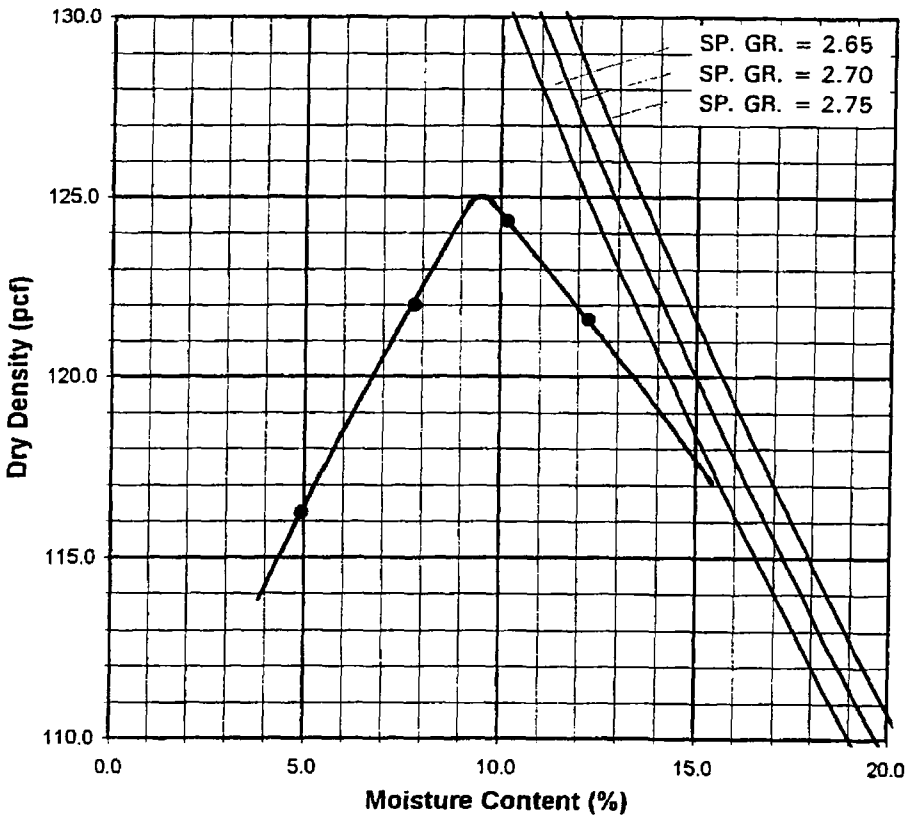
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if No.4 retained < 20%

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if + #4 > 20% and + 3/8 " < 20%

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if + 3/8 in >20% and + ¾ in <30%

Particle-Size Distribution:
2:71:27
GR:SA:FI

Atterberg Limits:
LL,PL,PI



Teratest Labs, Inc.

COMPACTION TEST

ASTM D 1557

Project Name:	Anomaly Area 3, Formar MCAS Eltoro, CA	Tested By :	JRS	Date:	11/01/01
Project No.:	37380 / CTO 0078	Calculated By :	MTR	Date:	11/05/02
EPA ID:	LK151	Depth (ft.)	1.0-2.0		
Sample No. :	AA3-TR08-S1				

Visual Sample Description: Brown clayey sand (SC)

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03322 *Ram Weight 10 LBS Drop 18 inches*

	2.5	5	7.5	10		
TEST NO.	1	2	3	4	5	6
Wt. Comp. Soil + Mold (gm.)	3559.0	3706.0	3784.0	3719.0		
Wt. of Mold (gm.)	1803.0	1803.0	1803.0	1803.0		
Net Wt. of Soil (gm.)	1756.0	1903.0	1981.0	1916.0		
Wet Wt. of Soil + Cont. (gm.)	490.10	443.80	451.40	485.70		
Dry Wt. of Soil + Cont. (gm.)	459.90	408.30	406.30	428.50		
Wt. of Container (gm.)	52.50	51.50	47.50	50.00		
Moisture Content (%)	7.41	9.95	12.57	15.11		
Wet Density (pcf)	116.5	126.3	131.5	127.2		
Dry Density (pcf)	108.5	114.9	116.8	110.5		

Maximum Dry Density (pcf) 118.5 **Optimum Moisture Content(%)** 11.5

PROCEDURE USED

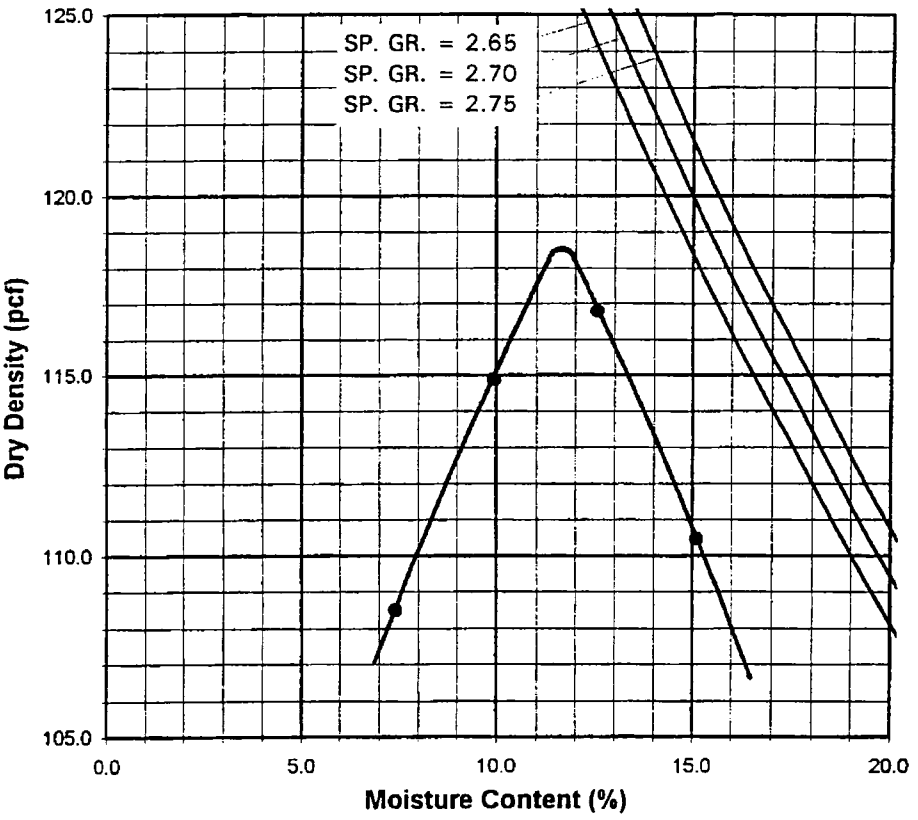
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if No.4 retained < 20%

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if + #4 > 20% and + 3/8 " < 20%

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if + 3/8 in >20% and + ¾ in <30%

Particle-Size Distribution:
: :37
GR:SA:FI

Atterberg Limits:
31,19,12
LL,PL,PI



TERATEST LABS, INC.

SPECIFIC GRAVITY OF SOILS
ASTM D 854

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Project No. : 37380 / CTO 0078

Tested By : ACS Date: 11/07/02
Data Input By: LF Date: 11/11/02
Checked By: LF Date: 11/11/02

BORING NUMBER	LK143	LK151				
SAMPLE NUMBER	AA3-TR01-S3	AA3-TR08-S1				
DEPTH (FT)	2 - 8	1 - 2				
USCS	SM	SC				
AVG. SPECIFIC GRAVITY (Gs)	**2.65**	**2.64**				
(Gs) PASSING #4	**2.62**	**2.61**				
(Gs) PASSING #4 (Dry Back)	**2.67**	**2.67**				
BULK SPECIFIC GRAVITY						
ABSORBTION (%)						
CONTAINER	55	146				
FLASK NUMBER	13	16				
WT. FLASK+WATER+SOIL	419.74	418.09				
TEMPERATURE	20	19				
CORRECTION FACTOR	1.0000	1.0002				
WT. DRY SOIL	100.66	100.49				
WT. FLASK & WATER	357.44	356.12				
% RETAINED #4	0.0	0.0				
% PASSING #4	100.0	100.0				
CONTAINER NO.	K-2	K-5				
DRY SOIL AFTER TEST + CONT.	174.56	175.11				
WT.+ #4 SATURATE + CONT.						
WT.+ #4 + CONT.(WATER)						
WT. OF CONTAINER	75.05	75.93				
WT. OF CONTAINER (WATER)						
WT.DRY BACK SOIL	99.51	99.18				
WT.+ #4 SATURATE (AIR)						
WT.+ #4 IN WATER						

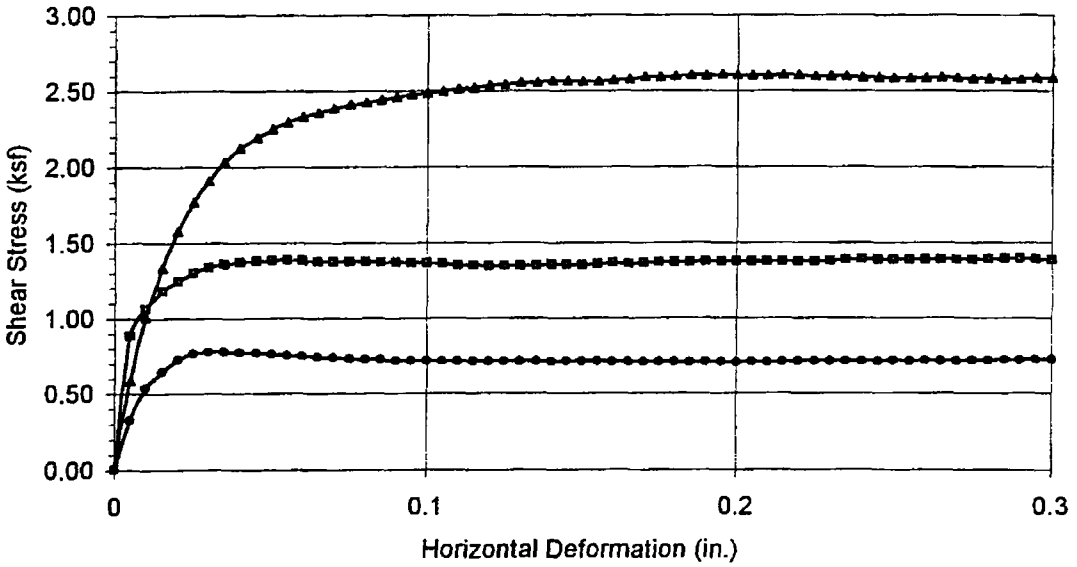
TEMPERATURE (CELSIUS)	CORRECTION FACTOR
17	1.0006
18	1.0004
19	1.0002
20	1.0000
21	0.9998
22	0.9996
23	0.9993
24	0.9991
25	0.9989
26	0.9986
27	0.9983

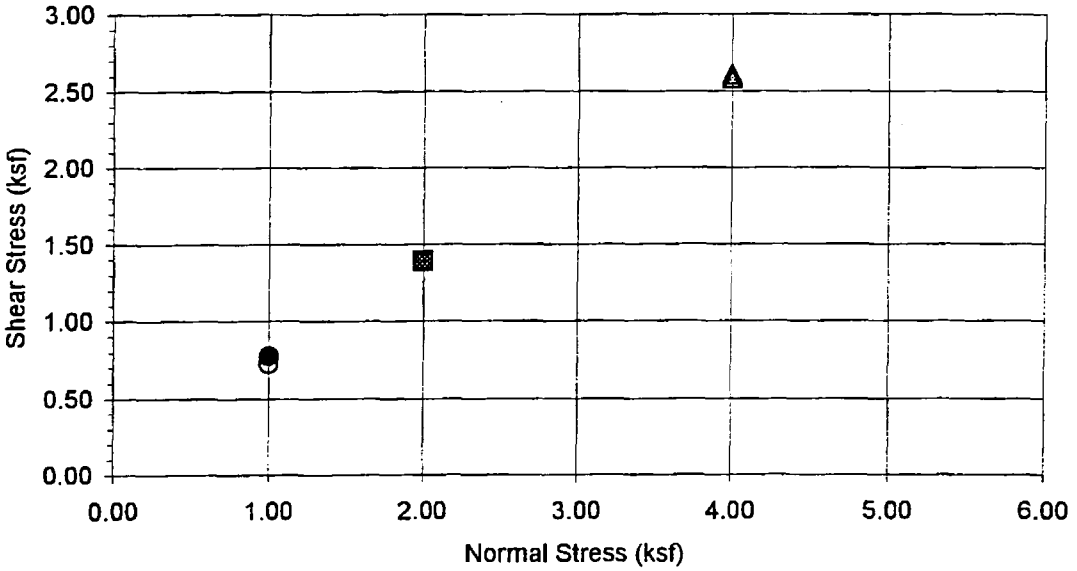
DIRECT SHEAR TEST

ASTM D3080

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Tested By: ACS
Date: 11/06/02
Project No.: 37380 / CTO 0078
Checked By: LF
EPA ID: LK143
Sample Type: Remolded to 85% RC @ Opt. +2% M. C.
Sample No.: AA3-TR01-S3 (85% Remold)
Depth (ft.): 2 - 8
Sample Description: Brown silty sand (SM)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	188.49	187.87	188.08
Weight of Ring(gm):	45.76	45.59	45.38
Before Shearing			
Weight of Wet Sample+Cont.(gm):	245.72	245.72	245.72
Weight of Dry Sample+Cont.(gm):	228.05	228.05	228.05
Weight of Container(gm):	70.45	70.45	70.45
Vertical Rdg.(in): Initial	0.0000	0.3386	0.3154
Vertical Rdg.(in): Final	-0.0065	0.3475	0.3320
After Shearing			
Weight of Wet Sample+Cont.(gm):	211.60	215.65	201.96
Weight of Dry Sample+Cont.(gm):	188.95	193.59	180.85
Weight of Container(gm):	62.38	66.81	53.80
Specific Gravity :	2.65	2.65	2.65
Water Density(pcf):	62.43	62.43	62.43





Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.776	■ 1.394	▲ 2.606
Shear Stress @ End of Test (ksf)	○ 0.726	□ 1.384	△ 2.582
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	11.21	11.21	11.21
Dry Density (pcf)	106.7	106.4	106.7
Saturation (%)	54.0	53.5	54.0
Soil Height Before Shearing (in.)	0.9935	0.9911	0.9834
Final Moisture Content (%)	17.9	17.4	16.6

Teratest Labs, Inc.

DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

EPA ID: LK143
Sample No.: AA3-TR01-S3 (85% Remold)
Depth (ft): 2 - 8
Soil Description: Brown silty sand (SM)

Project No.: 37380 / CTO 007
Anomaly Area 3, Former MCAS El Toro, CA

11-02

DS LK143 @ 85%.xls

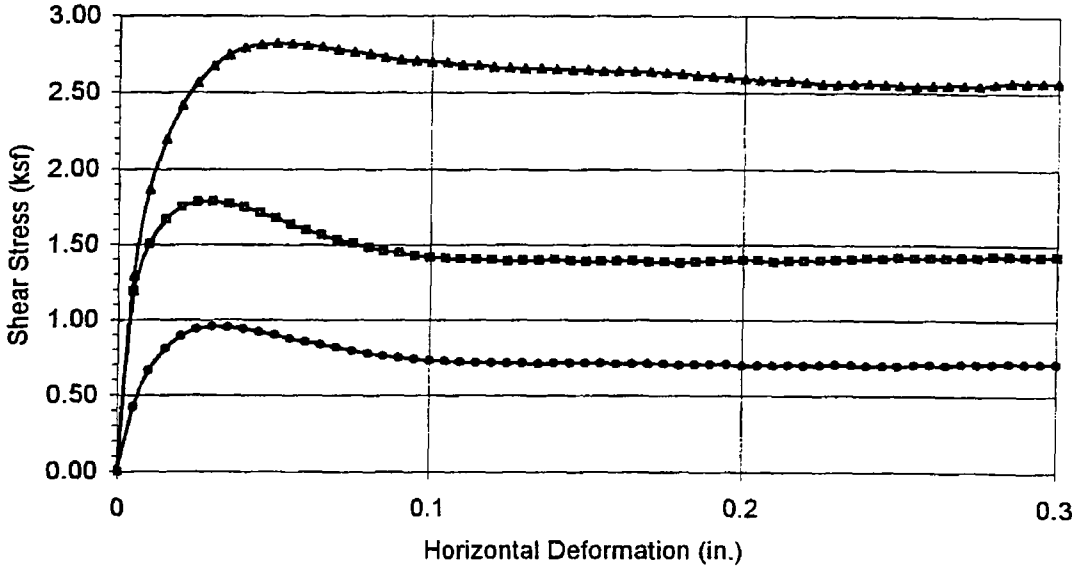
Torrent Labs, Inc.

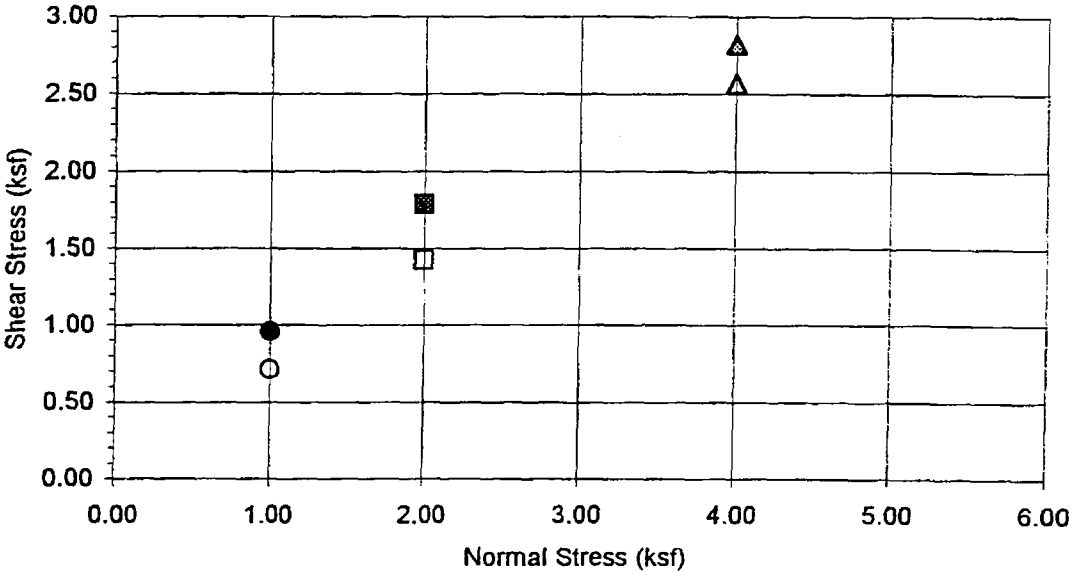
DIRECT SHEAR TEST

ASTM D3080

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Tested By: ACS
Date: 11/06/02
Project No.: 37380 / CTO 0078
Checked By: LF
EPA ID: LK143
Sample Type: Remolded to 90% RC @ Opt. +2% M. C.
Sample No.: AA3-TR01-S3 (90% Remold)
Depth (ft.): 2 - 8
Sample Description: Brown silty sand (SM)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	195.71	197.27	197.37
Weight of Ring(gm):	45.62	46.29	46.39
Before Shearing			
Weight of Wet Sample+Cont.(gm):	245.72	245.72	245.72
Weight of Dry Sample+Cont.(gm):	228.05	228.05	228.05
Weight of Container(gm):	70.45	70.45	70.45
Vertical Rdg.(in): Initial	0.0000	0.3223	0.3638
Vertical Rdg.(in): Final	-0.0001	0.3280	0.3791
After Shearing			
Weight of Wet Sample+Cont.(gm):	231.01	212.55	193.26
Weight of Dry Sample+Cont.(gm):	208.81	191.10	171.95
Weight of Container(gm):	75.75	56.47	38.18
Specific Gravity :	2.65	2.65	2.65
Water Density(pcf):	62.43	62.43	62.43





Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.957	■ 1.786	▲ 2.818
Shear Stress @ End of Test (ksf)	○ 0.714	□ 1.425	△ 2.566
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	11.21	11.21	11.21
Dry Density (pcf)	112.2	112.9	112.9
Saturation (%)	62.7	63.9	63.9
Soil Height Before Shearing (in.)	0.9999	0.9943	0.9847
Final Moisture Content (%)	16.7	15.9	15.9

Teratest Labs, Inc
A Lehigh Group Company

DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

EPA ID: LK143
Sample No.: AA3-TR01-S3 (90% Remold)
Depth (ft): 2 - 8
Soil Description: Brown silty sand (SM)

Project No.: 37380 / CTO 007
Anomaly Area 3, Former MCAS El Toro, CA

11-02

DS LK143 @ 90%.xls

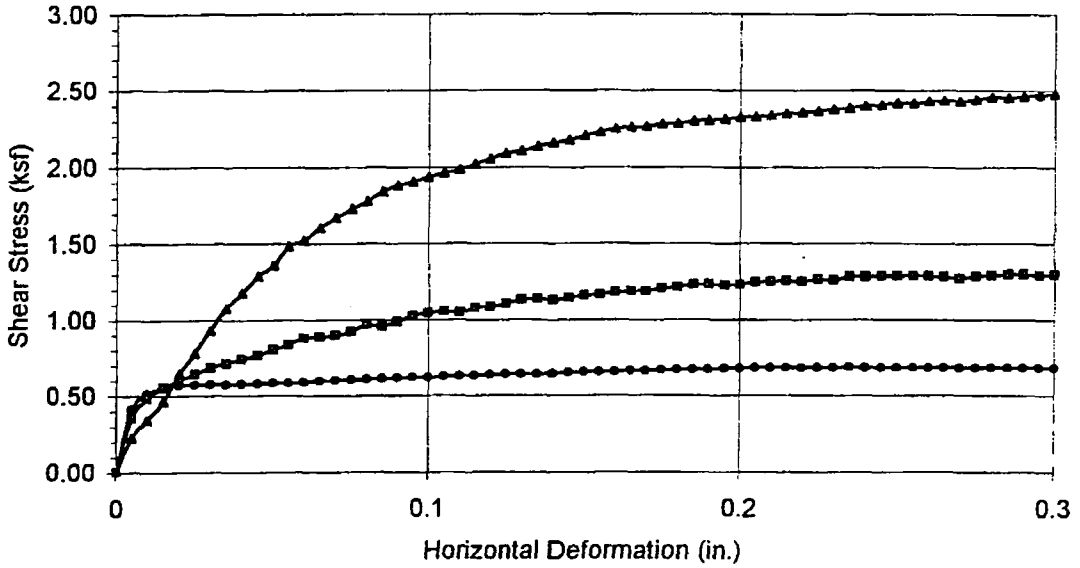
Terracon Lab, Inc.

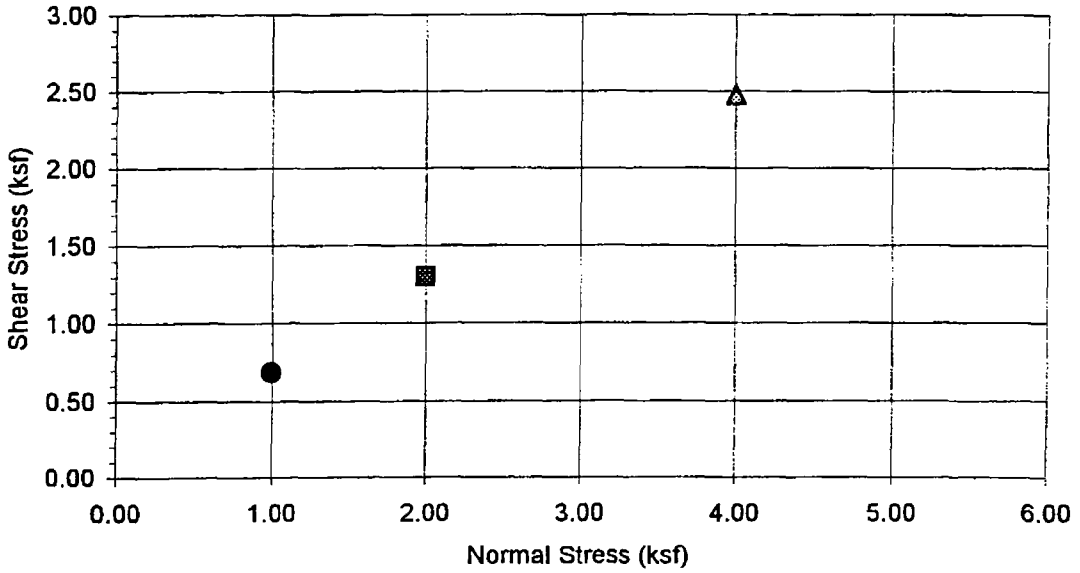
DIRECT SHEAR TEST

ASTM D3080

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Tested By: ACS
Date: 11/07/02
Project No.: 37380 / CTO 0078
Checked By: LF
EPA ID: LK151
Sample Type: Remolded to 85% RC @ Opt. +2% M. C.
Sample No.: AA3-TR08-S1 (85% Remold)
Depth (ft.): 1 - 2
Sample Description: Brown clayey sand (SC)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	183.99	182.96	183.55
Weight of Ring(gm):	46.29	45.38	45.62
Before Shearing			
Weight of Wet Sample+Cont.(gm):	215.05	215.05	215.05
Weight of Dry Sample+Cont.(gm):	196.47	196.47	196.47
Weight of Container(gm):	56.93	56.93	56.93
Vertical Rdg.(in): Initial	0.3355	0.3349	0.0000
Vertical Rdg.(in): Final	0.3414	0.3459	-0.0260
After Shearing			
Weight of Wet Sample+Cont.(gm):	200.77	182.49	214.76
Weight of Dry Sample+Cont.(gm):	177.42	160.76	195.02
Weight of Container(gm):	57.02	39.78	74.24
Specific Gravity:	2.64	2.64	2.64
Water Density(pcf):	62.43	62.43	62.43





Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.689	■ 1.303	▲ 2.476
Shear Stress @ End of Test (ksf)	○ 0.683	□ 1.303	△ 2.476
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	13.32	13.32	13.32
Dry Density (pcf)	101.1	101.0	101.2
Saturation (%)	55.7	55.6	56.0
Soil Height Before Shearing (in.)	0.9941	0.9890	0.9740
Final Moisture Content (%)	19.4	18.0	16.3

Teratest Labs, Inc
A LEIGHTON GROUP COMPANY

DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

EPA ID: LK151
Sample No.: AA3-TR08-S1 (85% Remold)
Depth (ft): 1 - 2
Soil Description: Brown clayey sand (SC)

Project No.: 37380 / CTO 007
Anomaly Area 3, Former MCAS El Toro, CA

11-02

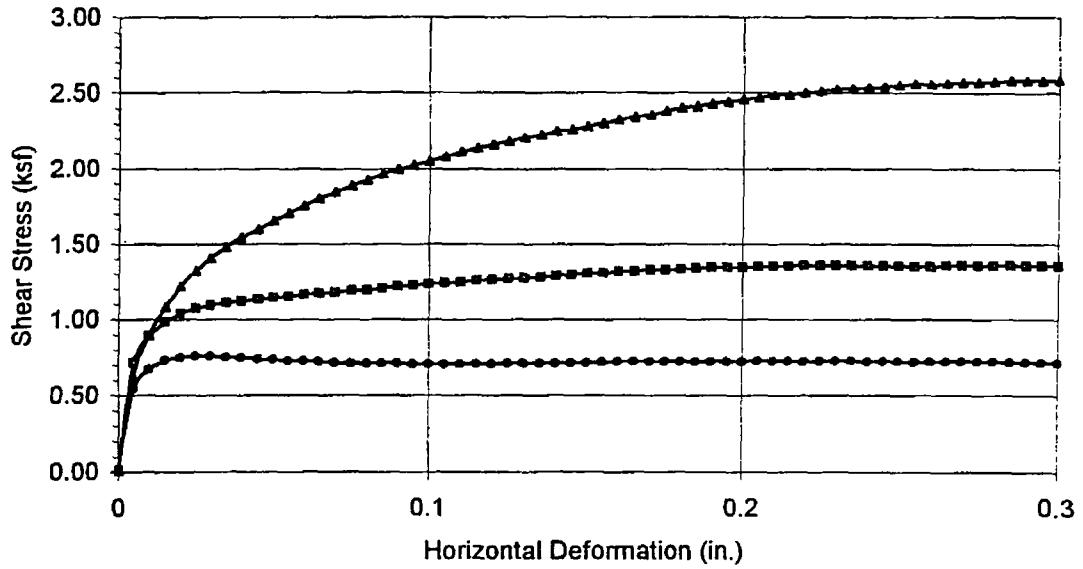
DS LK151 @ 85%.xls

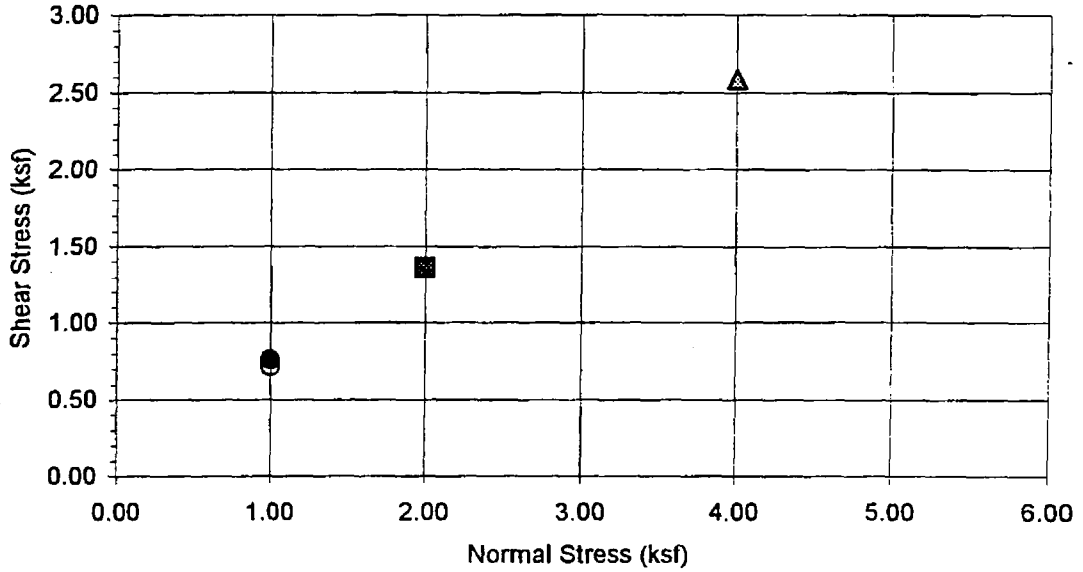
DIRECT SHEAR TEST

ASTM D3080

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Tested By: ACS
Date: 11/07/02
Project No.: 37380 / CTO 0078
Checked By: LF
EPA ID: LK151
Sample Type: Remolded to 90% RC @ Opt. +2% M. C.
Sample No.: AA3-TR08-S1 (90% Remold)
Depth (ft.): 1 - 2
Sample Description: Brown clayey sand (SC)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	191.52	191.48	191.55
Weight of Ring(gm):	45.57	45.52	45.48
Before Shearing			
Weight of Wet Sample+Cont.(gm):	215.05	215.05	215.05
Weight of Dry Sample+Cont.(gm):	196.47	196.47	196.47
Weight of Container(gm):	56.93	56.93	56.93
Vertical Rdg.(in): Initial	0.3104	0.3345	0.0000
Vertical Rdg.(in): Final	0.3155	0.3448	-0.0011
After Shearing			
Weight of Wet Sample+Cont.(gm):	201.70	225.83	205.18
Weight of Dry Sample+Cont.(gm):	178.48	203.88	184.26
Weight of Container(gm):	51.16	76.36	56.24
Specific Gravity:	2.64	2.64	2.64
Water Density(pcf):	62.43	62.43	62.43





Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.761	■ 1.362	▲ 2.588
Shear Stress @ End of Test (ksf)	○ 0.717	□ 1.356	△ 2.588
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	13.32	13.32	13.32
Dry Density (pcf)	107.1	107.1	107.2
Saturation (%)	65.3	65.3	65.4
Soil Height Before Shearing (in.)	0.9949	0.9897	0.9989
Final Moisture Content (%)	18.2	17.2	16.3

Teratest Labs, Inc
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DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

EPA ID:	LK151
Sample No.:	AA3-TR08-S1 (90% Remold)
Depth (ft):	1 - 2
Soil Description:	Brown clayey sand (SC)

Project No.: 37380 / CTO 007

Anomaly Area 3, Former MCAS El Toro, CA

11-02

DS LK151 @ 90%.xls

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

December 11, 2002

Earth Tech, Inc.
100 West Broadway, Suite 240
Long Beach, CA 90802-4443

Attention: Mr. Crispin Wanyoike

Subject: **Report/Laboratory Testing Results**
Project Name: Anomaly Area 3, Former MCAS El Toro, California
Project No.: 37380 / CTO 0078
Subcontract No.: 02S-2831-HI09 / CTO No.: 0078
TERATEST No.: 015230

Dear Mr. Wanyoike:

Enclosed please find laboratory testing results for the soil samples from the above referenced project. The requested tests were conducted in essential accordance with the standard test methods listed below.

TYPE OF TEST	TEST METHOD
Laboratory Determination of Water (Moisture) Content of Soil and Rock	ASTM D 2216
Density of Soil in Place by the Drive-Cylinder Method	ASTM D 2937
Amount of Material in Soils Finer Than the No. 200 Sieve	ASTM D 1140
Particle-Size Analysis of Soils	ASTM D 422
Liquid Limit, Plastic Limit and Plasticity Index of Soils	ASTM D 4318

Test results are presented Table 2 and the attached Data Sheets.

ASTM: American Society for Testing and Materials, Annual Book of ASTM Standards, Section 4 Construction, Volume 04.08 Soil and Rock (I), 2000.

17781 Cowan ▪ Irvine, CA 92614-6009
949.253.5922 ▪ Fax 949.263.8843 ▪ www.teratest.com

Thank you for selecting Teratest Labs, Inc. to provide laboratory testing services to Earth Tech, Inc. Please feel free to contact us if you should have any questions concerning these results.

Very truly yours,

TERATEST LABS, INC.
Laboratory Testing Services

Lester Fruth

Lester Fruth, Ph.D.
Soils Laboratory Supervisor

REGISTERED PROFESSIONAL ENGINEER
MOHAMMAD H. FAKHARPOUR
No. C049035
Exp. 9-30-04
CIVIL
STATE OF CALIFORNIA

Mohammad Fakharpour, P.E.
Registered Civil Engineer

Enclosures

Teratest Labs, Inc.

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Project No.: 37380 / CTO 0078
Client: Earth Tech, Inc.

Teratest No.: 015230
Tabulated By: LF
Date: 12/11/02

TABLE 2

SUMMARY of LABORATORY TEST RESULTS

Sample ID	Exploration Location	Depth (ft)	Moisture Content ASTM D 2216 (%)	Dry Density ASTM D 2937 (pcf)	Particle - Size Distribution ASTM D 422 GR:SA:FI[2] (%)	Percent Passing No. 200 Sieve ASTM D 1140 (%)	Atterberg Limits ASTM D 4318 LL,PL,PI[1]	Soil Classification / Identification ASTM D 2487 / ASTM D 2488* (group symbol)
LK169	AA3-MW05	2-2.5	5.2	96.3	3:94:3			SP
LK170	AA3-MW05	6-6.5	2.6	97.6				SP*
LK171	AA3-MW05	10.5-11	6.1	106.5	4:79:17			SM
LK172	AA3-MW05	15.5-16	5.2	99.3	1:88:11			SP-SM
LK173	AA3-MW05	20-20.5	5.1	98.7				SP-SM & SP*
LK174	AA3-MW05	25.5-26	8.2	120.7	38:49:13			(SM)g
LK175	AA3-MW05	30.5-31	29.7	98.2				SM & CL*
LK176	AA3-MW05	35-35.5	23.2	102.6				CL*
LK177	AA3-MW05	40-41.5	27.5		5:36:59			s(CL)
LK178	AA3-MW05	45-46.5	48.3			85.0	96,50,46	(MH)s
LK179	AA3-MW05	55-56.5	57.1					CL*
LK180	AA3-MW05	57-57.5	37.1	83.0		67.7		s(CL)
LK181	AA3-MW06	1.5-2	4.0	99.5		29.5		SM
LK182	AA3-MW06	6.6.5	8.4	90.6				SM*
LK183	AA3-MW06	11-11.5	11.5	90.8				SM*
LK184	AA3-MW06	16-16.5	16.8	102.2		44.6	41,22,19	SC
LK185	AA3-MW06	21-21.5	24.1	95.4	2:39:59			s(ML)
LK186	AA3-MW06	26-26.5	21.1	97.4				SC & CL*
LK187	AA3-MW06	31-31.5	9.6	128.9	41:49:10			(SW-SM)g
LK188	AA3-MW06	36-36.5	78.5	53.0		85.5		CL
LK189	AA3-MW06	40-41.5	73.3			90.6	84,46,38	MH
LK190	AA3-MW07	2-2.5	2.6	100.3				SP-SM*
LK191	AA3-MW07	6-6.5	2.6	103.7	0:88:12			SW-SM
LK192	AA3-MW07	10.5-11	2.7	96.5				SP*
LK193	AA3-MW07	15.5-16	2.3	100.7	1:93:6			SP-SM
LK194	AA3-MW07	25-25.5	4.2	112.6	22:66:12			(SW-SM)g

[1]LL,PL,PI = Liquid Limit, Plastic Limit, Plasticity Index
[2]GR:SA:FI = Gravel: Sand: Fines (Percent Passing #200 Sieve)

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Project No.: 37380 / CTO 0078
Client: Earth Tech, Inc.

Teratest No.: 015230
Tabulated By: LF
Date: 12/11/02

TABLE 2

SUMMARY of LABORATORY TEST RESULTS

Sample ID	Exploration Location	Depth (ft)	Moisture Content ASTM D 2216 (%)	Dry Density ASTM D 2937 (pcf)	Particle - Size Distribution ASTM D 422 GR:SA:FI[2] (%)	Percent Passing No. 200 Sieve ASTM D 1140 (%)	Atterberg Limits ASTM D 4318 LL,PL,PI[1]	Soil Classification / Identification ASTM D 2487 / ASTM D 2488* (group symbol)
LK195	AA3-MW07	31-31.5	11.8	110.6		22.4		SM
LK196	AA3-MW07	36-36.5	27.9	92.4			36,26,10	ML
LK197	AA3-MW07	40.5-41	19.6			34.4		SM
LK198	AA3-MW07	46-46.5	29.2	91.4				ML*
LK199	AA3-MW07	50-50.5	24.0	100.1	0:86:14			SM
LK200	AA3-MW08	1-1.5	1.9	93.1				SP*
LK201	AA3-MW08	6-6.5	13.2	106.6		55.1		s(CL)
LK202	AA3-MW08	11-11.5	21.3	89.7	2:15:83			(ML)s
LK203	AA3-MW08	16-16.5	8.3	104.3	1:75:24			SM
LK204	AA3-MW08	21-21.5	9.5	109.6				SM*
LK205	AA3-MW08	26-26.5	14.4	102.2	5:79:16			SC
LK206	AA3-MW09	1-1.5	3.9	99.6				SM*
LK207	AA3-MW09	6-6.5	4.3	105.0	1:88:11			SP-SM
LK208	AA3-MW09	10.5-11	7.7	108.4				SM*
LK209	AA3-MW09	16-16.5	11.8	96.0	2:75:23			SM
LK210	AA3-MW09	21-21.5	11.9	96.6		35.4		SM
LK211	AA3-MW09	26-26.5	12.1	108.3				SC*
LK212	AA3-MW09	31-31.5	7.3	126.7	55:37:8			(GW-GM)s
LK213	AA3-MW09	35-36.5	13.0					(SP)g*
LK214	AA3-MW09	40-41.5	16.7		1:97:2			SP
LK215	AA3-MW09	45-46.5	17.0					SP*
LK216	AA3-MW09	50-51.5	21.5		1:93:6			SP-SM
LK217	AA3-MW09	55-56.5	12.1					SP*
LK218	AA3-MW09	60-61.5	20.0					SP*
LK219	AA3-MW09	65-66.5	17.4		1:95:4			SP
LK220	AA3-MW09	70-71.5	13.9					SP*
LK221	AA3-MW09	75-76.5	17.7					SP*
LK222	AA3-MW09	80-81.5	17		0:94:6			SP-SM

[1] LL,PL,PI = Liquid Limit, Plastic Limit, Plasticity Index
[2] GR:SA:FI = Gravel: Sand: Fines (Percent Passing #200 Sieve)

Project Name: Anomaly Area 3, Former MCAS El Toro, CA

Project No.: 37380 / CTO 0078

Client: Earth Tech, Inc.

Teratest No.: 015230

Tabulated By: LF

Date: 12/11/02

TABLE 2

SUMMARY of LABORATORY TEST RESULTS

Sample ID	Exploration Location	Depth (ft)	Moisture Content ASTM D 2216 (%)	Dry Density ASTM D 2937 (pcf)	Particle - Size Distribution ASTM D 422 GR:SA:FI[2] (%)	Percent Passing No. 200 Sieve ASTM D 1140 (%)	Atterberg Limits ASTM D 4318 LL,PL,PI[1]	Soil Classification / Identification ASTM D 2487 / ASTM D 2488* (group symbol)
LK223	AA3-MW10	2-2.5	6.8	95.3				CL*
LK224	AA3-MW10	6-6.5	5.5	109.3	15:56:29			(SC)g
LK225	AA3-MW10	11-11.5	17.4	93.2				CL*
LK226	AA3-MW10	16-16.5	15.9	91.8		41.6	49,21,28	SC
LK227	AA3-MW10	20.5-21	2.4	104.9	14:81:5			SP-SM
LK228	AA3-MW10	26-26.5	2.3	114.1				SP*
LK229	AA3-MW10	31-31.5	2.8	105.6	4:91:5			SP-SM
LK230	AA3-MW10	36-36.5	9.7	98.8		30.8		SC
LK231	AA3-MW10	41-41.5	15.8	109.5	0:93:7			SP-SM
LK232	AA3-MW10	45.0	8.9		1:95:4			SP

[1] LL,PL,PI = Liquid Limit, Plastic Limit, Plasticity Index

[2] GR:SA:FI = Gravel: Sand: Fines (Percent Passing #200 Sieve)

CHAIN OF CUSTODY RECORD

GEOTECHNICAL LABORATORY TESTING - EXISTING COVER MATERIALS AND NEAR-SURFACE FILL SOILS
EL TORO MCAS - ANOMALY AREA 3 (AA3)

Laboratory: Teralest Labs
17781 Cowan Avenue, Suite 150
Irvine, California 92614

Due 12-9-02

Project Name: Anomaly Area 3
Project Number: 37380-02-30-02
Project Manager: Mr. Crispin Wanyoike
Telephone Number: 562-951-2057
Fax Number: 562-951-2086

Sampler: Rod Lazo
Date: 11/22/2002

Sample IDs	Exploration Location	Depth (feet)	Matrix	Type of Container	Sampling Date	Moisture Content (ASTM D2216)	Dry Unit Weight - Drive Cylinder (ASTM D2937)	Fines Fraction (ASTM D1140)	Grain Size Distribution - Sieve Analysis (ASTM D422)	Atterberg Limits (ASTM D4318)	Comments
						16 MC	48 MYD	12	26	5	
LK169	AA3-MW05	2.0-2.5	Soil	MC (2.5" I.D.)	11/5/2002	✓	✓		✓		
LK170	AA3-MW05	6 - 6.5	Soil	MC (2.5" I.D.)	11/5/2002	✓	✓				
LK171	AA3-MW05	10.5-11.0	Soil	MC (2.5" I.D.)	11/5/2002	✓	✓		✓		
LK172	AA3-MW05	15.5 16.5	Soil	MC (2.5" I.D.)	11/5/2002	✓	✓		✓		
LK173	AA3-MW05	20 - 20.5	Soil	MC (2.5" I.D.)	11/5/2002	✓	✓				
LK174	AA3-MW05	25.5 - 26.0	Soil	MC (2.5" I.D.)	11/5/2002	✓	✓		✓		
LK175	AA3-MW05	30.5 31.0	Soil	MC (2.5" I.D.)	11/5/2002	✓	✓				
LK176	AA3-MW05	35 - 35.5	Soil	MC (2.5" I.D.)	11/5/2002	✓	✓				
LK177	AA3-MW05	40 - 41.5	Soil	SPT (Bag)	11/5/2002	✓			✓		
LK178	AA3-MW05	45 - 46.5	Soil	SPT (Bag)	11/5/2002	✓		✓		✓	
LK179	AA3-MW05	55 - 56.5	Soil	SPT (Bag)	11/4/2002	✓					
57-57.5 LK180	AA3-MW05	[illegible]	Soil	~~SPT (Bag)~~ Done	11/4/2002	✓	✓	✓			
LK181	AA3-MW06	1.0-2.0	Soil	MC (2.5" I.D.)	11/4/2002	✓	✓	✓			
LK182	AA3-MW06	6 - 6.5	Soil	MC (2.5" I.D.)	11/4/2002	✓	✓				
LK183	AA3-MW06	10 - 11.5	Soil	MC (2.5" I.D.)	11/4/2002	✓	✓				
16-16.5 LK184	AA3-MW06	15 - 16.5	Soil	MC (2.5" I.D.)	11/4/2002	✓	✓	✓		✓	
LK185	AA3-MW06	20 - 21.5	Soil	MC (2.5" I.D.)	11/4/2002	✓	✓		✓		
LK186	AA3-MW06	25 - 26.5	Soil	MC (2.5" I.D.)	11/4/2002	✓	✓				
LK187	AA3-MW06	30 - 31.5	Soil	MC (2.5" I.D.)	11/4/2002	✓	✓		✓		
LK188	AA3-MW06	35 - 36.5	Soil	MC (2.5" I.D.)	11/4/2002	✓	✓	✓			
LK189	AA3-MW06	40 - 41.5	Soil	SPT (Bag)	11/4/2002	✓		✓		✓	
LK190	AA3-MW07	2.0-2.5	Soil	MC (2.5" I.D.)	11/4/2002	✓	✓				
LK191	AA3-MW07	6 - 6.5	Soil	MC (2.5" I.D.)	11/4/2002	✓	✓		✓		
LK192	AA3-MW07	10.5-11.0	Soil	MC (2.5" I.D.)	11/4/2002	✓	✓				
LK193	AA3-MW07	15.5 16.0	Soil	MC (2.5" I.D.)	11/4/2002	✓	✓		✓		
LK194	AA3-MW07	25 - 25.5	Soil	MC (2.5" I.D.)	11/4/2002	✓	✓		✓		
						4	22	6	10	3	

Received by: James Ward
JAMES WARD 15:27
11/25/02

CHAIN OF CUSTODY RECORD

GEOTECHNICAL LABORATORY TESTING - EXISTING COVER MATERIALS AND NEAR-SURFACE FILL SOILS
EL TORO MCAS - ANOMALY AREA 3 (AA3)

Laboratory: Teralest Labs
17761 Cowan Avenue, Suite 150
Irvine, California 92614

Project Name: Anomaly Area 3
Project Number: 37380-02-30-02
Project Manager: Mr. Crispin Wanyoike
Telephone Number: 562-951-2057
Fax Number: 562-951-2086

Sampler: Rod Lazo
Date: 11/22/2002

Sample IDs	Exploration Location	Depth (feet)	Matrix	Type of Container	Sampling Date	Moisture Content (ASTM D2216)	Dry Unit Weight - Drive Cylinder (ASTM D2937)	Sieve Fraction (ASTM D1140)	Grain Size Distribution - Sieve Analysis (ASTM D422)	Atterberg Limits (ASTM D4318)	Comments
LK195	AA3-MW07	30 - 31.5	Soil	MC (2.5" I.D.)	11/4/2002	✓	✓	✓			
LK196	AA3-MW07	36 ~~35~~ - 36.5	Soil	MC (2.5" I.D.)	11/6/2002	✓	✓			✓	
LK197	AA3-MW07	40 ~~35~~ - 41.5	Soil	MC (2.5" I.D.)	11/6/2002	✓	DIST.	✓			Disturbed Sample
LK198	AA3-MW07	45 - 46.5	Soil	MC (2.5" I.D.)	11/6/2002	✓	✓				
LK199	AA3-MW07	50 - 50.5	Soil	MC (2.5" I.D.)	11/6/2002	✓	✓		✓		
LK200	AA3-MW08	1.0-1.5	Soil	MC (2.5" I.D.)	11/6/2002	✓	✓				
LK201	AA3-MW08	6 - 6.5	Soil	MC (2.5" I.D.)	11/6/2002	✓	✓	✓			
LK202	AA3-MW08	10 - 11.5	Soil	MC (2.5" I.D.)	11/6/2002	✓	✓		✓		
LK203	AA3-MW08	15 - 16.5	Soil	MC (2.5" I.D.)	11/6/2002	✓	✓		✓		
LK204	AA3-MW08	20 - 21.5	Soil	MC (2.5" I.D.)	11/6/2002	✓	✓				
LK205	AA3-MW08	25 - 26.5	Soil	MC (2.5" I.D.)	11/6/2002	✓	✓		✓		
LK206	AA3-MW08	30 - 31.5	Soil	MC (2.5" I.D.)	11/6/2002	✓	✓				
LK207	AA3-MW08	35 - 36.5	Soil	MC (2.5" I.D.)	10/29/2002	✓	✓		✓		
LK208	AA3-MW08	40 - 41.5	Soil	MC (2.5" I.D.)	10/29/2002	✓	✓	N/A	✓		N/A
LK209	AA3-MW08	45 - 46.5	Soil	MC (2.5" I.D.)	10/29/2002	✓	✓	✓		✓	
LK210	AA3-MW08	50 - 51.5	Soil	MC (2.5" I.D.)	10/29/2002	✓	✓				
LK211 206	AA3-MW09	1.0-1.5	Soil	MC (2.5" I.D.)	10/29/2002	✓	✓				
LK212 207	AA3-MW09	6 - 6.5	Soil	MC (2.5" I.D.)	10/29/2002	✓	✓		✓		
LK213 208	AA3-MW09	10 - 11.5	Soil	MC (2.5" I.D.)	10/29/2002	✓	✓				
LK214 209	AA3-MW09	15 - 16.5	Soil	MC (2.5" I.D.)	10/29/2002	✓	✓		✓		
LK215 210	AA3-MW09	20 - 21.5	Soil	MC (2.5" I.D.)	10/29/2002	✓	✓	✓			
LK216 211	AA3-MW09	25 - 26.5	Soil	MC (2.5" I.D.)	10/29/2002	✓	✓				
LK217 212	AA3-MW09	30 - 31.5	Soil	MC (2.5" I.D.)	10/29/2002	✓	✓		✓		
LK218 213	AA3-MW09	35 - 36.5	Soil	SPT (Bag)	10/29/2002	✓					
LK219 214	AA3-MW09	40 - 41.5	Soil	SPT (Bag)	10/29/2002	✓			✓		
LK220 215	AA3-MW09	45 - 46.5	Soil	SPT (Bag)	10/29/2002	✓					
						4	17	4	8	1	

NO Samples

CHAIN OF CUSTODY RECORD

GEOTECHNICAL LABORATORY TESTING - EXISTING COVER MATERIALS AND NEAR-SURFACE FILL SOILS
EL TORO MCAS - ANOMALY AREA 3 (AA3)

Laboratory: Teratest Labs
17761 Cowan Avenue, Suite 150
Irvine, California 92614

Project Name: Anomaly Area 3
Project Number: 37380-02-30-02
Project Manager: Mr. Crispin Wanyoike
Telephone Number: 562-951-2057
Fax Number: 562-951-2086

Sampler: Rod Lazo
Date: 11/22/2002

Sample IDs	Exploration Location	Depth (feet)	Matrix	Type of Container	Sampling Date	Moisture Content (ASTM D2216)	Dry Unit Weight - Drive Cylinder (ASTM D2937)	Fines Fraction (ASTM D1140)	Grain Size Distribution - Sieve Analysis (ASTM D422)	Atterberg Limits (ASTM D4318)	Comments
LK221 216	AA3-MW09	50 - 51.5	Soil	SPT (Bag)	10/29/2002	1			1		
LK222 217	AA3-MW09	55 - 56.5	Soil	SPT (Bag)	10/29/2002	1					
LK223 218	AA3-MW09	60 - 61.5	Soil	SPT (Bag)	10/29/2002	1					
LK224 219	AA3-MW09	65 - 66.5	Soil	Bag	10/31/2002	1			1		
LK225 220	AA3-MW09	70 - 71.5	Soil	Bag	10/31/2002	1					
LK226 221	AA3-MW09	75 - 76.5	Soil	Bag	10/31/2002	1					
LK227 222	AA3-MW09	80 - 81.5	Soil	Bag	10/31/2002	1			1		
LK228 223	AA3-MW10	2.0-2.5	Soil	MC (2.5" I.D.)	10/31/2002	1	1				
LK229 224	AA3-MW10	6 - 6.5	Soil	MC (2.5" I.D.)	10/31/2002	1	1		1		
LK230 225	AA3-MW10	10 - 11.5	Soil	MC (2.5" I.D.)	10/31/2002	1	1				
16-16.5 + LK231 226	AA3-MW10	15.5 - 16.0	Soil	MC (2.5" I.D.)	10/31/2002	1	1	1		1	
LK232 227	AA3-MW10	20.5 - 21.0	Soil	MC (2.5" I.D.)	10/31/2002	1	1		1		
LK233 228	AA3-MW10	26 - 26.5	Soil	MC (2.5" I.D.)	10/31/2002	1	1				
LK234 229	AA3-MW10	31 - 31.5	Soil	MC (2.5" I.D.)	10/31/2002	1	1		1		
LK235 230	AA3-MW10	36 - 36.5	Soil	MC (2.5" I.D.)	10/31/2002	1	1	1			
LK236 231	AA3-MW10	41 - 41.5	Soil	MC (2.5" I.D.)	10/31/2002	1	1		1		
** LK237 232	AA3-MW10	75 - 76.5	Soil	MC (2.5" I.D.)	10/31/2002	1	1		1		

Relinquished by:	Rod Lazo	Date / Time	11/25/02 1527
Signature	Rod Lazo		
Printed	Rod Lazo		
Company	Earth Tech		
Reason			
Comments:	Lab-/Testing.		

Received by:	JAMES WARD	Date / Time	11/25/02 15:27
Signature	James Ward		
Printed	JAMES WARD		
Company	TERATEST LABS		
Reason	TESTING		

Sample ID	LK169	LK170	LK171	LK172	LK173	LK174	LK175	LK176
Exploration Location	AA3-MW05	AA3-MW05	AA3-MW05	AA3-MW05	AA3-MW05	AA3-MW05	AA3-MW05	AA3-MW05
Depth (ft.)	2-2.5	6-6.5	10.5-11	15.5-16	20-20.5	25.5-26	30.5-31	35-35.5
Sample Type	Drive	Drive	Drive	Drive	Drive	Drive	Drive	Drive
Visual Soil Classification	Brown poorly graded sand (SP); LOOSE	Light brown poorly graded sand (SP); LOOSE	Light brown silty sand (SM); FIRM	Light brown poorly graded sand with silt (SP-SM); LOOSE	Light brown, Top: poorly graded sand with silt (SP-SM); Bot: poorly graded sand (SP)	Light brown silty sand with gravel (SM)g; LOOSE	Brown, Top; silty sand (SM); Bot: lean clay (CL); WET & SOFT	Olive lean clay (CL)
Pocket Penetrometer	N/A	N/A	3.5	N/A	2.5 / 0.75	2.0	0.5	2.5
Weight Soil + Rings / Tube (gm.	893.12	825.30	973.86	951.80	849.96	989.54	1081.86	967.20
Weight of Rings / Tube (gm.	251.76	201.16	200.70	200.70	200.70	200.70	200.70	200.70
Average Length (in.)	5.240	5.160	5.660	5.950	5.180	5.000	5.721	5.022
Average Diameter (in.)	2.421	2.421	2.421	2.421	2.421	2.421	2.421	2.421
Wet. Wt. of Soil + Cont. (gm.	628.80	214.44	649.58	599.59	214.95	987.28	238.63	257.50
Dry Wt. of Soil + Cont. (gm.)	601.60	210.78	616.60	573.80	207.48	918.60	199.25	220.22
Weight of Container (gm)	75.15	68.29	75.77	76.77	60.15	79.15	66.80	59.20
Container No.:								
Wet Density	101.3	100.1	113.0	104.5	103.7	130.6	127.5	126.3
Moisture Content (%)	**5.2**	**2.6**	**6.1**	**5.2**	**5.1**	**8.2**	**29.7**	**23.2**
Dry Density (pcf)	**96.3**	**97.6**	**106.5**	**99.3**	**98.7**	**120.7**	**98.2**	**102.6**
Degree of Saturation (%)	18.6	9.5	28.3	20.1	19.3	55.7	112.2	97.1

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

MOISTURE & DENSITY of SOILS

ASTM D 2937

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Project No.: 37380 / CTO 0078
Client Name: Earth Tech, Inc.
Tested By: RA Date: 11/22/02

M&D.xls

Sample ID	LK177	LK178	LK179	LK180	LK181	LK182	LK183	LK184
Exploration Location	AA3-MW05	AA3-MW05	AA3-MW05	AA3-MW05	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW06
Depth (ft.)	40-41.5	45-46.5	55-56.5	57-57.5	1.5-2	6-6.5	11-11.5	16-16.5
Sample Type	SPT (Bag)	SPT (Bag)	SPT (Bag)	Drive	Drive	Drive	Drive	Drive
Visual Soil Classification	Olive sandy lean clay s(CL)	Olive elsatic silt with sand (MH)s	Olive lean clay (CL)	Olive, sandy Bot: lean clay (CL); Top: silt (ML)	Yellowish brown silty sand (SM); LOOSE	Brown silty sand (SM); LOOSE	Dark brown silty sand (SM) with lumps of clay	Dark brown clayey sand (SC)
Pocket Penetrometer				N/A	N/A	N/A	N/A	2.5
Weight Soil + Rings / Tube (gm.				984.62	947.32	739.10	667.60	604.58
Weight of Rings / Tube (gm.				200.70	261.66	202.08	261.36	200.70
Average Length (in.)				5.700	5.481	4.522	3.321	2.800
Average Diameter (in.)				2.421	2.421	2.421	2.421	2.421
Wet. Wt. of Soil + Cont. (gm.	404.81	370.65	317.21	416.47	455.61	231.70	262.71	577.93
Dry Wt. of Soil + Cont. (gm.)	333.83	274.34	229.90	324.51	440.86	217.63	241.47	505.79
Weight of Container (gm)	75.80	74.83	76.89	76.75	75.65	50.99	56.29	75.50
Container No.:								
Wet Density				113.8	103.5	98.3	101.2	119.4
Moisture Content (%)	**27.5**	**48.3**	**57.1**	**37.1**	**4.0**	**8.4**	**11.5**	**16.8**
Dry Density (pcf)				**83.0**	**99.5**	**90.6**	**90.8**	**102.2**
Degree of Saturation (%)				97.2	15.7	26.5	36.2	69.8

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

MOISTURE & DENSITY of SOILS

ASTM D 2937

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Project No.: 37380 / CTO 0078
Client Name: Earth Tech, Inc.
Tested By: RA Date: 11/22/02

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Sample ID	LK185	LK186	LK187	LK188	LK189	LK190	LK191	LK192
Exploration Location	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW07	AA3-MW07	AA3-MW07
Depth (ft.)	21-21.5	26-26.5	31-31.5	36-36.5	40-41.5	2-2.5	6-6.5	10.5-11
Sample Type	Drive	Drive	Drive	Drive	SPT (Bag)	Drive	Drive	Drive
Visual Soil Classification	Olive sandy silt s(ML)	Reddish brown, Top: clayey sand (SC); Bot: lean clay (CL)	Brown well-graded sand with silt and gravel (SW-SM)g; LOOSE	Pale yellow lean clay (CL)	Olive elastic silt (MH)	Reddish brown poorly graded sand with silt (SP-SM); LOOSE	Reddish brown well-graded sand with silt (SW-SM); LOOSE	Yellowish brown poorly graded sand (SP); LOOSE
Pocket Penetrometer	0.75	2.0	4.0	2.0		N/A	N/A	N/A
Weight Soil + Rings / Tube (gm.	873.06	612.14	1180.16	885.76		926.82	1007.42	797.84
Weight of Rings / Tube (gm.	200.70	251.02	202.04	202.52		261.20	251.15	251.44
Average Length (in.)	4.700	2.532	5.731	5.981		5.353	5.882	4.561
Average Diameter (in.)	2.421	2.421	2.421	2.421		2.421	2.421	2.421
Wet. Wt. of Soil + Cont. (gm.	501.03	221.73	958.28	340.71	369.59	243.85	534.64	251.71
Dry Wt. of Soil + Cont. (gm.)	419.05	195.63	881.18	227.05	246.36	238.66	523.09	246.45
Weight of Container (gm)	79.15	72.10	74.26	82.27	78.21	36.83	76.04	52.76
Container No.:								
Wet Density	118.4	118.0	141.2	94.5		102.9	106.4	99.1
Moisture Content (%)	**24.1**	**21.1**	**9.6**	**78.5**	**73.3**	**2.6**	**2.6**	**2.7**
Dry Density (pcf)	**95.4**	**97.4**	**128.9**	**53.0**		**100.3**	**103.7**	**96.5**
Degree of Saturation (%)	84.9	78.2	83.9	97.1		10.2	11.2	9.8

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

MOISTURE & DENSITY of SOILS
ASTM D 2937

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Project No.: 37380 / CTO 0078
Client Name: Earth Tech, Inc.
Tested By: RA Date: 11/22/02

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Sample ID	LK193	LK194	LK195	LK196	LK197	LK198	LK199	LK200
Exploration Location	AA3-MW07	AA3-MW07	AA3-MW07	AA3-MW07	AA3-MW07	AA3-MW07	AA3-MW07	AA3-MW08
Depth (ft.)	15.5-16	25-25.5	31-31.5	36-36.5	40.5-41	46-46.5	50-50.5	1-1.5
Sample Type	Drive	Drive	Drive	Drive	Drive	Drive	Drive	Drive
Visual Soil Classification	Pale brown poorly graded sand with silt (SP-SM)	Pale brown well- graded sand with silt and gravel (SW-SM)g	Brown silty sand (SM)	Light yellow silt (ML)	Pale olive silty sand (SM); LOOSE / DISTURBED / No Density	Pale olive silt (ML)	Pale yellow silty sand (SM)	Reddish brown poorly graded sand (SP); LOOSE
Pocket Penetrometer	1	>4.5	>4.5	3.5	N/A	1.5	1.0	N/A
Weight Soil + Rings / Tube (gm.	956.96	994.62	1001.38	1080.60		959.04	1095.80	793.86
Weight of Rings / Tube (gm.	261.19	250.43	251.18	251.05		251.87	263.05	201.29
Average Length (in.)	5.590	5.250	5.021	5.810		4.952	5.553	5.171
Average Diameter (in.)	2.421	2.421	2.421	2.421	2.421	2.421	2.421	2.421
Wet. Wt. of Soil + Cont. (gm.	494.66	650.22	600.32	351.20	389.39	246.68	469.14	254.95
Dry Wt. of Soil + Cont. (gm.)	485.32	627.18	545.02	290.88	338.11	206.70	393.31	251.40
Weight of Container (gm)	76.06	75.63	77.27	74.73	76.85	70.01	77.02	66.00
Container No.:								
Wet Density	103.0	117.3	123.6	118.2		118.2	124.1	94.8
Moisture Content (%)	**2.3**	**4.2**	**11.8**	**27.9**	**19.6**	**29.2**	**24.0**	**1.9**
Dry Density (pcf)	**100.7**	**112.6**	**110.6**	**92.4**		**91.4**	**100.1**	**93.1**
Degree of Saturation (%)	9.1	22.7	60.9	91.4		93.6	94.7	6.4

Teratest Labs, Inc.
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MOISTURE & DENSITY of SOILS
ASTM D 2937

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Project No.: 37380 / CTO 0078
Client Name: Earth Tech, Inc.
Tested By: RA Date: 11/22/02

D.xls

Sample ID	LK201	LK202	LK203	LK204	LK205	LK206	LK207	LK208
Exploration Location	AA3-MW08	AA3-MW08	AA3-MW08	AA3-MW08	AA3-MW08	AA3-MW09	AA3-MW09	AA3-MW09
Depth (ft.)	6-6.5	11-11.5	16-16.5	21-21.5	26-26.5	1-1.5	6-6.5	10.5-11
Sample Type	Drive	Drive	Drive	Drive	Drive	Drive	Drive	Drive
Visual Soil Classification	Brown sandy lean clay s(CL)	Brown silt with sand (ML)s	Brown silty sand (SM)	Yellowish brown silty sand (SM)	Brown, Top: clayey sand (SC); Bot: poorly graded sand (SP)	Dark brown silty sand (SM)	Brown poorly graded sand with silt (SP-SM)	Yellowish brown silty sand (SM)
Pocket Penetrometer	>4.5	3.5	1.5	4.5	1.0	0.5	3.0	1.75
Weight Soil + Rings / Tube (gm.	1076.46	955.06	993.22	1013.82	674.86	995.04	1006.30	1086.22
Weight of Rings / Tube (gm.	202.01	201.90	201.47	201.35	201.48	250.97	251.15	251.17
Average Length (in.)	6.001	5.730	5.800	5.601	3.350	5.951	5.702	5.921
Average Diameter (in.)	2.421	2.421	2.421	2.421	2.421	2.421	2.421	2.421
Wet. Wt. of Soil + Cont. (gm.	381.37	370.56	510.27	223.84	558.78	309.22	485.54	289.06
Dry Wt. of Soil + Cont. (gm.)	345.76	319.13	476.99	209.38	497.98	300.21	468.46	272.85
Weight of Container (gm)	75.20	77.62	76.42	57.81	76.71	70.43	74.31	61.70
Container No.:								
Wet Density	120.6	108.8	113.0	120.0	116.9	103.5	109.6	116.7
Moisture Content (%)	**13.2**	**21.3**	**8.3**	**9.5**	**14.4**	**3.9**	**4.3**	**7.7**
Dry Density (pcf)	**106.6**	**89.7**	**104.3**	**109.6**	**102.2**	**99.6**	**105.0**	**108.4**
Degree of Saturation (%)	61.1	65.4	36.4	47.9	60.0	15.3	19.3	37.3

Teratest Labs, Inc.
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MOISTURE & DENSITY of SOILS

ASTM D 2937

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Project No.: 37380 / CTO 0078
Client Name: Earth Tech, Inc.
Tested By: RA Date: 11/22/02

M&D.xls

Sample ID	LK209	LK210	LK211	LK212	LK213	LK214	LK215	LK216
Exploration Location	AA3-MW09	AA3-MW09	AA3-MW09	AA3-MW09	AA3-MW09	AA3-MW09	AA3-MW09	AA3-MW09
Depth (ft.)	16-16.5	21-21.5	26-26.5	31-31.5	35-36.5	40-41.5	45-46.5	50-51.5
Sample Type	Drive	Drive	Drive	Drive	SPT (Bag)	SPT (Bag)	SPT (Bag)	SPT (Bag)
Visual Soil Classification	Brown silty sand (SM)	Brown silty sand (SM)	Dark brown clayey sand (SC)	Yellowish brown well-graded gravel with silt and sand (GW-GM)s	Pale yellow poorly graded sand with gravel (SP)g	Olive yellow poorly graded sand (SP)	Olive yellow poorly graded sand (SP)	Pale yellow poorly graded sand with silt (SP-SM)
Pocket Penetrometer	0.75	1.5	>4.5	>4.5				
Weight Soil + Rings / Tube (gm.	967.00	970.08	1101.74	1034.24				
Weight of Rings / Tube (gm.	261.20	261.66	261.45	262.13				
Average Length (in.)	5.441	5.420	5.730	4.702				
Average Diameter (in.)	2.421	2.421	2.421	2.421				
Wet. Wt. of Soil + Cont. (gm.	460.27	466.89	237.90	929.36	329.16	752.56	300.09	896.68
Dry Wt. of Soil + Cont. (gm.)	419.66	425.26	216.34	871.30	297.60	655.60	267.24	757.20
Weight of Container (gm)	76.73	76.81	37.60	72.14	55.30	75.03	74.15	107.92
Container No.:								
Wet Density	107.3	108.2	121.4	135.9				
Moisture Content (%)	**11.8**	**11.9**	**12.1**	**7.3**	**13.0**	**16.7**	**17.0**	**21.5**
Dry Density (pcf)	**96.0**	**96.6**	**108.3**	**126.7**				
Degree of Saturation (%)	42.3	43.3	58.5	59.3				

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

MOISTURE & DENSITY of SOILS

ASTM D 2937

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Project No.: 37380 / CTO 0078
Client Name: Earth Tech, Inc.
Tested By: RA Date: 11/22/02

Sample ID	LK217	LK218	LK21[illegible]	LK220	LK221	LK222	LK223	[illegible]224
Exploration Location	AA3-MW09	AA3-MW09	AA3-MW09	AA3-MW09	AA3-MW09	AA3-MW09	AA3-MW10	AA3-MW10
Depth (ft.)	55-56.5	60-61.5	65-66.5	70-71.5	75-76.5	80-81.5	2-2.5	6-6.5
Sample Type	SPT (Bag)	SPT (Bag)	Bag	Bag	Bag	Bag	Drive	Drive
Visual Soil Classification	Olive yellow poorly graded sand (SP)	Olive yellow poorly graded sand (SP)	Olive yellow poorly graded sand (SP)	Olive yellow poorly graded sand (SP)	Olive yellow poorly graded sand (SP)	Olive yellow poorly graded sand with silt (SP-SM)	Dark brown lean clay (CL)	Brown clayey sand with gravel (SC)g
Pocket Penetrometer							>4.5	>4.8
Weight Soil + Rings / Tube (gm.							948.28	954.08
Weight of Rings / Tube (gm.							261.33	250.93
Average Length (in.)							5.581	5.042
Average Diameter (in.)							2.421	2.421
Wet. Wt. of Soil + Cont. (gm.	308.44	191.09	976.60	304.68	367.20	1387.85	187.32	747.90
Dry Wt. of Soil + Cont. (gm.)	281.21	165.92	847.80	274.26	322.20	1202.30	177.60	712.50
Weight of Container (gm)	56.64	40.21	107.76	55.26	68.18	108.88	35.67	74.15
Container No.:								
Wet Density							101.9	115.4
Moisture Content (%)	**12.1**	**20.0**	**17.4**	**13.9**	**17.7**	**17.0**	**6.8**	**5.5**
Dry Density (pcf)							**95.3**	**109.3**
Degree of Saturation (%)							24.1	27.6

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

MOISTURE & DENSITY of SOILS
ASTM D 2937

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Project No.: 37380 / CTO 0078
Client Name: Earth Tech, Inc.
Tested By: RA Date: 11/22/02

M&D.xls

Sample ID	LK225	LK226	LK227	LK228	LK229	LK230	LK231	LK232
Exploration Location	AA3-MW10	AA3-MW10	AA3-MW10	AA3-MW10	AA3-MW10	AA3-MW10	AA3-MW10	AA3-MW10
Depth (ft.)	11-11.5	16-16.5	20.5-21	26-26.5	31-31.5	36-36.5	41-41.5	45.0
Sample Type	Drive	Drive	Drive	Drive	Drive	Drive	Drive	SPT (Bag)
Visual Soil Classification	Olive lean clay (CL)	Olive clayey sand (SC)	Brown poorly graded sand with silt (SP-SM); LOOSE	Yellowish brown poorly graded sand (SP)	Pale Yellow poorly graded sand with silt (SP-SM)	Dark brown clayey sand (SC)	Olive poorly graded sand with silt (SP-SM)	Olive yellow poorly graded sand (SP)
Pocket Penetrometer	N/A	>4.5	N/A	0.5	.05	0.5	0.25	
Weight Soil + Rings / Tube (gm.	1055.68	899.32	738.00	1096.96	1002.24	918.40	1125.64	
Weight of Rings / Tube (gm.	261.50	251.27	251.20	250.79	251.20	249.71	252.64	
Average Length (in.)	6.003	5.040	3.751	6.001	5.723	5.103	5.700	
Average Diameter (in.)	2.421	2.421	2.421	2.421	2.421	2.421	2.421	
Wet. Wt. of Soil + Cont. (gm.	276.36	773.44	493.38	240.89	707.08	639.82	610.24	704.22
Dry Wt. of Soil + Cont. (gm.)	240.85	678.70	483.61	236.84	689.90	589.80	538.30	653.60
Weight of Container (gm)	36.96	82.29	76.07	58.18	75.60	75.34	82.24	82.22
Container No.:								
Wet Density	109.5	106.4	107.4	116.7	108.6	108.4	126.7	
Moisture Content (%)	**17.4**	**15.9**	**2.4**	**2.3**	**2.8**	**9.7**	**15.8**	**8.9**
Dry Density (pcf)	**93.2**	**91.8**	**104.9**	**114.1**	**105.6**	**98.8**	**109.5**	
Degree of Saturation (%)	58.2	51.3	10.7	12.8	12.7	37.2	78.9	

Teratest Labs, Inc.
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MOISTURE & DENSITY of SOILS
ASTM D 2937

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Project No.: 37380 / CTO 0078
Client Name: Earth Tech, Inc.
Tested By: RA Date: 11/22/02

D.xls

Teratest Labs, Inc.

ATTERBERG LIMITS

ASTM D 4318

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/04/02
Project No. :	37380 / CTO 0078	Input By:	RA	Date:	12/09/02
Sample ID:	LK178	Checked By:	LF	Date:	12/09/02
Exploration Location:	AA3-MW05	Depth (ft.)	45-46.5		

Visual Sample Description: Olive elastic silt with sand (MH)s

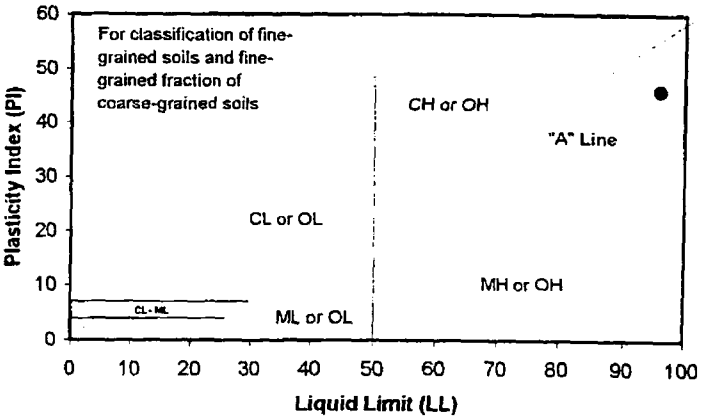
	PLASTIC LIMIT		LIQUID LIMIT			
TEST NO.	1	2	1	2	3	
Number of Blows [N]			30	23	16	
Wet Wt. of Soil + Cont. (gm)	8.28	8.21	17.15	17.19	16.92	
Dry Wt. of Soil + Cont. (gm)	5.86	5.83	9.34	9.26	9.01	
Wt. of Container (gm)	1.04	1.02	1.03	1.02	1.14	
Moisture Content (%) [Wn]	50.21	49.48	93.98	96.24	100.51	

Liquid Limit	**96**
Plastic Limit	**50**
Plasticity Index	**46**
USCS Classification	**MH**

PI at "A" - Line = 0.73(LL-20) = 55.48

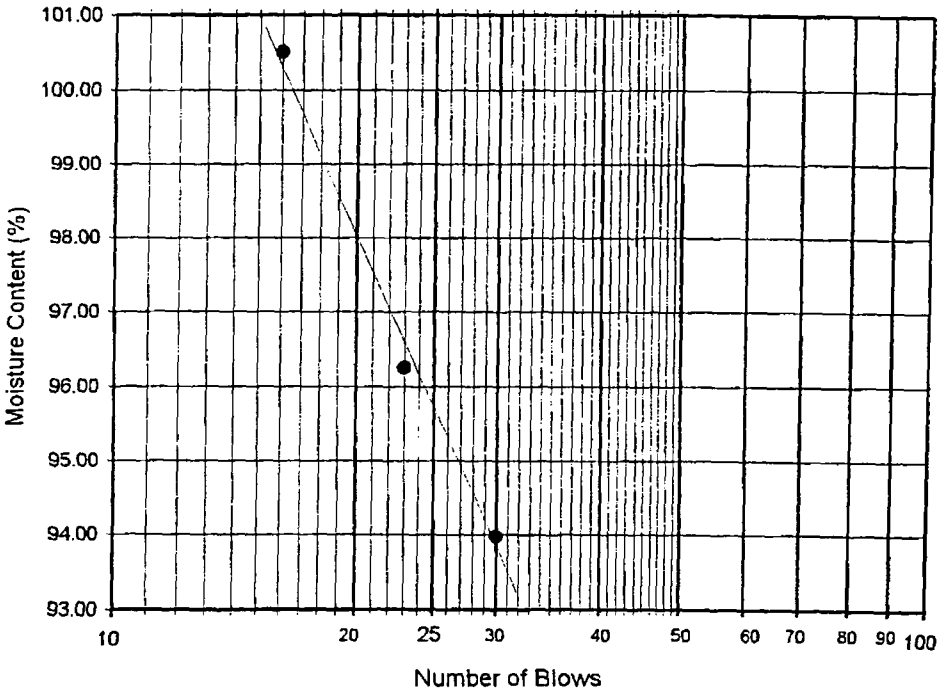
One - Point Liquid Limit Calculation

LL =Wn(N/25) $^{0.121}$



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



Teratest Labs, Inc.

ATTERBERG LIMITS

ASTM D 4318

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/04/02
Project No. :	37380 / CTO 0078	Input By:	RA	Date:	12/11/02
Sample ID:	LK184	Checked By:	LF	Date:	12/11/02
Exploration Location:	AA3-MW06	Depth (ft.)	16-16.5		

Visual Sample Description: Dark brown clayey sand (SC)

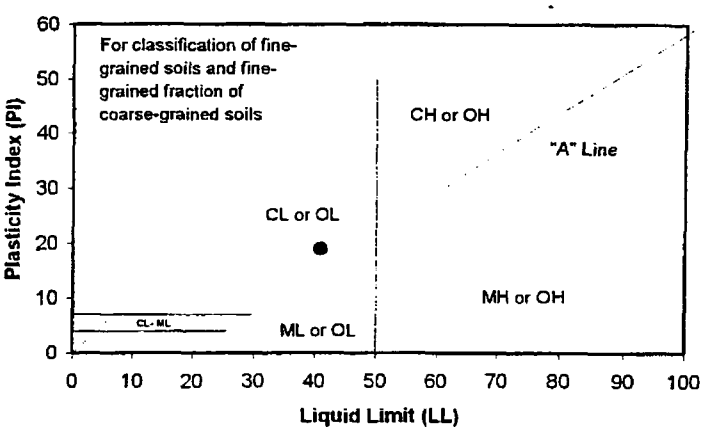
	PLASTIC LIMIT		LIQUID LIMIT			
TEST NO.	1	2	1	2	3	
Number of Blows [N]			31	23	18	
Wet Wt. of Soil + Cont. (gm)	9.82	10.46	19.70	19.82	18.32	
Dry Wt. of Soil + Cont. (gm)	8.27	8.80	14.40	14.30	13.11	
Wt. of Container (gm)	1.11	1.11	1.07	1.08	1.05	
Moisture Content (%) [Wn]	21.65	21.59	39.76	41.75	43.20	

Liquid Limit	**41**
Plastic Limit	**22**
Plasticity Index	**19**
USCS Classification	**CL**

PI at "A" - Line = 0.73(LL-20) = 15.33

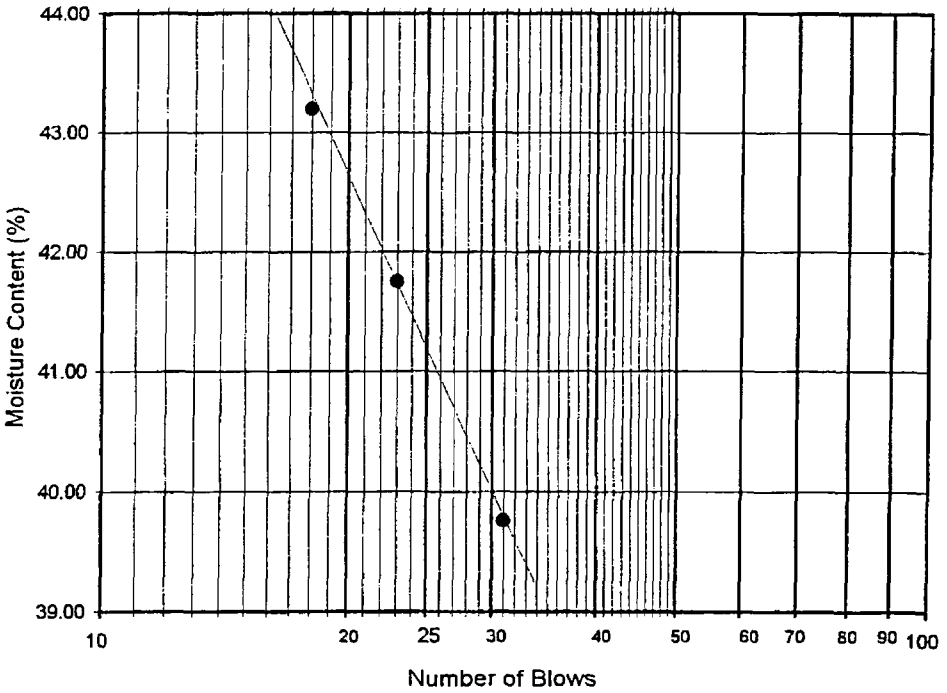
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



PROCEDURES USED

- [ ] Wet Preparation Multipoint - Wet
- [x] Dry Preparation Multipoint - Dry
- [x] Procedure A Multipoint Test
- [ ] Procedure B One-point Test



Teratest Labs, Inc.

ATTERBERG LIMITS

ASTM D 4318

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/04/02
Project No. :	37380 / CTO 0078	Input By:	RA	Date:	12/09/02
Sample ID:	LK189	Checked By:	LF	Date:	12/09/02
Exploration Location:	AA3-MW06	Depth (ft.)	40-41.5		

Visual Sample Description: Olive elastic silt (MH)

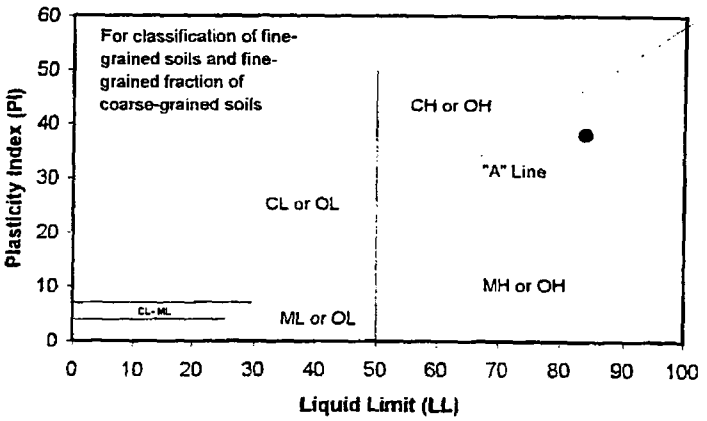
	PLASTIC LIMIT		LIQUID LIMIT			
TEST NO.	1	2	1	2	3	
Number of Blows [N]			32	22	18	
Wet Wt. of Soil + Cont. (gm)	9.44	8.75	16.92	16.05	16.37	
Dry Wt. of Soil + Cont. (gm)	6.80	6.32	9.73	9.15	9.26	
Wt. of Container (gm)	1.09	1.05	1.04	1.03	1.05	
Moisture Content (%) [Wn]	46.23	46.11	82.74	84.98	86.60	

Liquid Limit	**84**
Plastic Limit	**46**
Plasticity Index	**38**
USCS Classification	**MH**

PI at "A" - Line = 0.73(LL-20) = 46.72

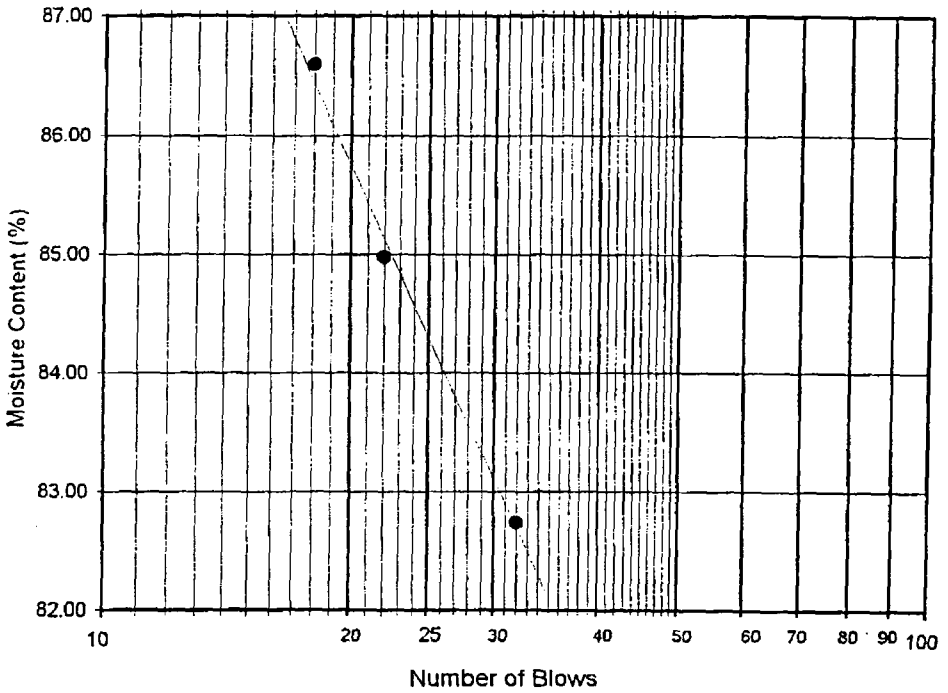
One - Point Liquid Limit Calculation

LL =Wn(N/25) $^{0.121}$



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



Teratest Labs, Inc.

ATTERBERG LIMITS

ASTM D 4318

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/04/02
Project No. :	37380 / CTO 0078	Input By:	RA	Date:	12/11/02
Sample ID:	LK196	Checked By:	LF	Date:	12/11/02
Exploration Location:	AA3-MW07	Depth (ft.)	36-36.5		

Visual Sample Description: Light yellow silt (ML)

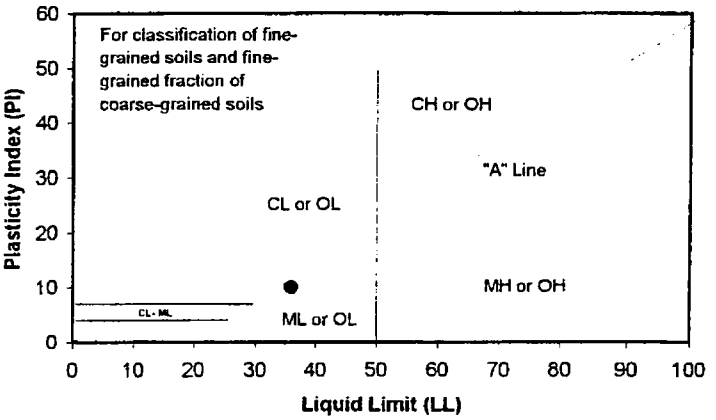
	PLASTIC LIMIT		LIQUID LIMIT			
TEST NO.	1	2	1	2	3	
Number of Blows [N]			31	23	16	
Wet Wt. of Soil + Cont. (gm)	9.36	8.66	16.96	17.77	19.86	
Dry Wt. of Soil + Cont. (gm)	7.67	7.09	12.84	13.34	14.72	
Wt. of Container (gm)	1.05	1.01	1.04	1.09	1.05	
Moisture Content (%) [Wn]	25.53	25.82	34.92	36.16	37.60	

Liquid Limit	**36**
Plastic Limit	**26**
Plasticity Index	**10**
USCS Classification	**ML**

PI at "A" - Line = 0.73(LL-20) = 11.68

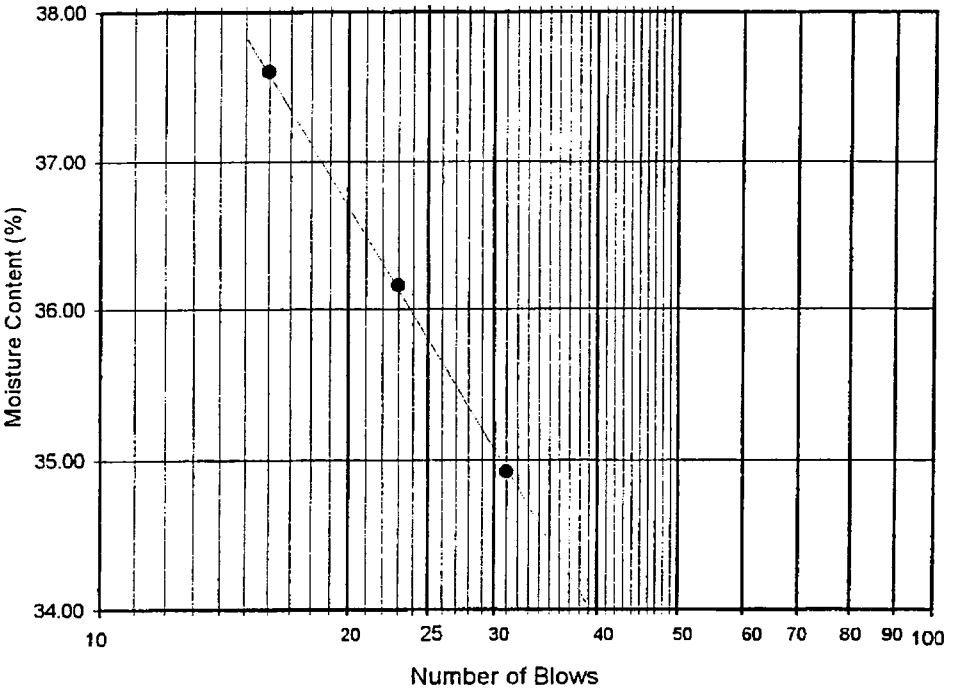
One - Point Liquid Limit Calculation

LL =Wn(N/25) $^{0.121}$



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



Teratest Labs, Inc.

ATTERBERG LIMITS

ASTM D 4318

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	RA	Date:	12/04/02
Project No. :	37380 / CTO 0078	Input By:	RA	Date:	12/11/02
Sample ID:	LK226	Checked By:	LF	Date:	12/11/02
Exploration Location:	AA3-MW10	Depth (ft.)	16-16.5		

Visual Sample Description: Olive clayey sand (SC)

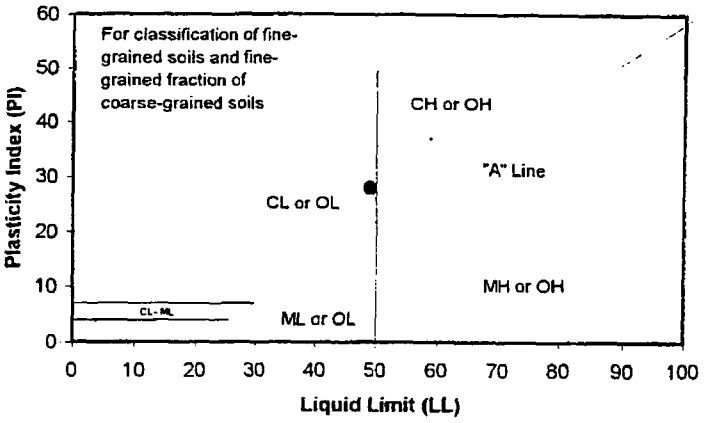
	PLASTIC LIMIT		LIQUID LIMIT			
TEST NO.	1	2	1	2	3	
Number of Blows [N]			35	27	22	
Wet Wt. of Soil + Cont. (gm)	13.59	14.56	15.34	18.11	17.09	
Dry Wt. of Soil + Cont. (gm)	11.40	12.20	10.74	12.51	11.73	
Wt. of Container (gm)	1.06	1.01	1.01	0.98	1.07	
Moisture Content (%) [Wn]	21.18	21.09	47.28	48.57	50.28	

Liquid Limit	**49**
Plastic Limit	**21**
Plasticity Index	**28**
USCS Classification	**CL**

PI at "A" - Line = 0.73(LL-20) = 21.17

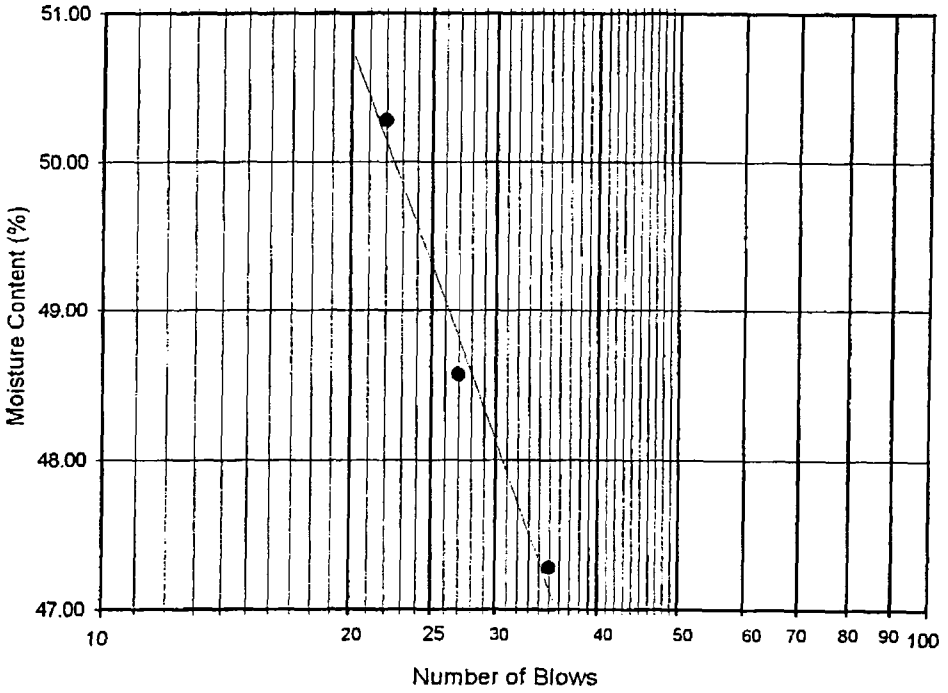
One - Point Liquid Limit Calculation

LL =Wn(N/25) $^{0.121}$



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



Sample ID	LK178	LK180	LK181	LK184	LK188	LK189	LK195	LK197
Exploration Location	AA3-MW05	AA3-MW05	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW06	AA3-MW07	AA3-MW07
Depth (ft.)	45-46.5	57-57.5	1.5-2.0	16-16.5	36-36.5	40-41.5	31-31.5	40.5-41
Sample Type	SPT	SPT	Drive	Drive	Drive	SPT	Drive	Drive
Visual Soil Classification	Olive elastic silt with sand (MH)s	Olive sandy lean clay s(CL)	Yellowish brown silty sand (SM)	Dark brown clayey sand (SC)	Pale yellow lean clay (CL)	Olive elastic silt (MH)	Brown silty sand (SM)	Pale Olive silty sand (SM)
Moisture Correction								
Wet Weight of Soil + Container (gm.)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dry Weight of Soil + Container (gm.)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weight of Container (gm)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Moisture Content (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Container No.:								
Sample Dry Weight Determination								
Weight of Sample + Container (gm.)	202.74	324.51	440.86	288.37	227.05	184.68	545.02	338.11
Weight of Container (gm.)	74.83	76.75	75.65	75.50	82.27	78.21	77.27	76.85
Weight of Dry Sample (gm.)	127.91	247.76	365.21	212.87	144.78	106.47	467.75	261.26
Container No.:								
After Wash								
Dry Weight of Sample + Container (gm)	93.97	156.88	333.18	193.47	103.20	88.19	440.32	248.26
Weight of Container (gm)	74.83	76.75	75.65	75.50	82.27	78.21	77.27	76.85
Dry Weight of Sample (gm)	19.14	80.13	257.53	117.97	20.93	9.98	363.05	171.41
% Passing No. 200 Sieve	**85.0**	**67.7**	**29.5**	**44.6**	**85.5**	**90.6**	**22.4**	**34.4**
% Retained No. 200 Sieve	15.0	32.3	70.5	55.4	14.5	9.4	77.6	65.6

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

PERCENT PASSING No. 200 SIEVE
ASTM D 1140

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Project No.: 37380 / CTO 0078
Client Name: Earth Tech, Inc.
Tested By: RA Date: 12/03/02

Sample ID	LK201	LK210	LK226	LK230				
Exploration Location	AA3-MW08	AA3-MW09	AA3-MW10	AA3-MW10				
Depth (ft.)	6-6.5	21-21.5	16-16.5	36-36.5				
Sample Type	Drive	Drive	Drive	Drive				
Visual Soil Classification	Brown sandy lean clay s(CL)	Brown silty sand (SM)	Olive clayey sand (SC)	Brown clayey sand (SC)				
Moisture Correction								
Wet Weight of Soil + Container (gm.)	0.00	0.00	0.00	0.00				
Dry Weight of Soil + Container (gm.)	0.00	0.00	0.00	0.00				
Weight of Container (gm)	1.00	1.00	1.00	1.00				
Moisture Content (%)	0.00	0.00	0.00	0.00				
Container No.:								
Sample Dry Weight Determination								
Weight of Sample + Container (gm.)	345.76	425.26	435.47	589.80				
Weight of Container (gm.)	75.20	76.81	82.29	75.34				
Weight of Dry Sample (gm.)	270.56	348.45	353.18	514.46				
Container No.:								
After Wash								
Dry Weight of Sample + Container (gm)	196.81	301.77	288.72	431.16				
Weight of Container (gm)	75.20	76.81	82.29	75.34				
Dry Weight of Sample (gm)	121.61	224.96	206.43	355.82				
% Passing No. 200 Sieve	**55.1**	**35.4**	**41.6**	**30.8**				
% Retained No. 200 Sieve	44.9	64.6	58.4	69.2				

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

PERCENT PASSING No. 200 SIEVE

ASTM D 1140

Project Name: Anomaly Area 3, Former MCAS El Toro, CA
Project No.: 37380 / CTO 0078
Client Name: Earth Tech, Inc.
Tested By: RA Date: 12/03/02

- 200 LK201 - LK230.xls

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/09/02
Sample ID:	LK169	Depth (ft.):	2-2.5		
Exploration Location:	AA3-MW05				

Visual Sample Description: Brown poorly graded sand (SP)

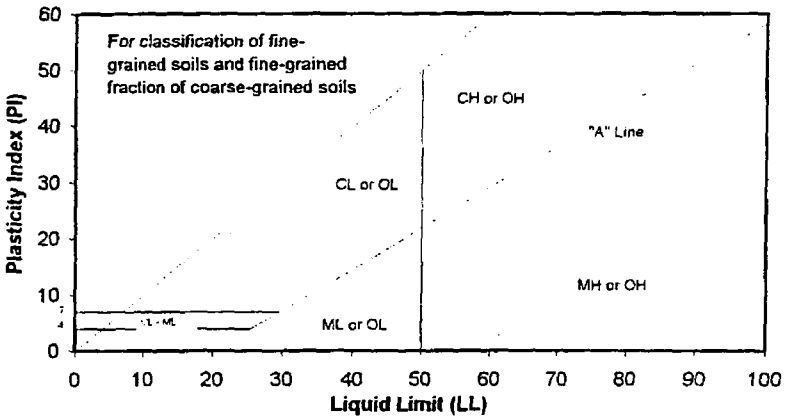
		Moisture Content of Total Air - Dry Soil	
Container No.:	RX-22	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	601.60	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	75.15	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	526.45	Moisture Content (%)	0.00

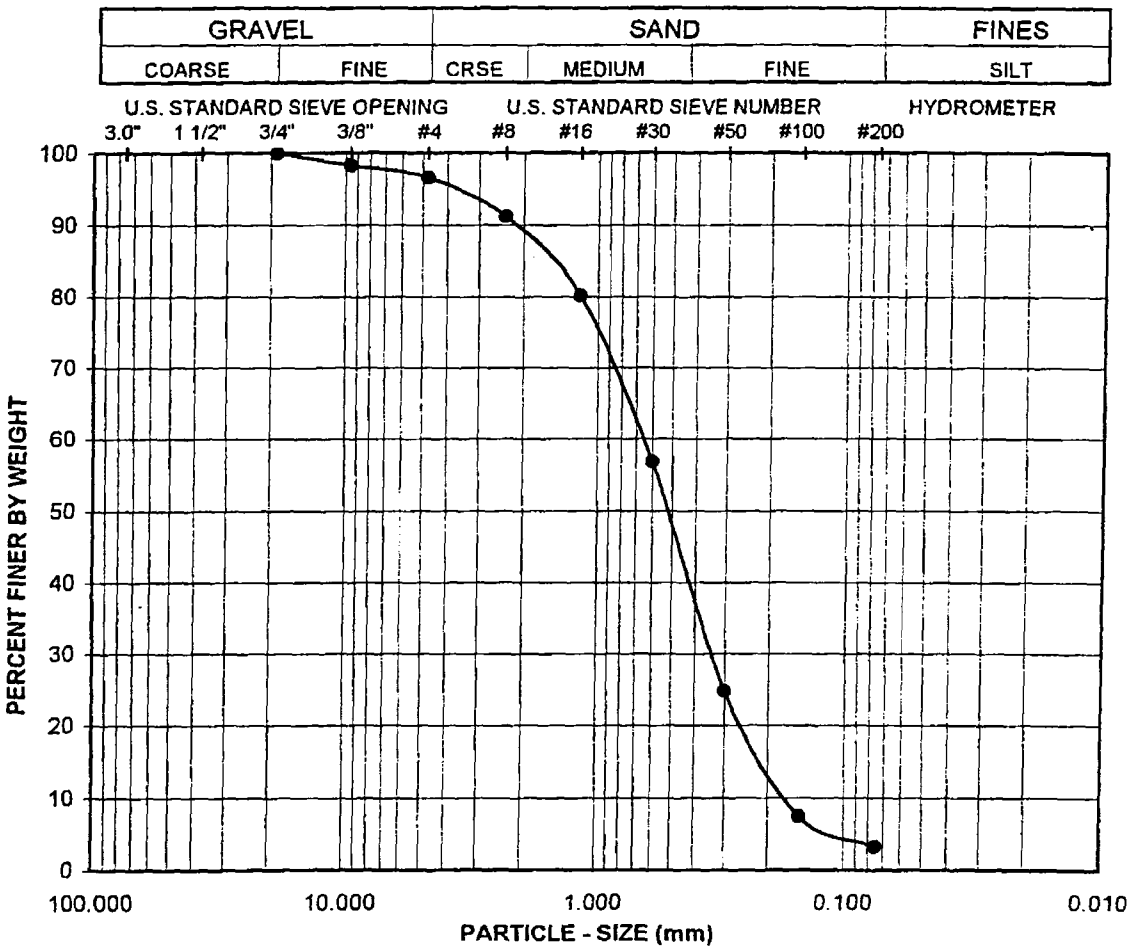
After Wet Sieve	Container No.	RX-22
	Wt. of Dry Soil + Container (gm.)	584.90
	Wt. of Container (gm.)	75.15
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	509.75

U. S. Sieve Size (in.)	(mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	9.04	98.3
#4	4.750	18.09	96.6
#8	2.360	46.25	91.2
#16	1.180	104.79	80.1
#30	0.600	227.56	56.8
#50	0.300	395.82	24.8
#100	0.150	487.32	7.4
#200	0.075	509.62	3.2
PAN			

GRAVEL:	3 %	Liquid Limit:	
SAND:	94 %	Plastic Limit	
FINES:	3 %	Plasticity Index:	
GRP. SYMBOL:	SP	Cu = D60/D10 =	3.76
		Cc = (D30)²/(D60*D10) =	1.06

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK169	AA3-MW05	2-2.5	SP	3 : 94 : 3	, N/A,

Visual Sample Description:
Brown poorly graded sand (SP)

Project No.: 37380 / CTO 0078
Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE
ASTM D 4318, D 422

12-02

SA LK169.xls

Teratest Labs, Inc.

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/09/02
Sample ID:	LK171	Depth (ft.):	10.5-11		
Exploration Location:	AA3-MW05				

Visual Sample Description: Light brown silty sand (SM)

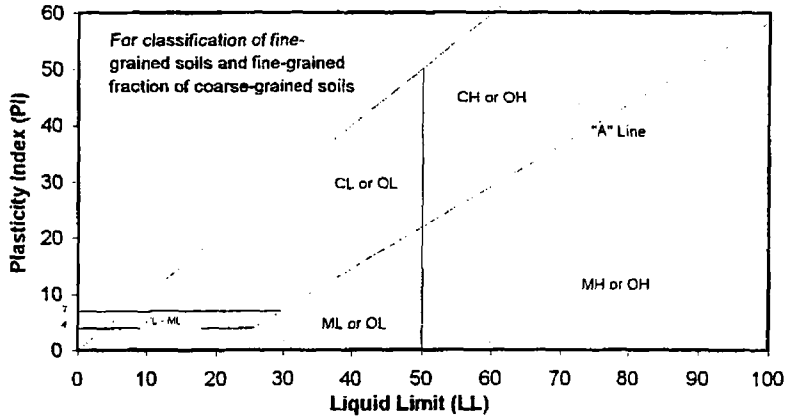
		Moisture Content of Total Air - Dry Soil	
Container No.:	521	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	616.60	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	75.77	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	540.83	Moisture Content (%)	0.00

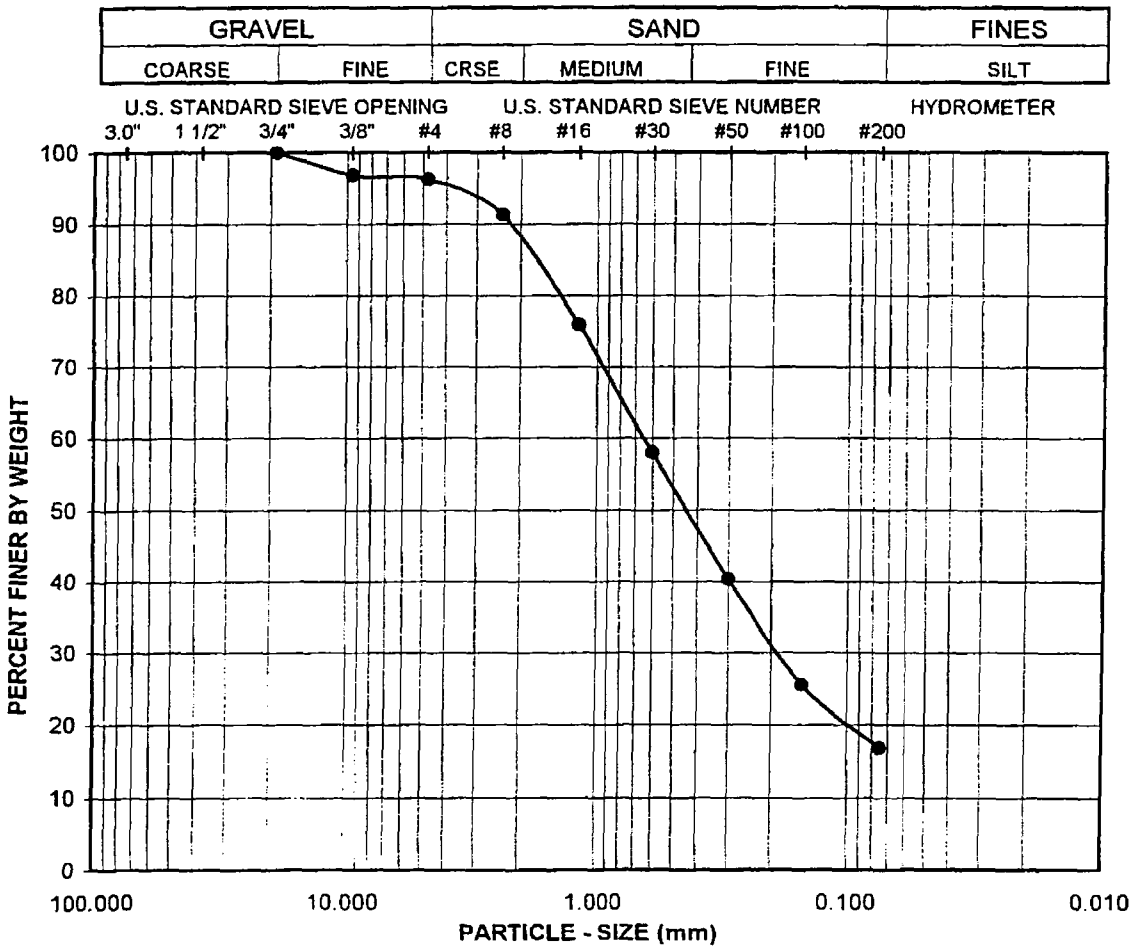
After Wet Sieve	Container No.	521
	Wt. of Dry Soil + Container (gm.)	527.90
	Wt. of Container (gm.)	75.77
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	452.13

U. S. Sieve Size (in.)	(mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	16.69	96.9
#4	4.750	19.99	96.3
#8	2.360	47.18	91.3
#16	1.180	131.12	75.8
#30	0.600	226.99	58.0
#50	0.300	322.66	40.3
#100	0.150	403.01	25.5
#200	0.075	450.05	16.8
PAN			

GRAVEL:	4 %	Liquid Limit:	
SAND:	79 %	Plastic Limit	
FINES:	17 %	Plasticity Index:	
GRP. SYMBOL:	SM	Cu = D60/D10 =	
		Cc = $(D30)^2/(D60*D10)$ =	

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK171	AA3-MW05	10.5-11	SM	4 : 79 : 17	, N/A,

Visual Sample Description:
Light brown silty sand (SM)

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

12-02

SA LK171.xls

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/09/02
Sample ID:	LK172	Depth (ft.):	15.5-16		
Exploration Location:	AA3-MW05				

Visual Sample Description: Light brown poorly graded sand with silt (SP-SM)

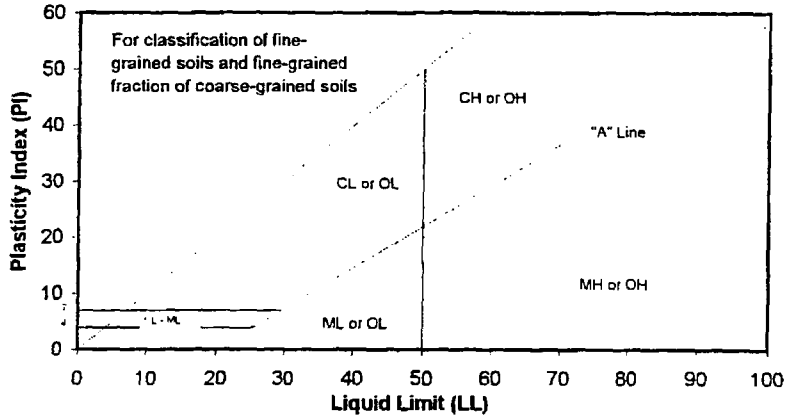
		Moisture Content of Total Air - Dry Soil	
Container No.:	741	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	573.80	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	76.77	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	497.03	Moisture Content (%)	0.00

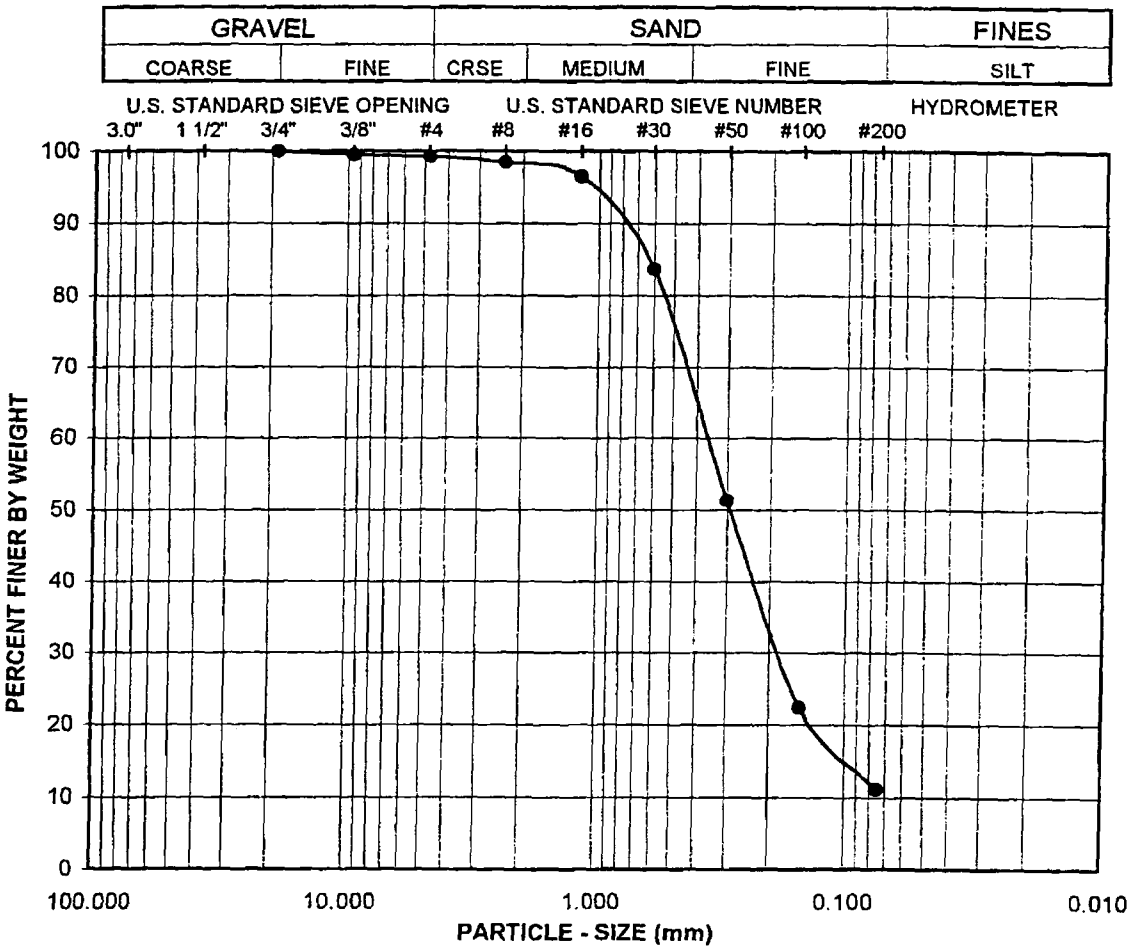
After Wet Sieve	Container No.	741
	Wt. of Dry Soil + Container (gm.)	520.89
	Wt. of Container (gm.)	76.77
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	444.12

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	2.50	99.5
#4	4.750	4.09	99.2
#8	2.360	7.25	98.5
#16	1.180	17.61	96.5
#30	0.600	81.06	83.7
#50	0.300	242.51	51.2
#100	0.150	385.49	22.4
#200	0.075	441.93	11.1
PAN			

GRAVEL:	1 %	Liquid Limit:	
SAND:	88 %	Plastic Limit	
FINES:	11 %	Plasticity Index:	
GRP. SYMBOL:	SP-SM	Cu = D60/D10 =	5.38
		Cc = (D30)²/(D60*D10) =	1.59

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK172	AA3-MW05	15.5-16	SP-SM	1 : 88 : 11	, N/A,

Visual Sample Description:
Light brown poorly graded sand with silt (SP-SM)

Project No.: 37380 / CTO 0078
Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE
ASTM D 4318, D 422

12-02

SA LK172.xls

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/09/02
Sample ID:	LK174	Depth (ft.):	25.5-26		
Exploration Location:	AA3-MW05				

Visual Sample Description: Light brown silty sand with gravel (SM)g

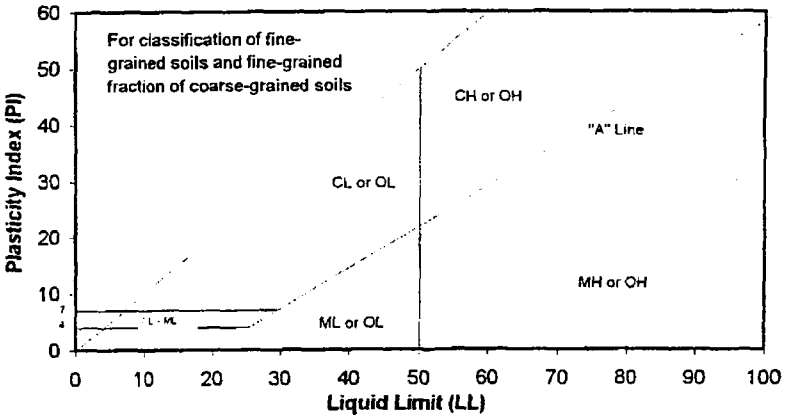
		Moisture Content of Total Air - Dry Soil	
Container No.:	722	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	918.60	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	79.15	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	839.45	Moisture Content (%)	0.00

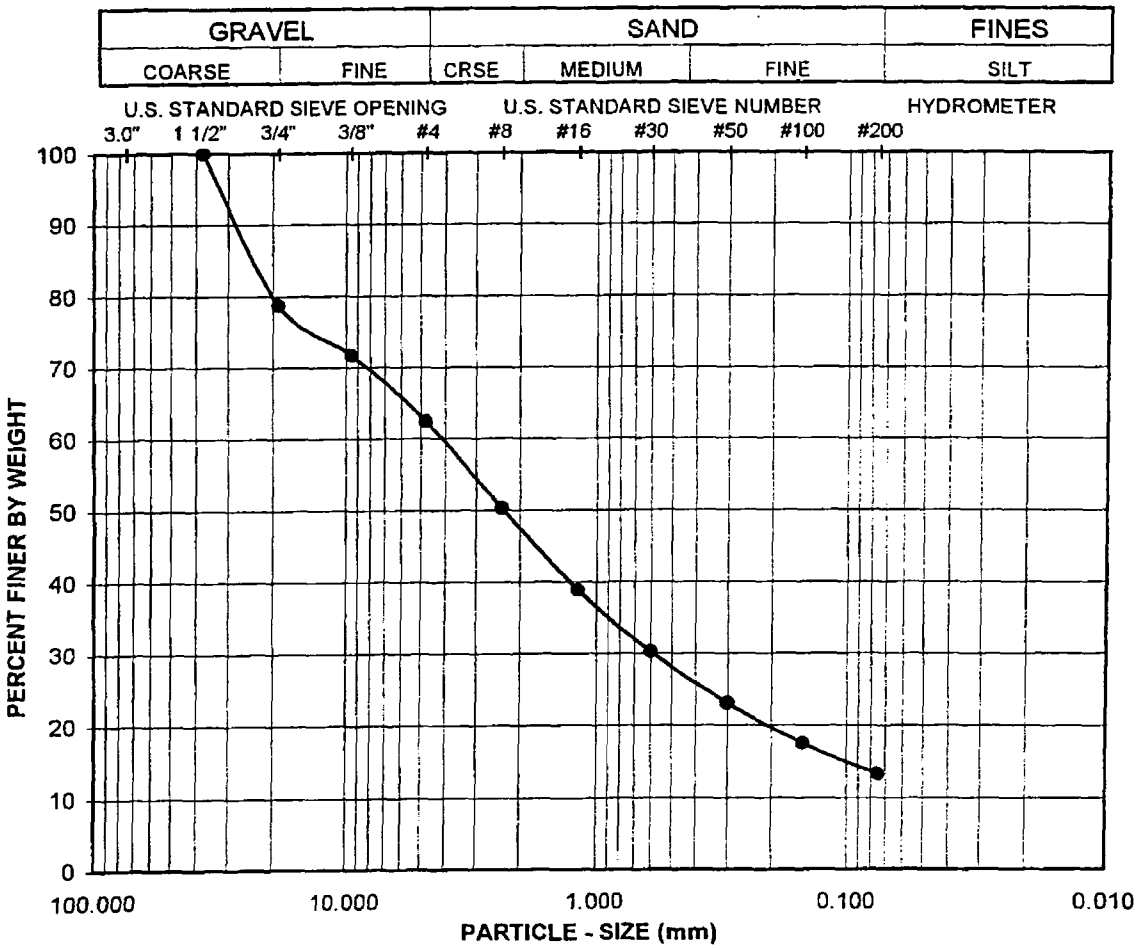
After Wet Sieve	Container No.	722
	Wt. of Dry Soil + Container (gm.)	810.20
	Wt. of Container (gm.)	79.15
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	731.05

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	100.0
3/4"	19.000	178.90	78.7
3/8"	9.500	237.15	71.7
#4	4.750	315.91	62.4
#8	2.360	418.26	50.2
#16	1.180	514.10	38.8
#30	0.600	585.40	30.3
#50	0.300	645.90	23.1
#100	0.150	692.80	17.5
#200	0.075	728.10	13.3
PAN			

GRAVEL:	38 %	Liquid Limit:	
SAND:	49 %	Plastic Limit	
FINES:	13 %	Plasticity Index:	
GRP. SYMBOL:	(SM)g	Cu = D60/D10 =	
		Cc = (D30)²/(D60*D10) =	

Remarks: Insufficient sample mass available to meet the ASTM specification for this material





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK174	AA3-MW05	25.5-26	(SM)g	38 : 49 : 13	, N/A,

Visual Sample Description:
Light brown silty sand with gravel (SM)g

Project No.: 37380 / CTO 0078
Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE
ASTM D 4318, D 422

12-02

SA LK174.xls

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/09/02
Sample ID:	LK177	Depth (ft.):	40-41.5		
Exploration Location:	AA3-MW05				

Visual Sample Description: Olive sandy lean clay s(CL)

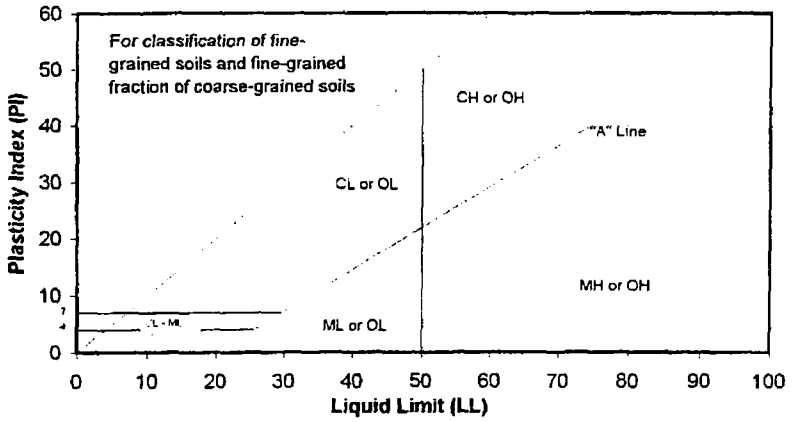
		Moisture Content of Total Air - Dry Soil	
Container No.:	772	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	333.83	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	75.80	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	258.03	Moisture Content (%)	0.00

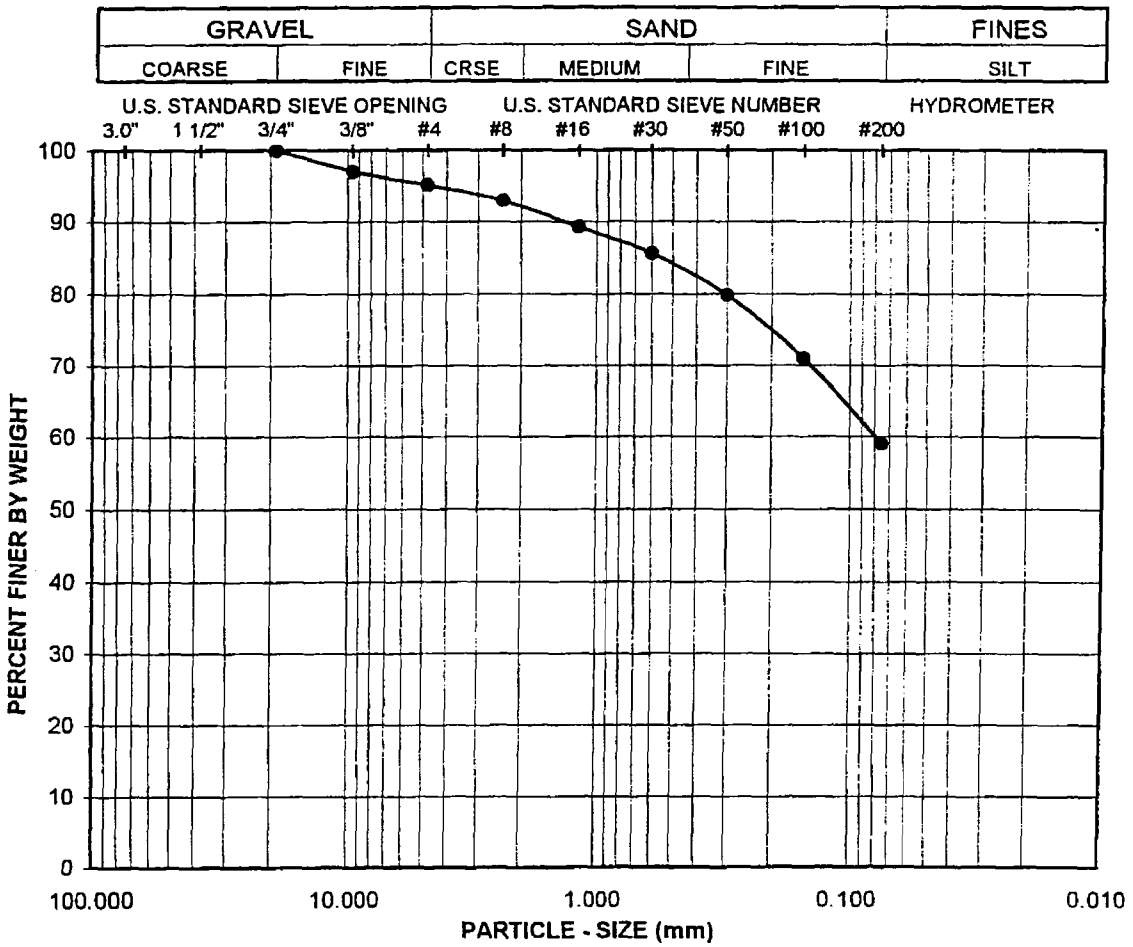
After Wet Sieve	Container No.	772
	Wt. of Dry Soil + Container (gm.)	183.20
	Wt. of Container (gm.)	75.80
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	107.40

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	7.63	97.0
#4	4.750	12.44	95.2
#8	2.360	18.16	93.0
#16	1.180	27.53	89.3
#30	0.600	37.15	85.6
#50	0.300	52.23	79.8
#100	0.150	75.21	70.9
#200	0.075	105.67	59.0
PAN			

GRAVEL:	5 %	Liquid Limit:	
SAND:	36 %	Plastic Limit	
FINES:	59 %	Plasticity Index:	
GRP. SYMBOL:	s(CL)	Cu = D60/D10 =	
		Cc = $(D30)^2/(D60*D10)$ =	

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK177	AA3-MW05	40-41.5	s(CL)	5 : 36 : 59	,N/A,

Visual Sample Description:
Olive sandy lean clay s(CL)

Project No.: 37380 / CTO 0078
Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE
ASTM D 4318, D 422

12-02

SA LK177.xls

Teratest Labs, Inc.

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/09/02
Sample ID:	LK185	Depth (ft.):	21-21.5		
Exploration Location:	AA3-MW06				

Visual Sample Description: Olive sandy silt s(ML)

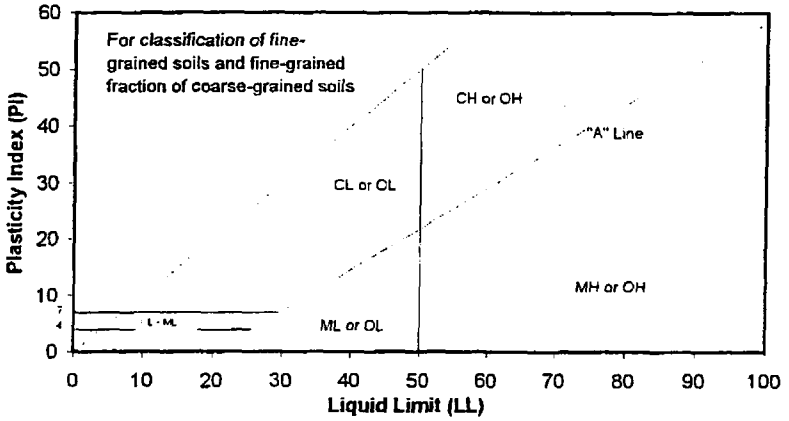
		Moisture Content of Total Air - Dry Soil	
Container No.:	742	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	419.05	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	79.15	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	339.90	Moisture Content (%)	0.00

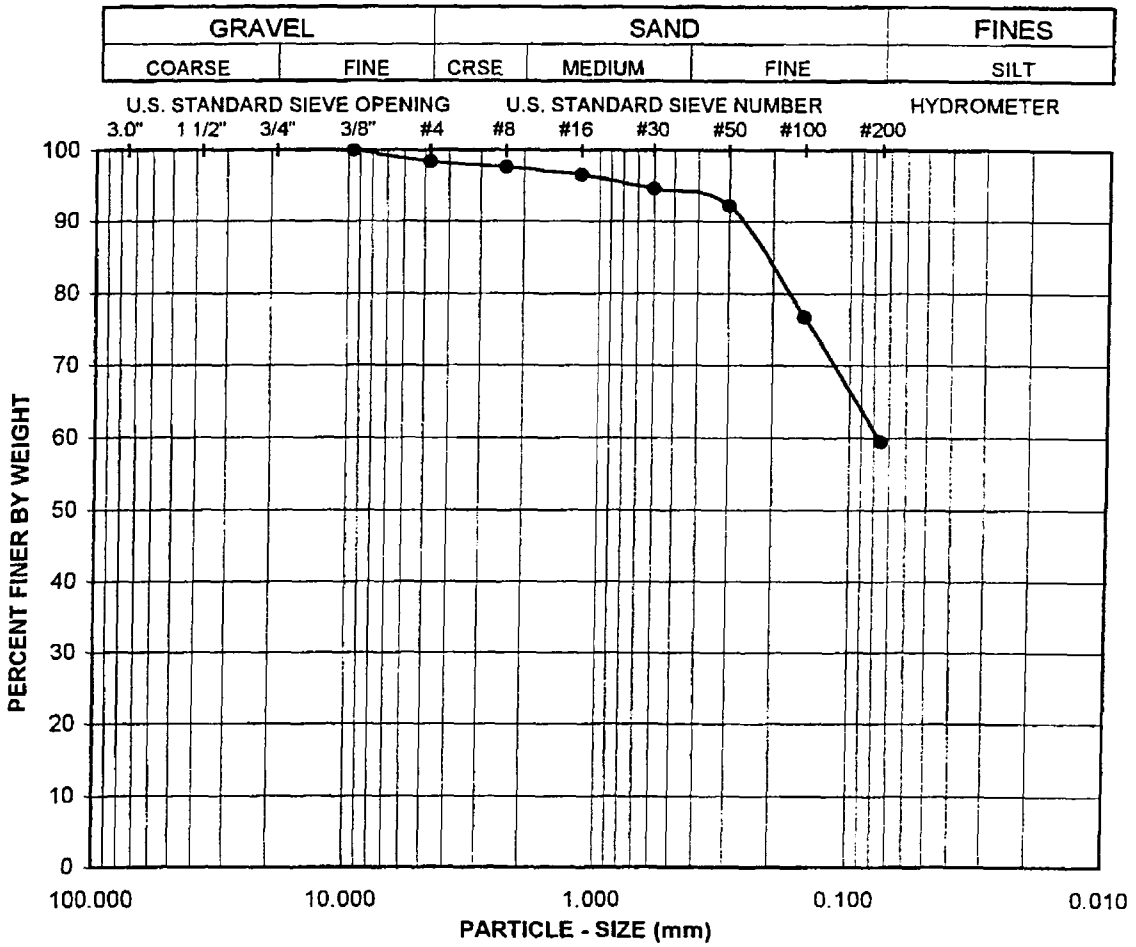
After Wet Sieve	Container No.	742
	Wt. of Dry Soil + Container (gm.)	218.76
	Wt. of Container (gm.)	79.15
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	139.61

U. S. Sieve Size (in.)	(mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	5.60	98.4
#8	2.360	8.25	97.6
#16	1.180	11.81	96.5
#30	0.600	18.25	94.6
#50	0.300	26.65	92.2
#100	0.150	79.31	76.7
#200	0.075	138.10	59.4
PAN			

GRAVEL:	2 %	Liquid Limit:	
SAND:	39 %	Plastic Limit	
FINES:	59 %	Plasticity Index:	
GRP. SYMBOL:	s(ML)	Cu = D60/D10 =	
		Cc = $(D30)^2/(D60*D10)$ =	

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK185	AA3-MW06	21-21.5	s(ML)	2 : 39 : 59	, N/A,

Visual Sample Description:
Olive sandy silt s(ML)

Terrasat Labs, Inc.

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

12-02

SA LK185.xls

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Teratest Labs, Inc.

A LEIGHTON GROUP COMPANY

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/09/02
Sample ID:	LK187	Depth (ft.):	31-31.5		
Exploration Location:	AA3-MW06				

Visual Sample Description: Brown well-graded sand with silt and gravel (SW-SM)g

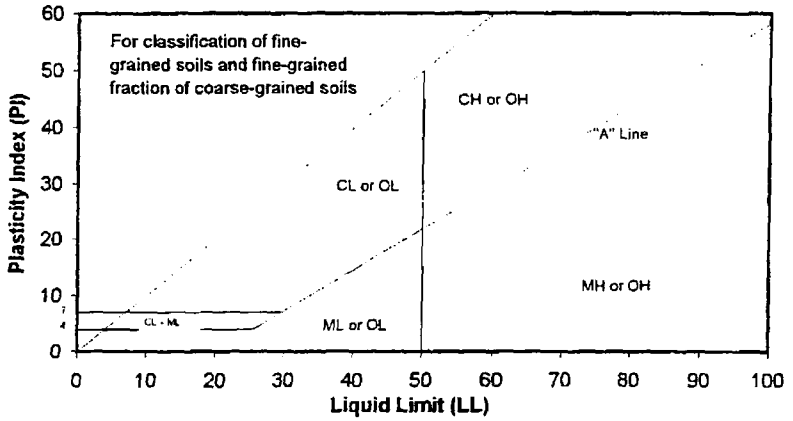
		Moisture Content of Total Air - Dry Soil	
Container No.:	C108	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	881.18	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	74.26	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	806.92	Moisture Content (%)	0.00

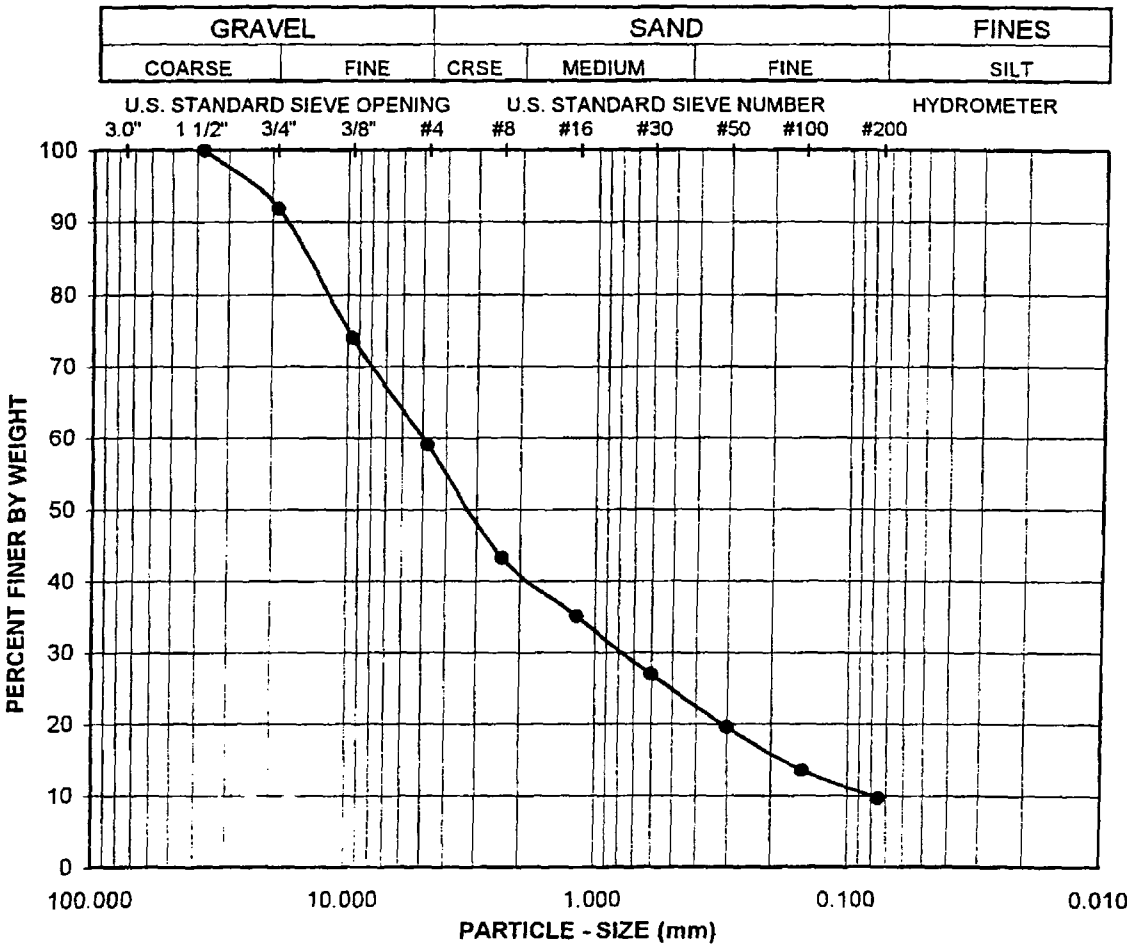
After Wet Sieve	Container No.	C108
	Wt. of Dry Soil + Container (gm.)	806.30
	Wt. of Container (gm.)	74.26
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	732.04

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	100.0
3/4"	19.000	65.17	91.9
3/8"	9.500	209.60	74.0
#4	4.750	330.69	59.0
#8	2.360	457.98	43.2
#16	1.180	523.49	35.1
#30	0.600	589.32	27.0
#50	0.300	649.54	19.5
#100	0.150	697.92	13.5
#200	0.075	729.46	9.6
PAN			

GRAVEL:	**41 %**	Liquid Limit:	
SAND:	**49 %**	Plastic Limit	
FINES:	**10 %**	Plasticity Index:	
GRP. SYMBOL:	**(SW-SM)g**	Cu = D60/D10 =	66.67
		Cc = $(D30)^2/(D60*D10)$ =	1.50

Remarks: Insufficient sample mass available to meet the ASTM specification for this material





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK187	AA3-MW06	31-31.5	(SW-SM)g	41 : 49 : 10	, N/A,

Visual Sample Description:
Brown well-graded sand with silt and gravel (SW-SM)g

Terrasat Labs, Inc.

Project No.: 37380 / CTO 0078
Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE
ASTM D 4318, D 422

12-02

SA LK187.xls

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/09/02
Sample ID:	LK191	Depth (ft.):	6-6.5		
Exploration Location:	AA3-MW07				

Visual Sample Description: Reddish brown well-graded sand with silt (SW-SM)

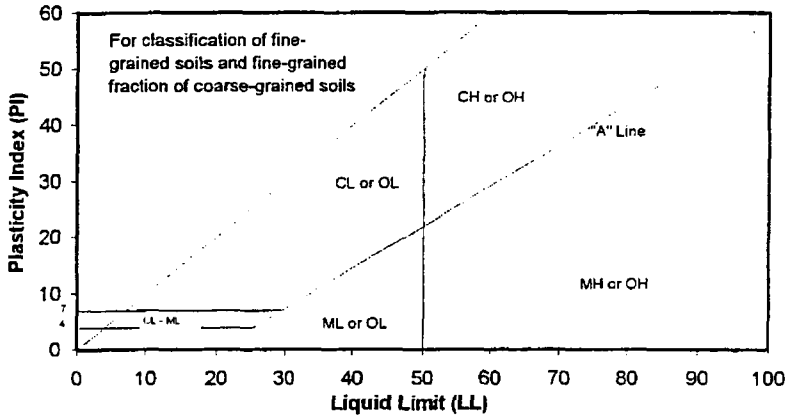
		Moisture Content of Total Air - Dry Soil	
Container No.:	798	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	523.09	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	76.04	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	447.05	Moisture Content (%)	0.00

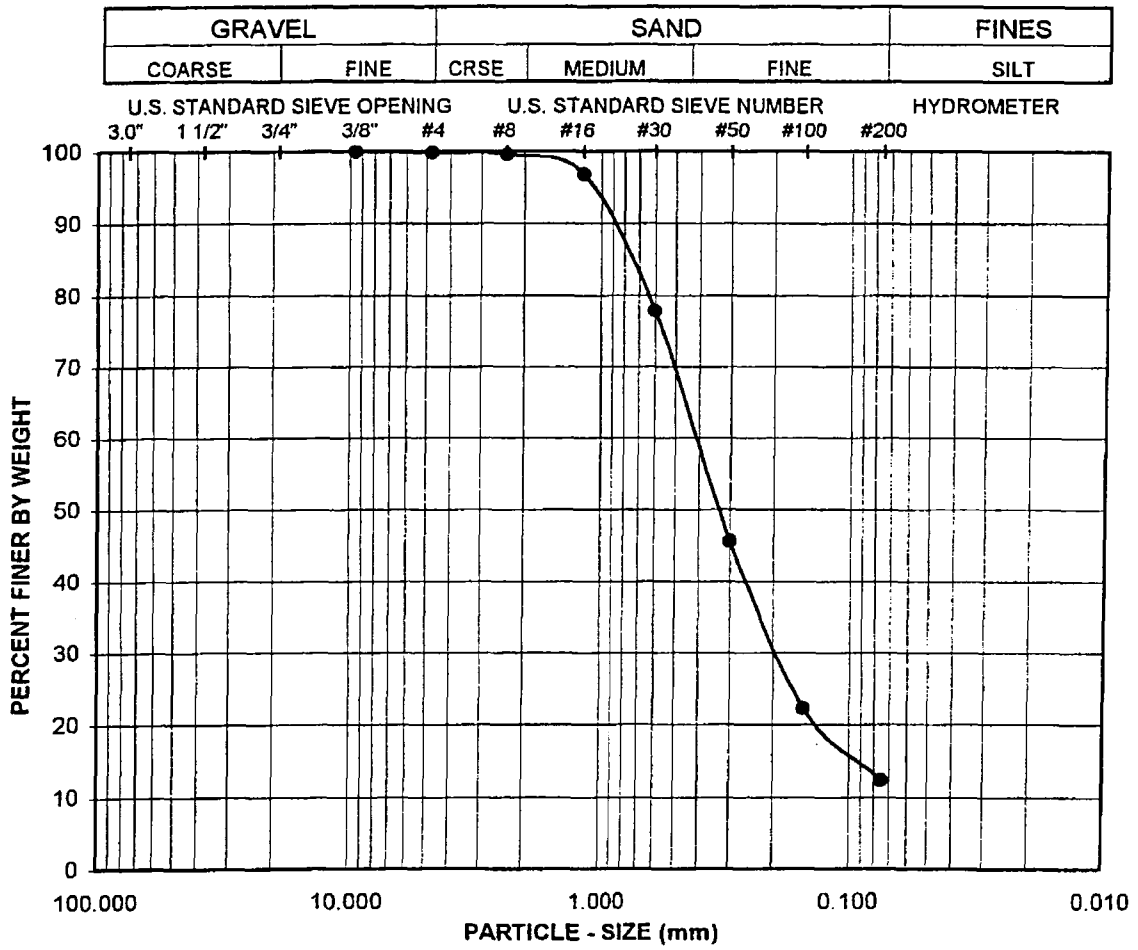
After Wet Sieve	Container No.	798
	Wt. of Dry Soil + Container (gm.)	469.99
	Wt. of Container (gm.)	76.04
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	393.95

U. S. Sieve Size (in.)	(mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	0.76	99.8
#8	2.360	1.72	99.6
#16	1.180	14.16	96.8
#30	0.600	99.37	77.8
#50	0.300	243.34	45.6
#100	0.150	347.64	22.2
#200	0.075	391.90	12.3
PAN			

GRAVEL:	0 %	Liquid Limit:	
SAND:	88 %	Plastic Limit	
FINES:	12 %	Plasticity Index:	
GRP. SYMBOL:	SW-SM	Cu = D60/D10 =	6.83
		Cc = $(D30)^2/(D60*D10)$ =	1.63

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK191	AA3-MW07	6-6.5	SW-SM	0 : 88 : 12	, N/A,

Visual Sample Description:
Reddish brown well-graded sand with silt (SW-SM)

Transient Labs, Inc.

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

12-02

SA LK191.xls

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/09/02
Sample ID:	LK193	Depth (ft.):	15.5-16		
Exploration Location:	AA3-MW07				

Visual Sample Description: Pale brown poorly graded sand with silt (SP-SM)

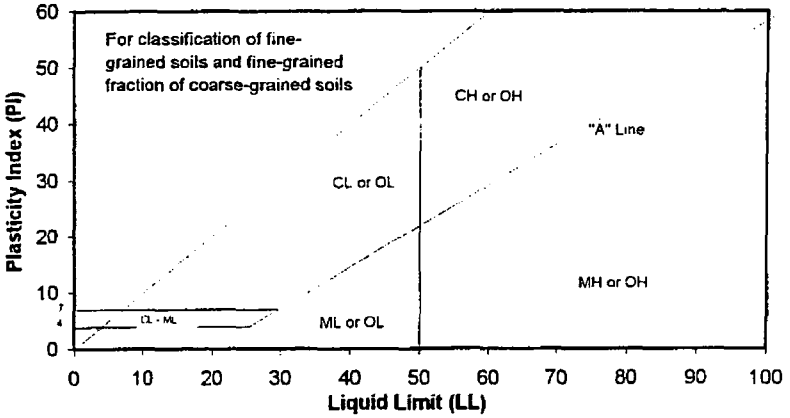
		Moisture Content of Total Air - Dry Soil	
Container No.:	757	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	485.32	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	76.06	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	409.26	Moisture Content (%)	0.00

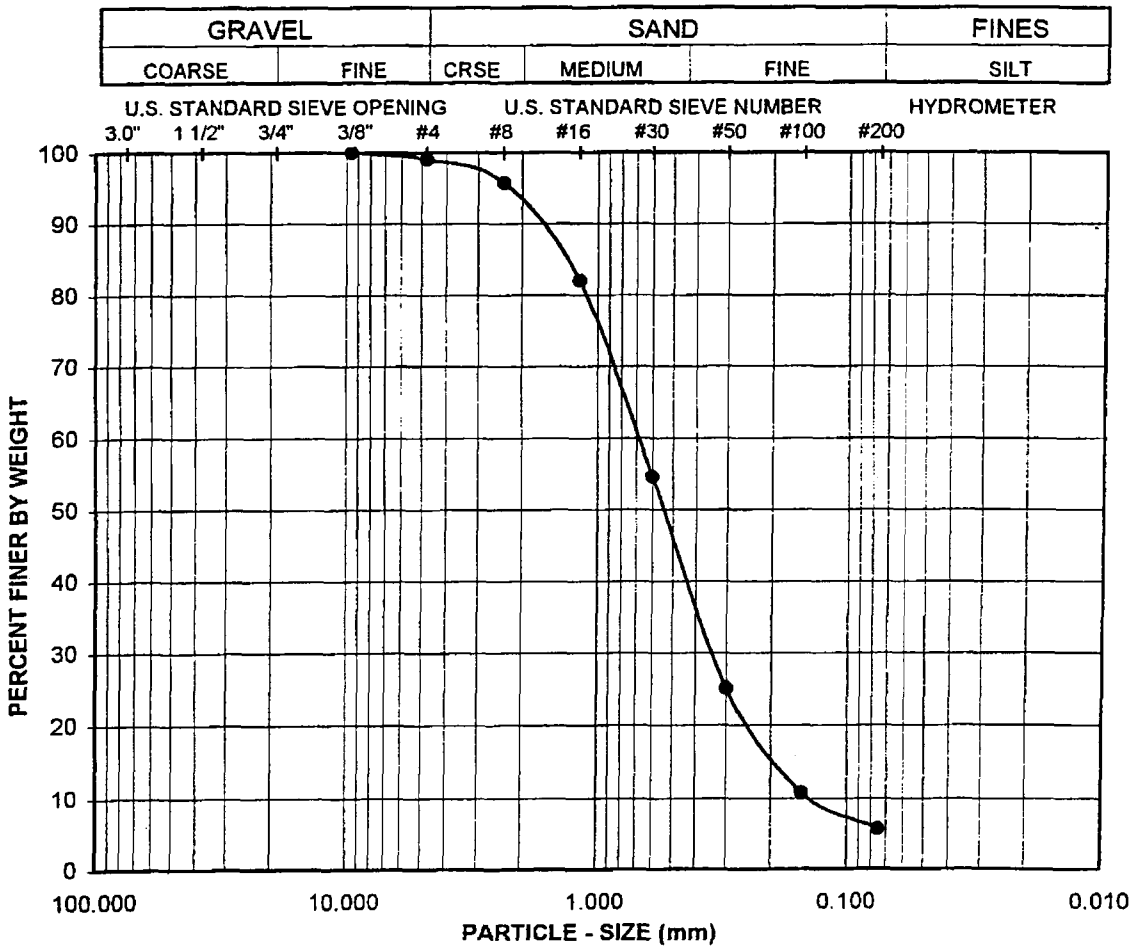
After Wet Sieve	Container No.	757
	Wt. of Dry Soil + Container (gm.)	462.85
	Wt. of Container (gm.)	76.06
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	386.79

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	3.56	99.1
#8	2.360	17.09	95.8
#16	1.180	73.59	82.0
#30	0.600	186.40	54.5
#50	0.300	306.68	25.1
#100	0.150	365.61	10.7
#200	0.075	386.04	5.7
PAN			

GRAVEL:	1 %	Liquid Limit:	
SAND:	93 %	Plastic Limit	
FINES:	6 %	Plasticity Index:	
GRP. SYMBOL:	SP-SM	Cu = D60/D10 =	4.69
		Cc = $(D30)^2/(D60*D10)$ =	1.21

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK193	AA3-MW07	15.5-16	SP-SM	1 : 93 : 6	, N/A,

Visual Sample Description:
Pale brown poorly graded sand with silt (SP-SM)

Project No.: 37380 / CTO 0078
Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE
ASTM D 4318, D 422

12-02

SA LK193.xls

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/09/02
Sample ID:	LK194	Depth (ft.):	25-25.5		
Exploration Location:	AA3-MW07				

Visual Sample Description: Pale brown well-graded sand with silt and gravel (SW-SM)g

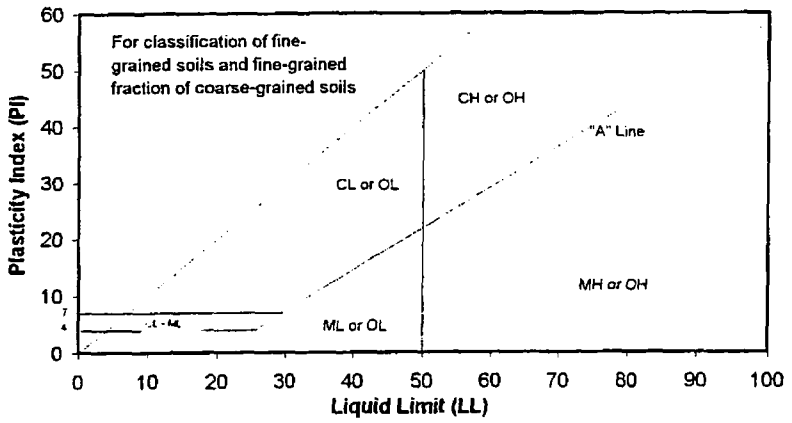
		Moisture Content of Total Air - Dry Soil	
Container No.:	780	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	627.18	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	75.63	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	551.55	Moisture Content (%)	0.00

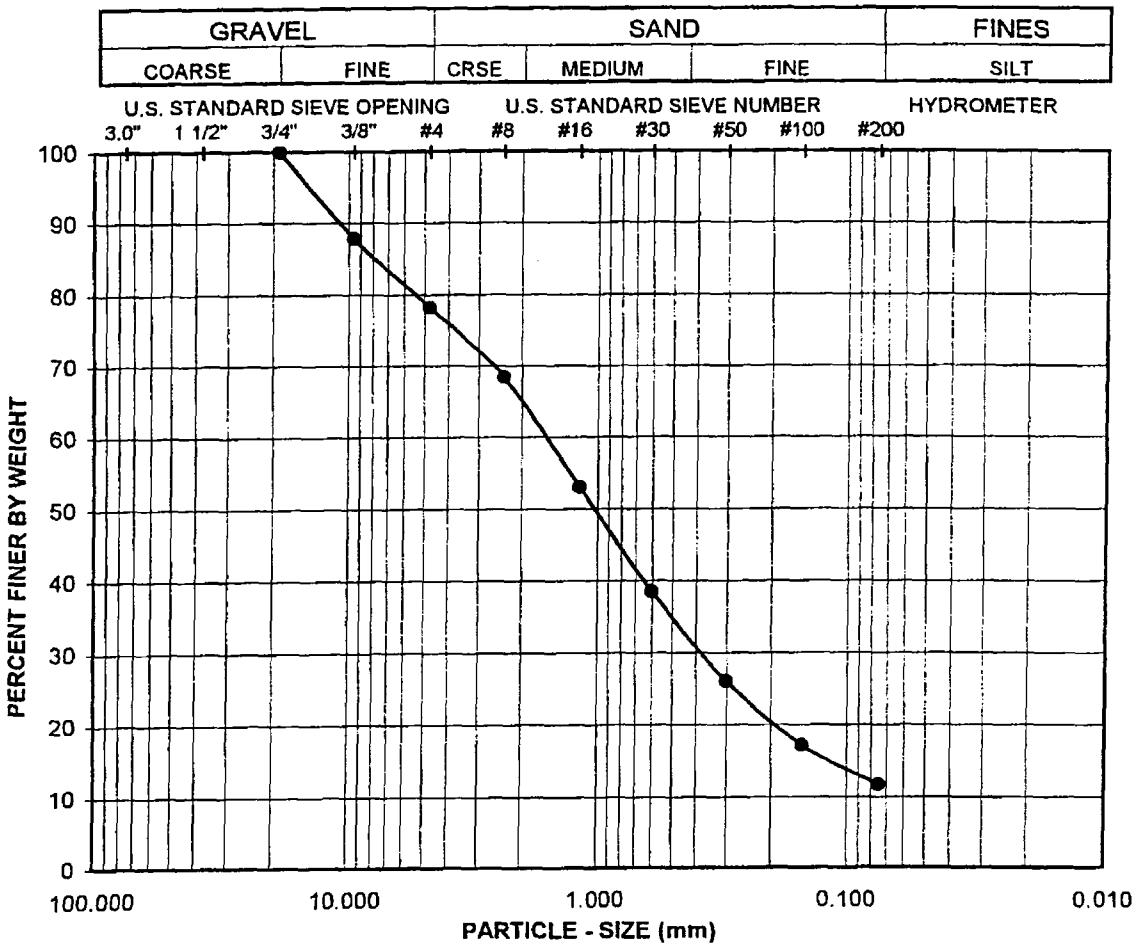
After Wet Sieve	Container No.	780
	Wt. of Dry Soil + Container (gm.)	564.70
	Wt. of Container (gm.)	75.63
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	489.07

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	67.47	87.8
#4	4.750	120.20	78.2
#8	2.360	174.54	68.4
#16	1.180	259.38	53.0
#30	0.600	339.30	38.5
#50	0.300	408.31	26.0
#100	0.150	456.59	17.2
#200	0.075	487.06	11.7
PAN			

GRAVEL:	**22 %**	Liquid Limit:	
SAND:	**66 %**	Plastic Limit	
FINES:	**12 %**	Plasticity Index:	
GRP. SYMBOL:	**(SW-SM)g**	Cu = D60/D10 =	32.00
		Cc = $(D30)^2/(D60*D10)$ =	1.81

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK194	AA3-MW07	25-25.5	(SW-SM)g	22 : 66 : 12	,N/A,

Visual Sample Description:
Pale brown well-graded sand with silt and gravel (SW-SM)g

Project No.: 37380 / CTO 0078
Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE
ASTM D 4318, D 422

12-02

SA LK194.xls

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Teralast Labs, Inc.

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/09/02
Sample ID:	LK199	Depth (ft.):	50-50.5		
Exploration Location:	AA3-MW07				

Visual Sample Description: Pale yellow silty sand (SM)

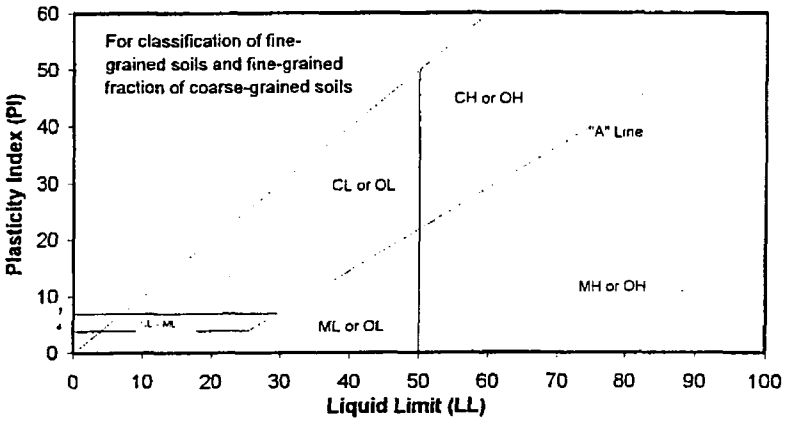
		Moisture Content of Total Air - Dry Soil	
Container No.:	533	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	393.31	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	77.02	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	316.29	Moisture Content (%)	0.00

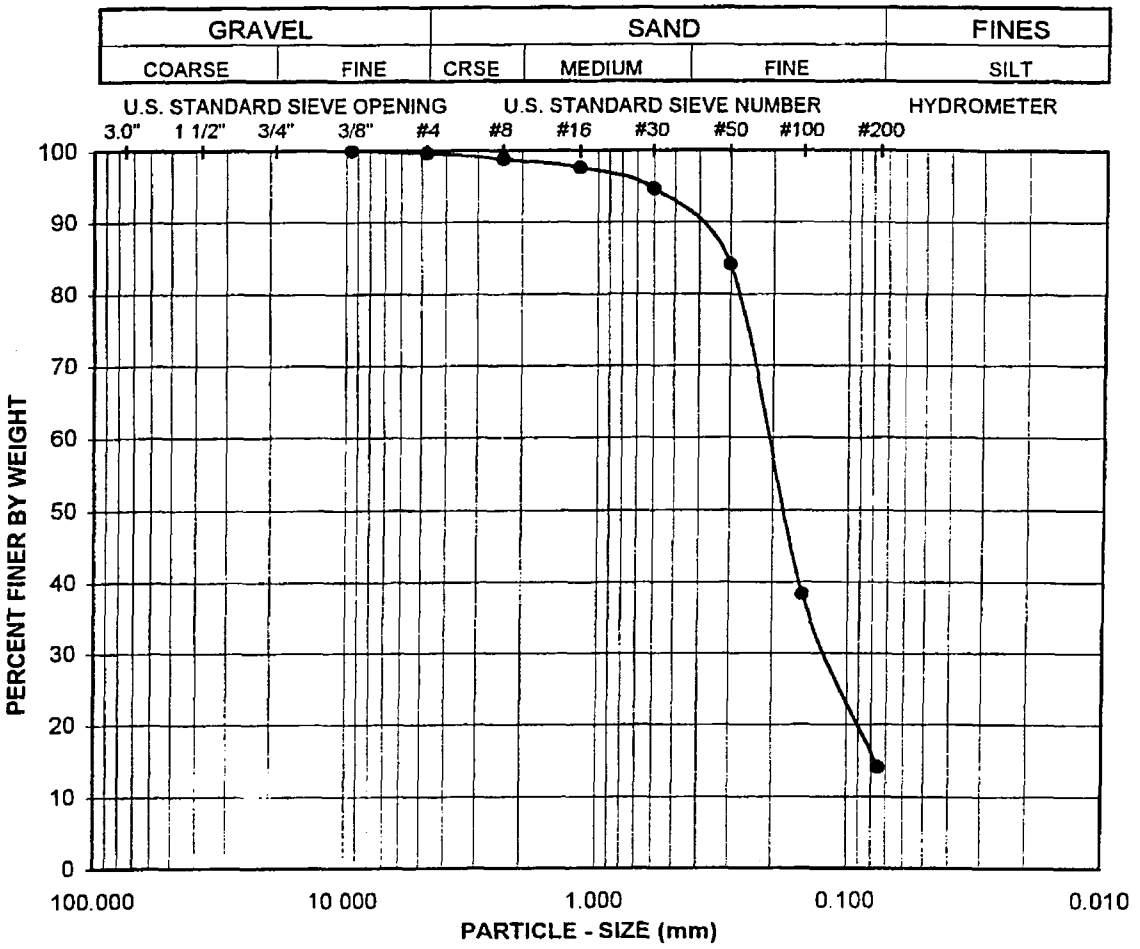
After Wet Sieve	Container No.	533
	Wt. of Dry Soil + Container (gm.)	351.49
	Wt. of Container (gm.)	77.02
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	274.47

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	0.84	99.7
#8	2.360	3.75	98.8
#16	1.180	7.69	97.6
#30	0.600	16.90	94.7
#50	0.300	50.26	84.1
#100	0.150	195.12	38.3
#200	0.075	272.15	14.0
PAN			

GRAVEL:	0 %	Liquid Limit:	
SAND:	86 %	Plastic Limit	
FINES:	14 %	Plasticity Index:	
GRP. SYMBOL:	SM	Cu = D60/D10 =	
		Cc = $(D30)^2/(D60*D10)$ =	

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK199	AA3-MW07	50-50.5	SM	0 : 86 : 14	N/A

Visual Sample Description:
Pale yellow silty sand (SM)

Terraphase Labs, Inc.

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

12-02

SA LK199.xls

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/09/02
Sample ID:	LK202	Depth (ft.):	11-11.5		
Exploration Location:	AA3-MW08				

Visual Sample Description: Brown silt with sand (ML)s

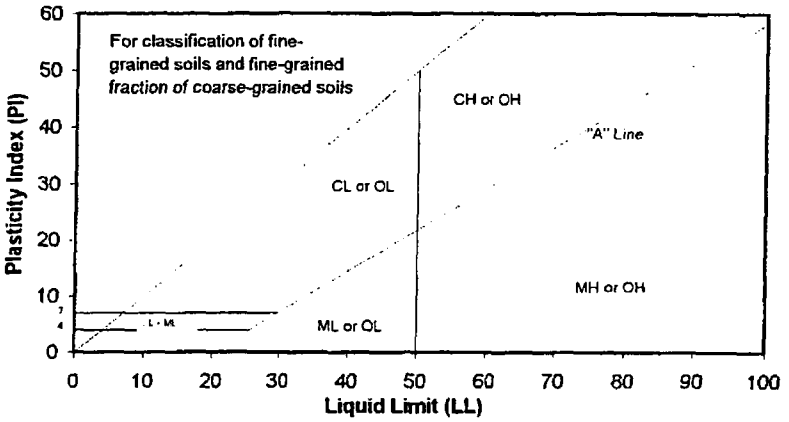
		Moisture Content of Total Air - Dry Soil	
Container No.:	549	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	319.13	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	77.62	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	241.51	Moisture Content (%)	0.00

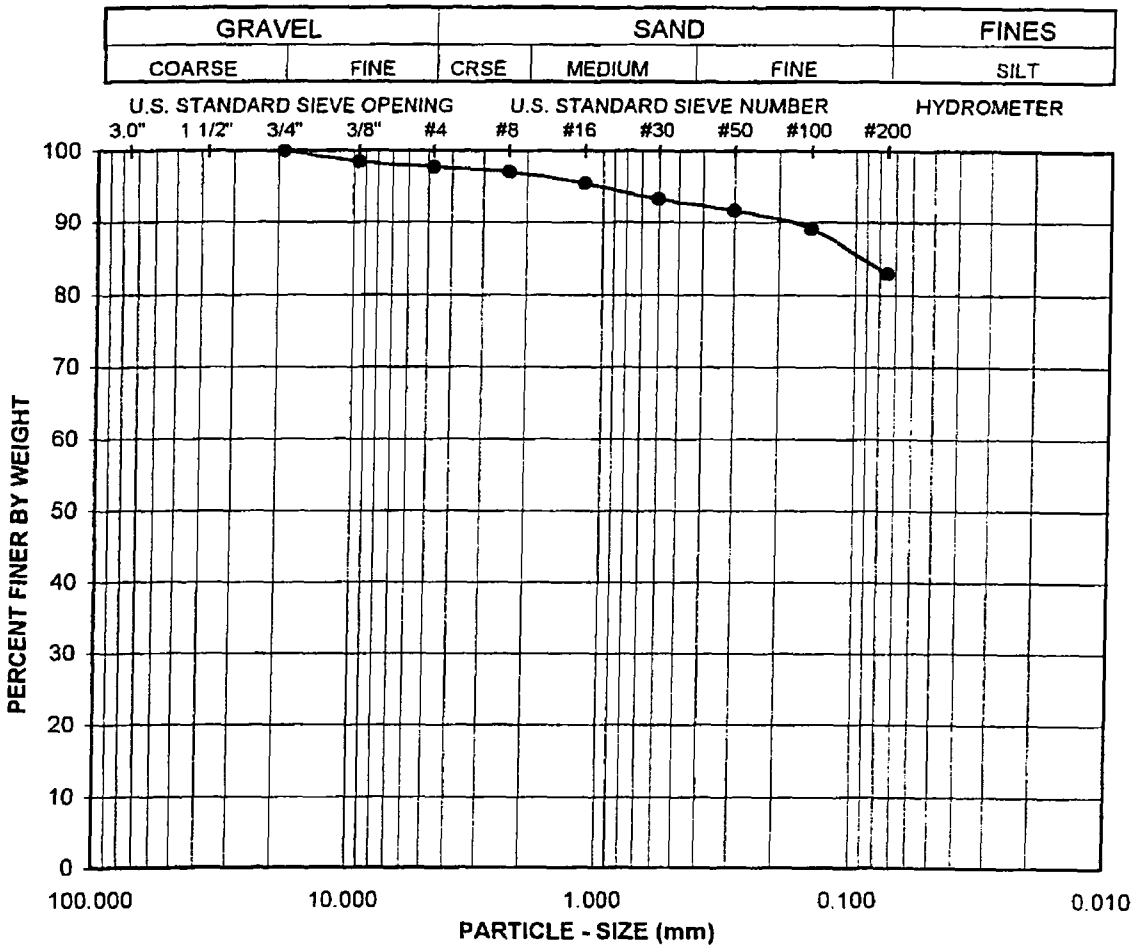
After Wet Sieve	Container No.	549
	Wt. of Dry Soil + Container (gm.)	122.74
	Wt. of Container (gm.)	77.62
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	45.12

U. S. Sieve Size (in.)	(mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	3.63	98.5
#4	4.750	5.57	97.7
#8	2.360	7.21	97.0
#16	1.180	11.08	95.4
#30	0.600	16.32	93.2
#50	0.300	20.28	91.6
#100	0.150	26.40	89.1
#200	0.075	41.34	82.9
PAN			

GRAVEL:	2 %	Liquid Limit:	
SAND:	15 %	Plastic Limit	
FINES:	83 %	Plasticity Index:	
GRP. SYMBOL:	(ML)s	Cu = D60/D10 =	
		Cc = $(D30)^2/(D60*D10)$ =	

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK202	AA3-MW08	11-11.5	(ML)s	2 : 15 : 83	, N/A,

Visual Sample Description:
Brown silt with sand (ML)s

Tersiant Labs, Inc.

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

12-02

SA LK202.xls

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Teratest Labs, Inc.

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/09/02
Sample ID:	LK203	Depth (ft.):	16-16.5		
Exploration Location:	AA3-MW08				

Visual Sample Description: Brown silty sand (SM)

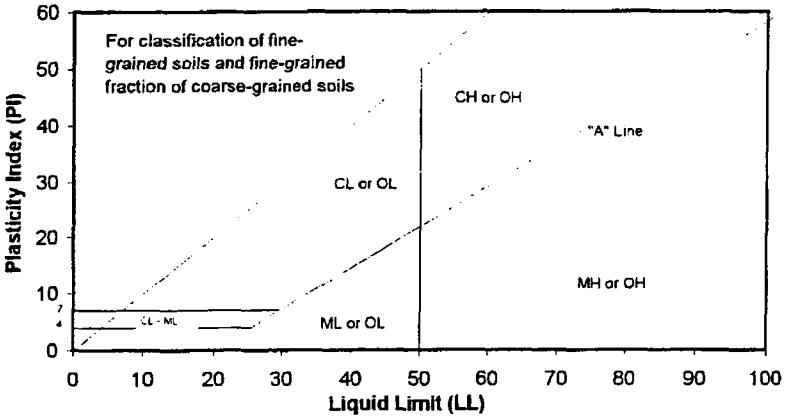
		Moisture Content of Total Air - Dry Soil	
Container No.:	737	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	476.99	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	76.42	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	400.57	Moisture Content (%)	0.00

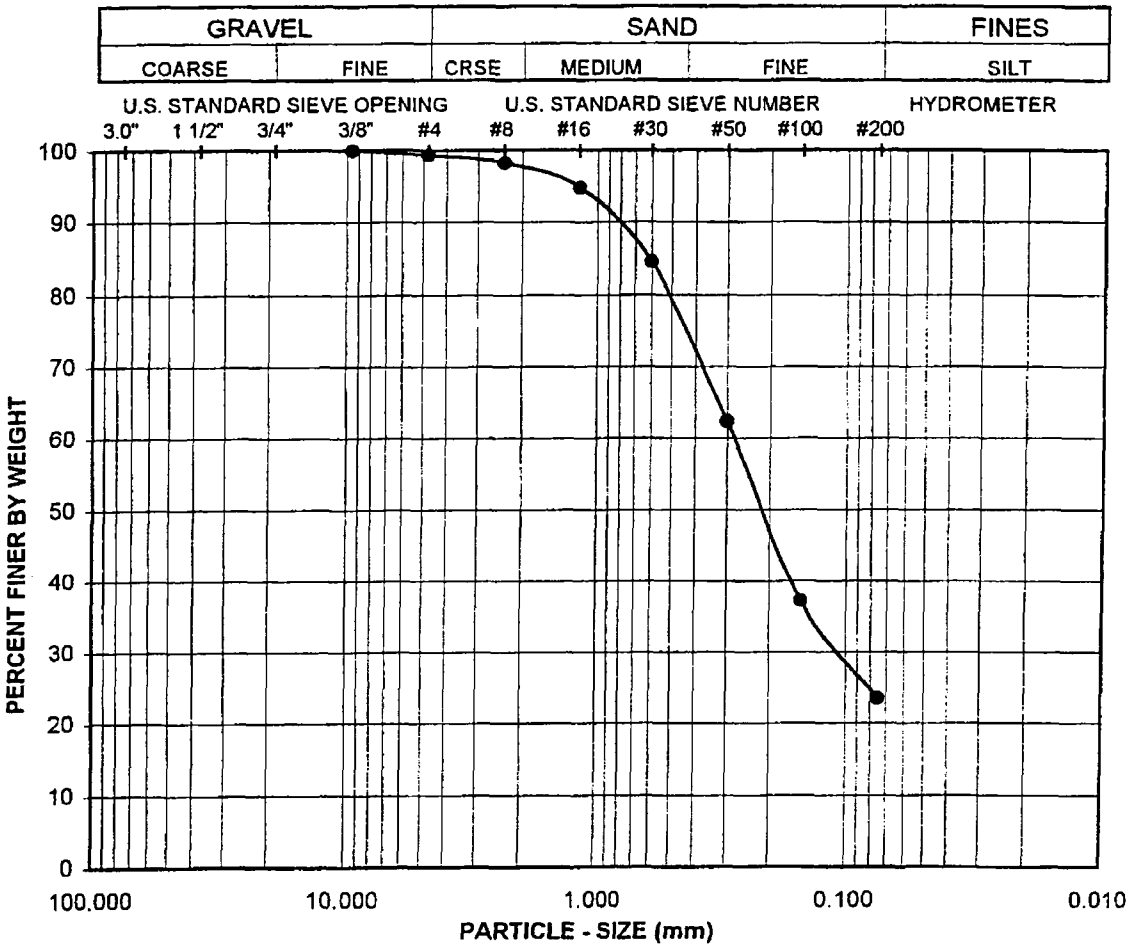
After Wet Sieve	Container No.	737
	Wt. of Dry Soil + Container (gm.)	387.36
	Wt. of Container (gm.)	76.42
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	310.94

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	2.74	99.3
#8	2.360	7.34	98.2
#16	1.180	21.41	94.7
#30	0.600	62.18	84.5
#50	0.300	150.87	62.3
#100	0.150	251.62	37.2
#200	0.075	306.49	23.5
PAN			

GRAVEL:	1 %	Liquid Limit:	
SAND:	75 %	Plastic Limit	
FINES:	24 %	Plasticity Index:	
GRP. SYMBOL:	SM	Cu = D60/D10 =	
		Cc = $(D30)^2/(D60*D10)$ =	

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK203	AA3-MW08	16-16.5	SM	1 : 75 : 24	, N/A,

Visual Sample Description:
Brown silty sand (SM)

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

12-02

SA LK203.xls

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name: Anomaly Area 3, Former MCAS El Toro, CA Tested By: ACS Date: 12/02/02

Project No.: 37380 / CTO 0078 Checked By: LF Date: 12/09/02

Sample ID: LK205 Depth (ft.): 26-26.5

Exploration Location: AA3-MW08

Visual Sample Description: Brown clayey sand (SC)

		Moisture Content of Total Air - Dry Soil	
Container No.:	724	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	497.98	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	76.71	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	421.27	Moisture Content (%)	0.00

After Wet Sieve	Container No.	724
	Wt. of Dry Soil + Container (gm.)	434.07
	Wt. of Container (gm.)	76.71
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	357.36

U. S. Sieve Size (in.)	(mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	8.07	98.1
#4	4.750	20.35	95.2
#8	2.360	43.22	89.7
#16	1.180	83.13	80.3
#30	0.600	156.85	62.8
#50	0.300	264.00	37.3
#100	0.150	326.39	22.5
#200	0.075	355.60	15.6
PAN			

GRAVEL: 5 %

SAND: 79 %

FINES: 16 %

GRP. SYMBOL: SC

Liquid Limit:

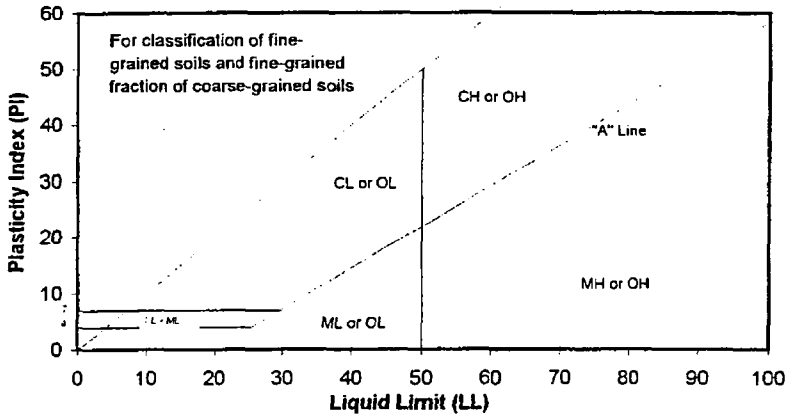
Plastic Limit

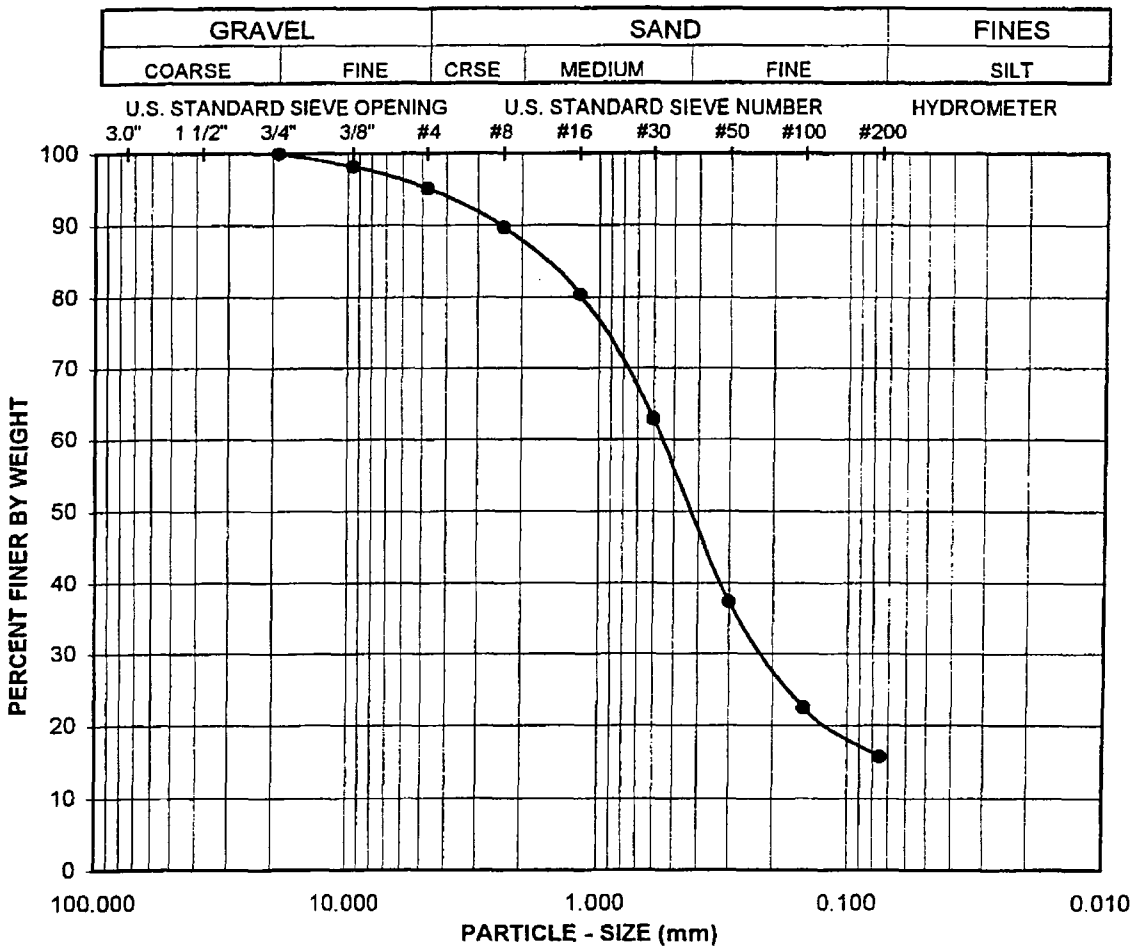
Plasticity Index:

Cu = D60/D10 =

Cc = $(D30)^2/(D60*D10)$ =

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK205	AA3-MW08	26-26.5	SC	5 : 79 : 16	, N/A,

Visual Sample Description:
Brown clayey sand (SC)

Terrasat Labs, Inc.

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

12-02

SA LK205.xls

Teratest Labs, Inc.

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/09/02
Sample ID:	LK207	Depth (ft.):	6-6.5		
Exploration Location:	AA3-MW09				

Visual Sample Description: Brown poorly graded sand with silt (SP-SM)

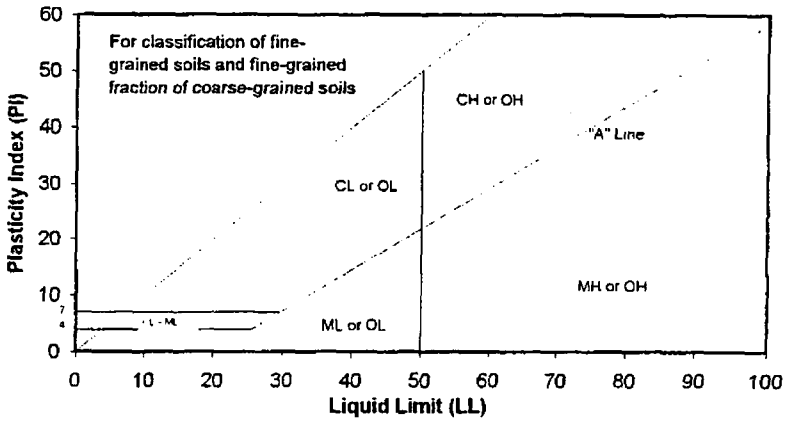
		Moisture Content of Total Air - Dry Soil	
Container No.:	NG18	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	468.46	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	74.31	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	394.15	Moisture Content (%)	0.00

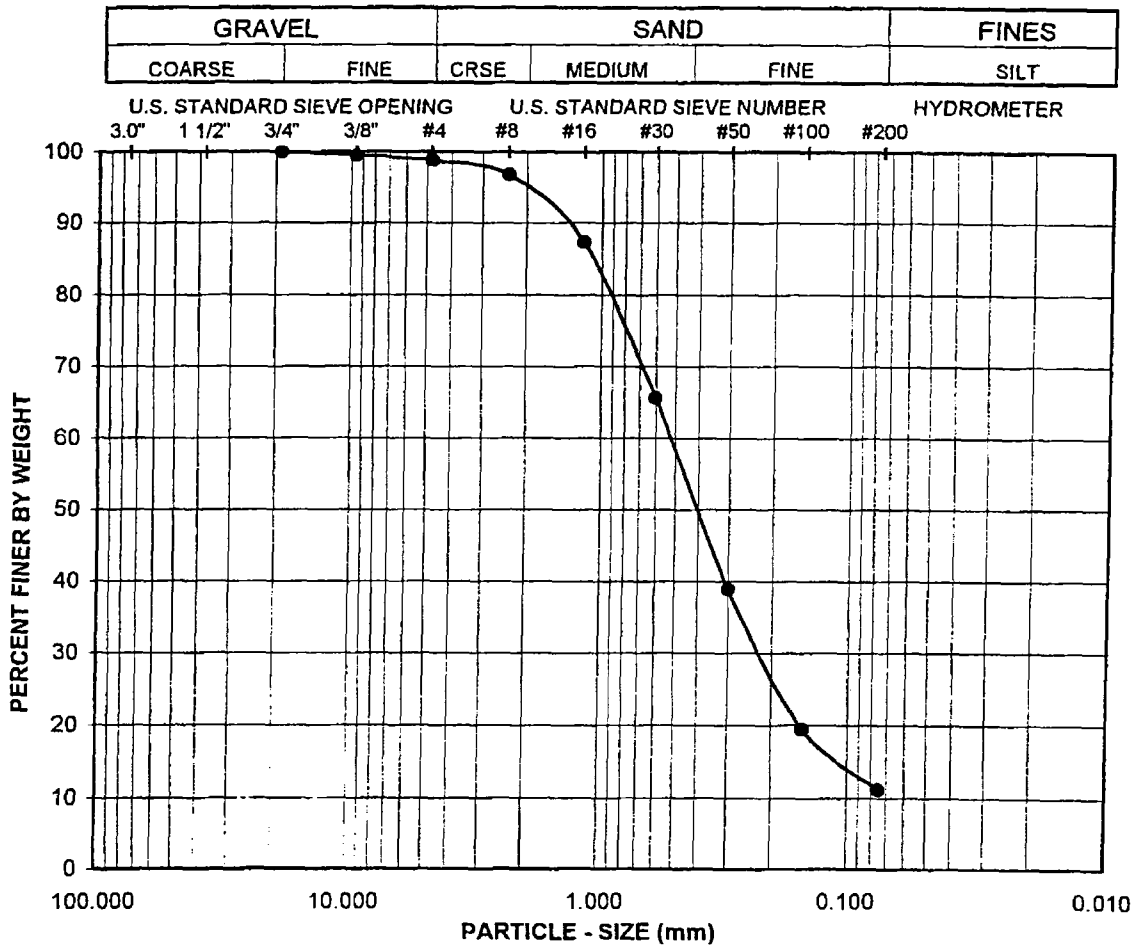
After Wet Sieve	Container No.	NG18
	Wt. of Dry Soil + Container (gm.)	425.38
	Wt. of Container (gm.)	74.31
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	351.07

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	1.81	99.5
#4	4.750	4.82	98.8
#8	2.360	12.64	96.8
#16	1.180	49.93	87.3
#30	0.600	135.99	65.5
#50	0.300	241.02	38.9
#100	0.150	317.66	19.4
#200	0.075	349.91	11.2
PAN			

GRAVEL:	1 %	Liquid Limit:	
SAND:	88 %	Plastic Limit	
FINES:	11 %	Plasticity Index:	
GRP. SYMBOL:	SP-SM	Cu = D60/D10 =	8.67
		Cc = $(D30)^2/(D60*D10)$ =	0.54

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK207	AA3-MW09	6-6.5	SP-SM	1 : 88 : 11	, N/A,

Visual Sample Description:
Brown poorly graded sand with silt (SP-SM)

Terrasat Labs, Inc.

Project No.: 37380 / CTO 0078
Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE
ASTM D 4318, D 422

12-02

SA LK207.xls

Teralest Labs, Inc.
A LEIGHTON GROUP COMPANY

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name: Anomaly Area 3, Former MCAS El Toro, CA Tested By: ACS Date: 12/02/02

Project No.: 37380 / CTO 0078 Checked By: LF Date: 12/09/02

Sample ID: LK209 Depth (ft.): 16-16.5

Exploration Location: AA3-MW09

Visual Sample Description: Brown silty sand (SM)

		Moisture Content of Total Air - Dry Soil	
Container No.:	784	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	419.66	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	76.73	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	342.93	Moisture Content (%)	0.00

After Wet Sieve	Container No.	784
	Wt. of Dry Soil + Container (gm.)	345.33
	Wt. of Container (gm.)	76.73
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	268.60

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	2.74	99.2
#4	4.750	5.35	98.4
#8	2.360	12.04	96.5
#16	1.180	33.60	90.2
#30	0.600	78.52	77.1
#50	0.300	139.18	59.4
#100	0.150	214.86	37.3
#200	0.075	265.56	22.6
PAN			

GRAVEL: 2 % Liquid Limit:

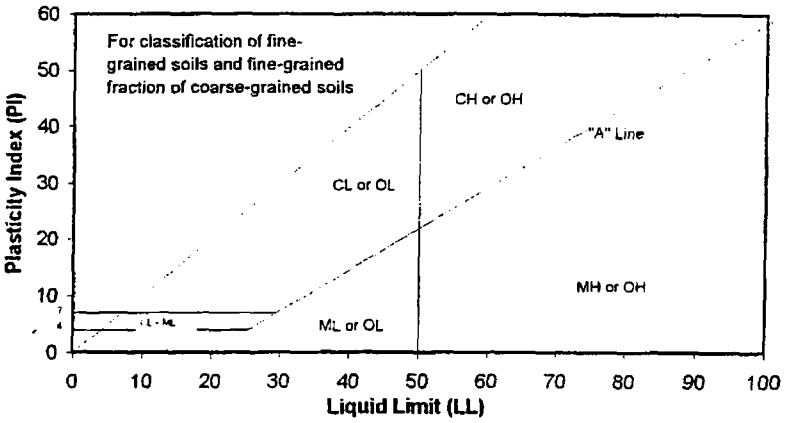
SAND: 75 % Plastic Limit

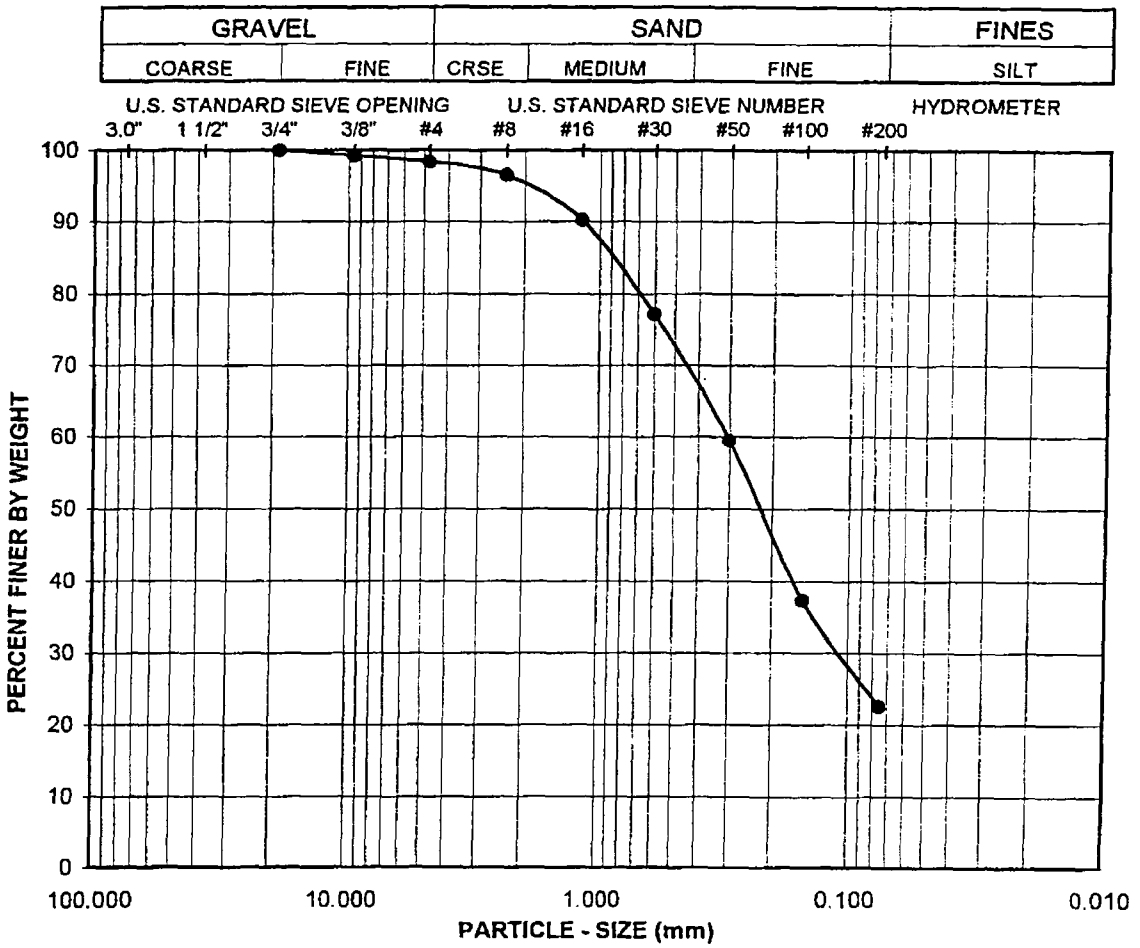
FINES: 23 % Plasticity Index:

GRP. SYMBOL: SM Cu = D60/D10 =

Cc = $(D30)^2/(D60*D10)$ =

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK209	AA3-MW09	16-16.5	SM	2 : 75 : 23	, N/A,

Visual Sample Description:
Brown silty sand (SM)

Terrasat Labs, Inc

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

12-02

SA LK209.xls

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Teratest Labs, Inc.

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/09/02
Sample ID:	LK212	Depth (ft.):	31-31.5		
Exploration Location:	AA3-MW09				

Visual Sample Description: Yellowish brown well-graded gravel with silt and sand (GW-GM)s

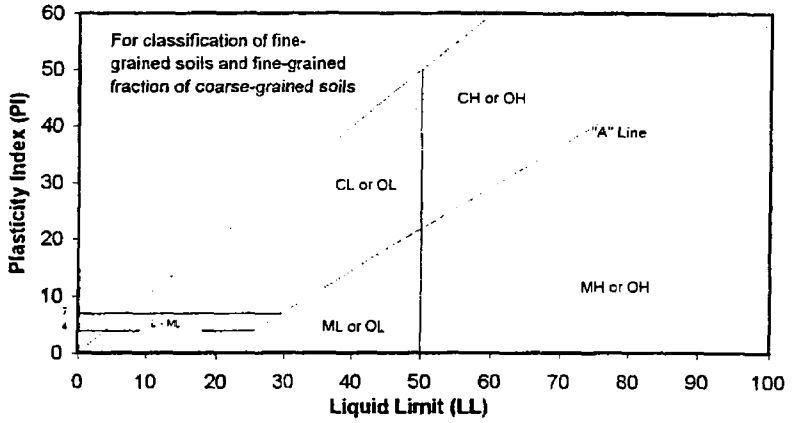
		Moisture Content of Total Air - Dry Soil	
Container No.:	1955	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	871.30	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	72.14	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	799.16	Moisture Content (%)	0.00

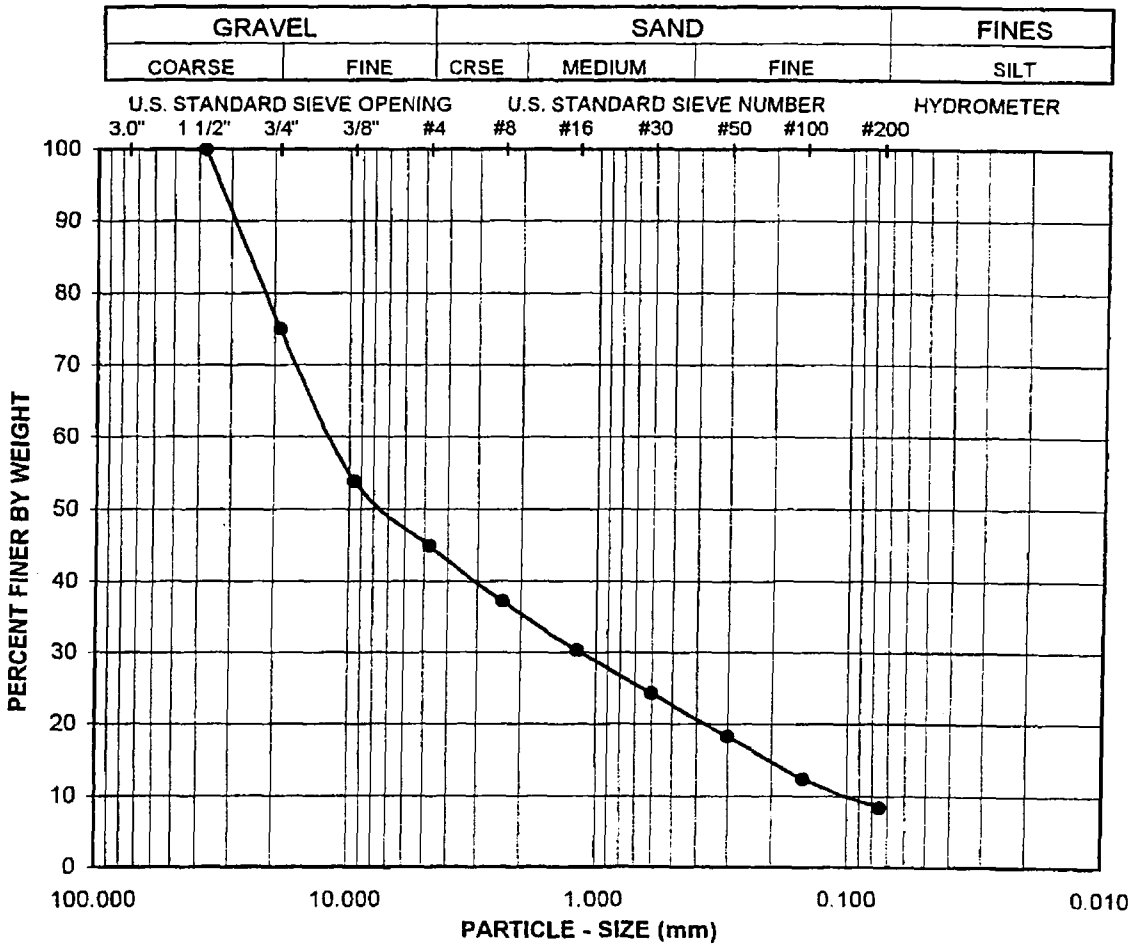
After Wet Sieve	Container No.	1955
	Wt. of Dry Soil + Container (gm.)	806.63
	Wt. of Container (gm.)	72.14
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	734.49

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	100.0
3/4"	19.000	199.47	75.0
3/8"	9.500	368.98	53.8
#4	4.750	440.64	44.9
#8	2.360	502.81	37.1
#16	1.180	556.83	30.3
#30	0.600	604.90	24.3
#50	0.300	653.20	18.3
#100	0.150	701.00	12.3
#200	0.075	732.30	8.4
PAN			

GRAVEL:	55 %	Liquid Limit:	
SAND:	37 %	Plastic Limit	
FINES:	8 %	Plasticity Index:	
GRP. SYMBOL:	(GW-GM)s	Cu = D60/D10 =	120.00
		Cc = $(D30)^2/(D60*D10)$ =	1.20

Remarks: Insufficient sample mass available to meet the ASTM specification for this material





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK212	AA3-MW09	31-31.5	(GW-GM)s	55 : 37 : 8	,N/A,

Visual Sample Description:
Yellowish brown well-graded gravel with silt and sand (GW-GM)s

Terratest Labs, Inc.

Project No.: 37380 / CTO 0078
Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE
ASTM D 4318, D 422

12-02

SA LK212.xls

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/09/02
Sample ID:	LK214	Depth (ft.):	40-41.5		
Exploration Location:	AA3-MW09				

Visual Sample Description: Olive yellow poorly graded sand (SP)

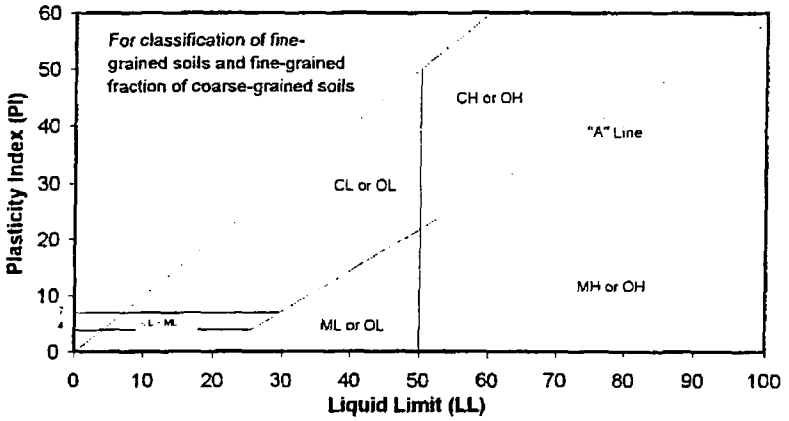
		Moisture Content of Total Air - Dry Soil	
Container No.:	884	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	655.60	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	75.03	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	580.57	Moisture Content (%)	0.00

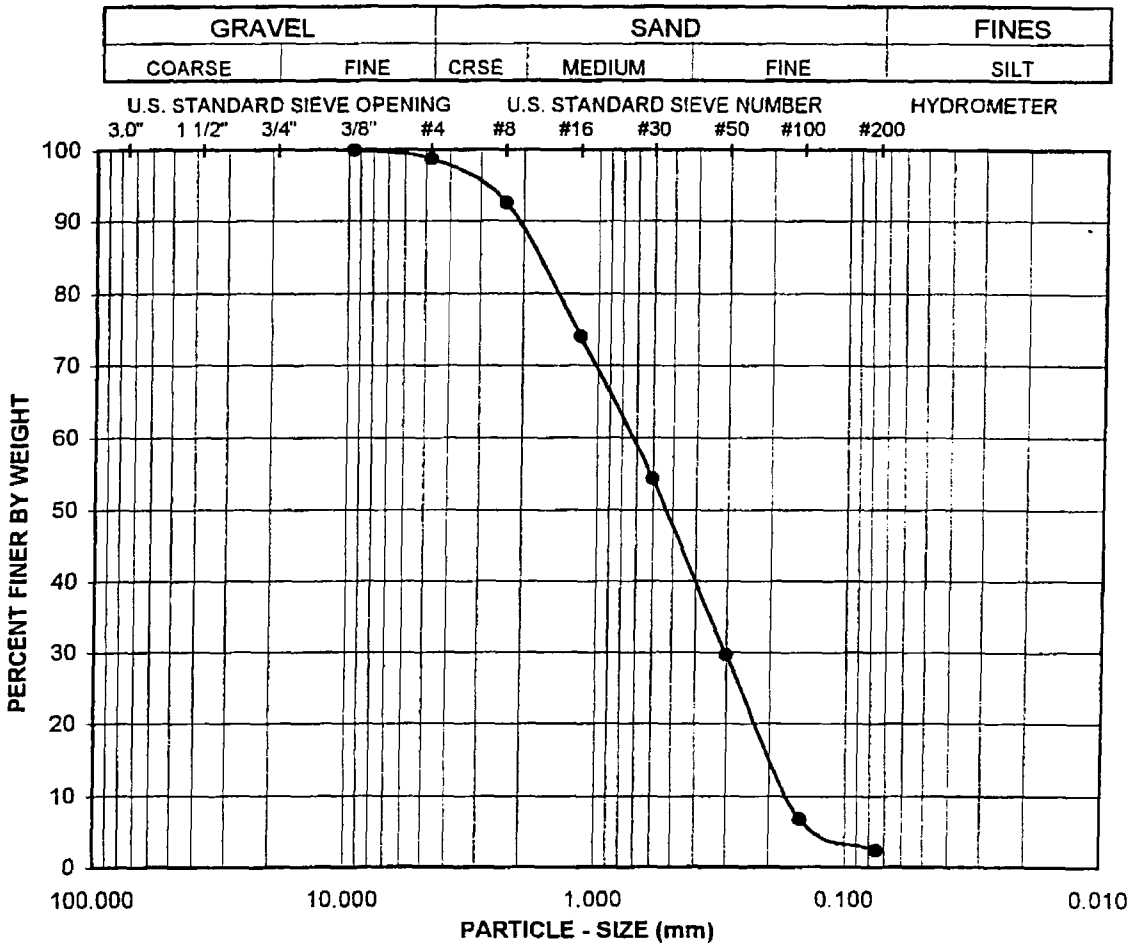
After Wet Sieve	Container No.	884
	Wt. of Dry Soil + Container (gm.)	642.00
	Wt. of Container (gm.)	75.03
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	566.97

U. S. Sieve Size (in.)	(mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	7.62	98.7
#8	2.360	43.25	92.6
#16	1.180	150.77	74.0
#30	0.600	265.21	54.3
#50	0.300	408.08	29.7
#100	0.150	541.12	6.8
#200	0.075	566.82	2.4
PAN			

GRAVEL:	1 %	Liquid Limit:	
SAND:	97 %	Plastic Limit	
FINES:	2 %	Plasticity Index:	
GRP. SYMBOL:	SP	Cu = D60/D10 =	3.94
		Cc = $(D30)^2/(D60*D10)$ =	0.70

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK214	AA3-MW09	40-41.5	SP	1 : 97 : 2	, N/A,

Visual Sample Description:
Olive yellow poorly graded sand (SP)

Terrasat Labs, Inc.

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

12-02

SA LK214.xls

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/09/02
Sample ID:	LK216	Depth (ft.):	50-51.5		
Exploration Location:	AA3-MW09				

Visual Sample Description: Pale yellow poorly graded sand with silt (SP-SM)

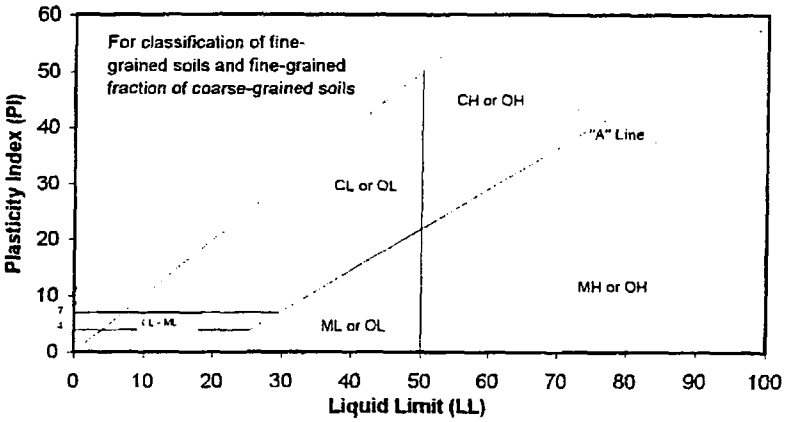
		Moisture Content of Total Air - Dry Soil	
Container No.:	4-C	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	757.20	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	107.92	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	649.28	Moisture Content (%)	0.00

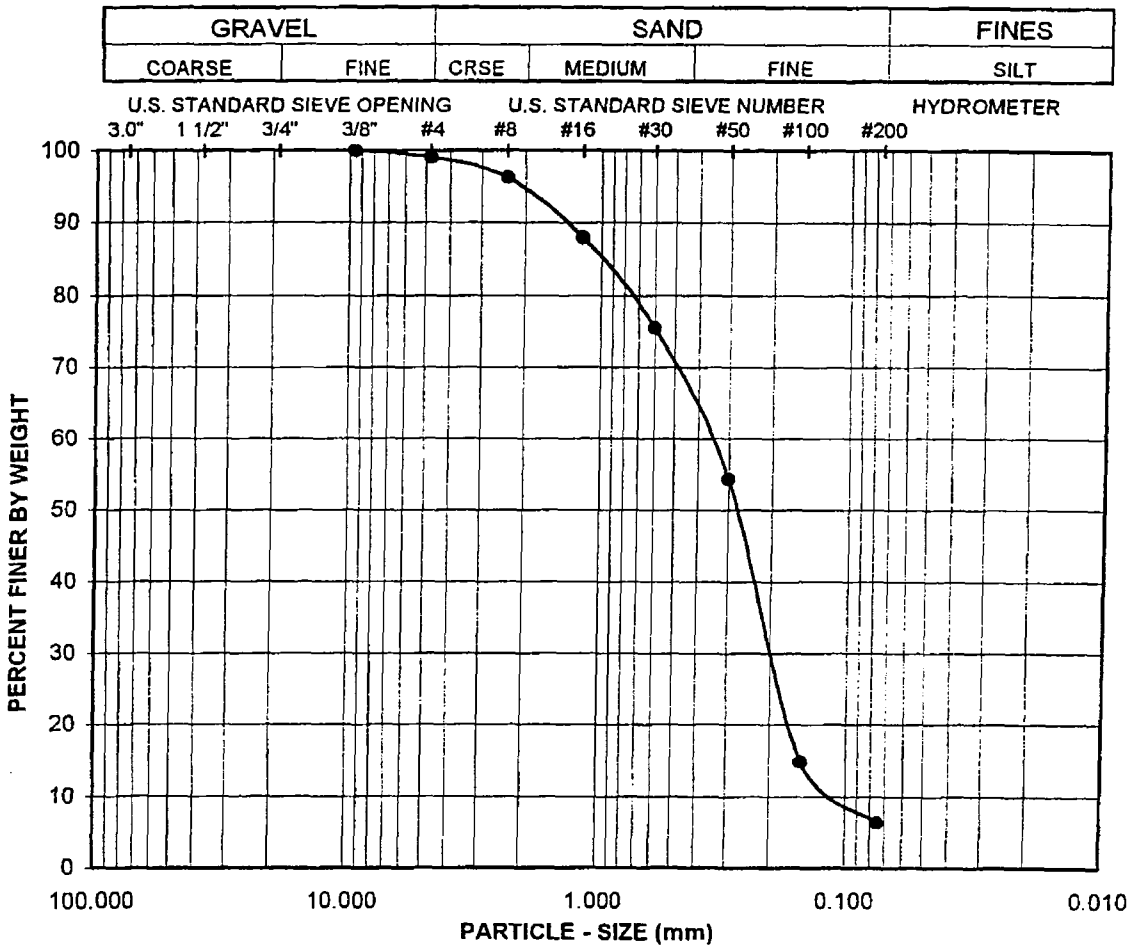
After Wet Sieve	Container No.	4-C
	Wt. of Dry Soil + Container (gm.)	718.10
	Wt. of Container (gm.)	107.92
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	610.18

U. S. Sieve Size (in.)	(mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	5.92	99.1
#8	2.360	23.90	96.3
#16	1.180	78.29	87.9
#30	0.600	159.35	75.5
#50	0.300	296.72	54.3
#100	0.150	553.00	14.8
#200	0.075	608.30	6.3
PAN			

GRAVEL:	1 %	Liquid Limit:	
SAND:	93 %	Plastic Limit	
FINES:	6 %	Plasticity Index:	
GRP. SYMBOL:	SP-SM	Cu = D60/D10 =	2.88
		Cc = $(D30)^2/(D60*D10)$ =	0.97

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK216	AA3-MW09	50-51.5	SP-SM	1 : 93 : 6	, N/A,

Visual Sample Description:
Pale yellow poorly graded sand with silt (SP-SM)

Terstiest Labs, Inc.

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

12-02

SA LK216.xls

Teratest Labs, Inc.

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/09/02
Sample ID:	LK219	Depth (ft.):	65-66.5		
Exploration Location:	AA3-MW09				

Visual Sample Description: Olive yellow poorly graded sand (SP)

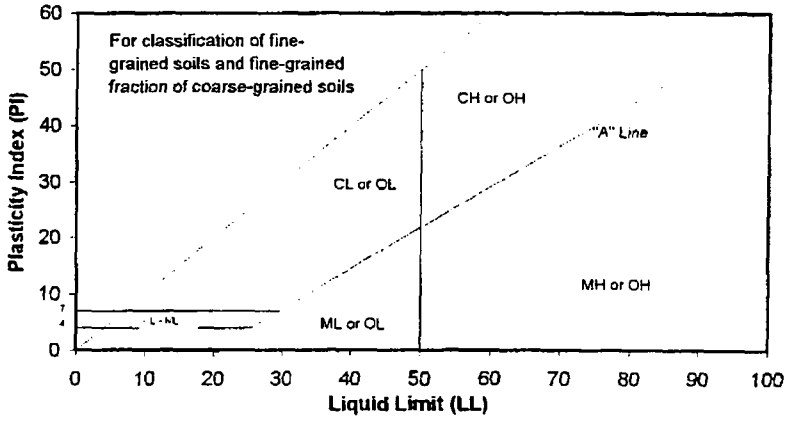
		Moisture Content of Total Air - Dry Soil	
Container No.:	934	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	847.80	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	107.70	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	740.10	Moisture Content (%)	0.00

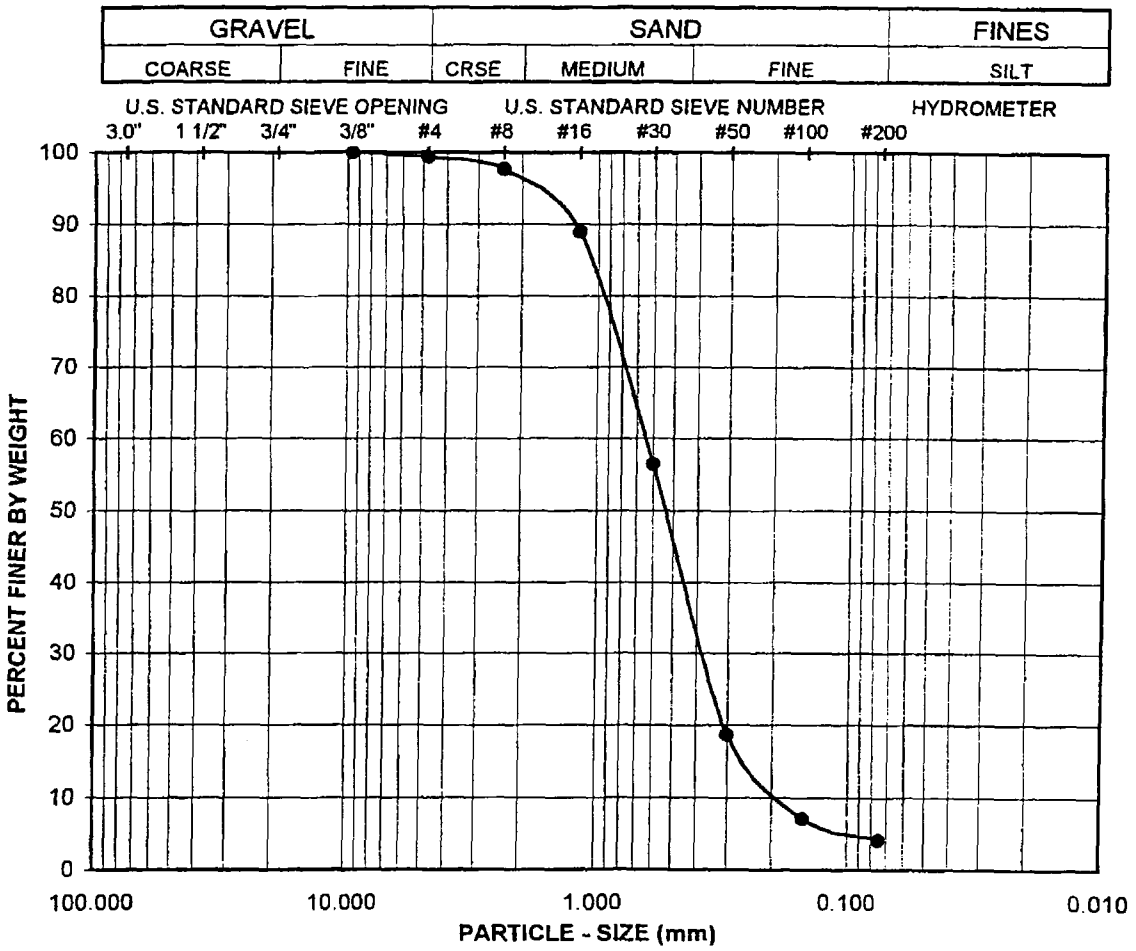
After Wet Sieve	Container No.	934
	Wt. of Dry Soil + Container (gm.)	818.10
	Wt. of Container (gm.)	107.70
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	710.40

U. S. Sieve Size (in.)	(mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	5.04	99.3
#8	2.360	18.11	97.6
#16	1.180	82.09	88.9
#30	0.600	321.74	56.5
#50	0.300	601.70	18.7
#100	0.150	687.30	7.1
#200	0.075	710.10	4.1
PAN			

GRAVEL:	1 %	Liquid Limit:	
SAND:	95 %	Plastic Limit	
FINES:	4 %	Plasticity Index:	
GRP. SYMBOL:	SP	Cu = D60/D10 =	3.20
		Cc = $(D30)^2/(D60*D10)$ =	1.13

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK219	AA3-MW09	65-66.5	SP	1 : 95 : 4	, N/A,

Visual Sample Description:
Olive yellow poorly graded sand (SP)

Terrasearch Labs, Inc.

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

12-02

SA LK219.xls

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/09/02
Sample ID:	LK222	Depth (ft.):	80-81.5		
Exploration Location:	AA3-MW09				

Visual Sample Description: Olive yellow poorly graded sand with silt (SP-SM)

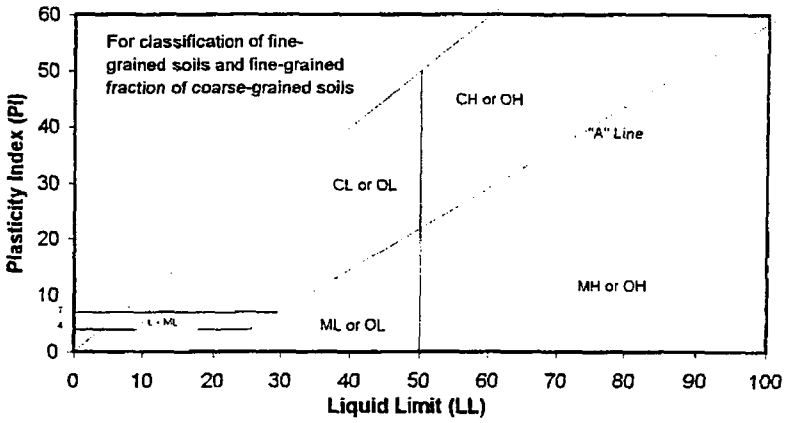
		Moisture Content of Total Air - Dry Soil	
Container No.:	954	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	1202.30	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	108.88	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	1093.42	Moisture Content (%)	0.00

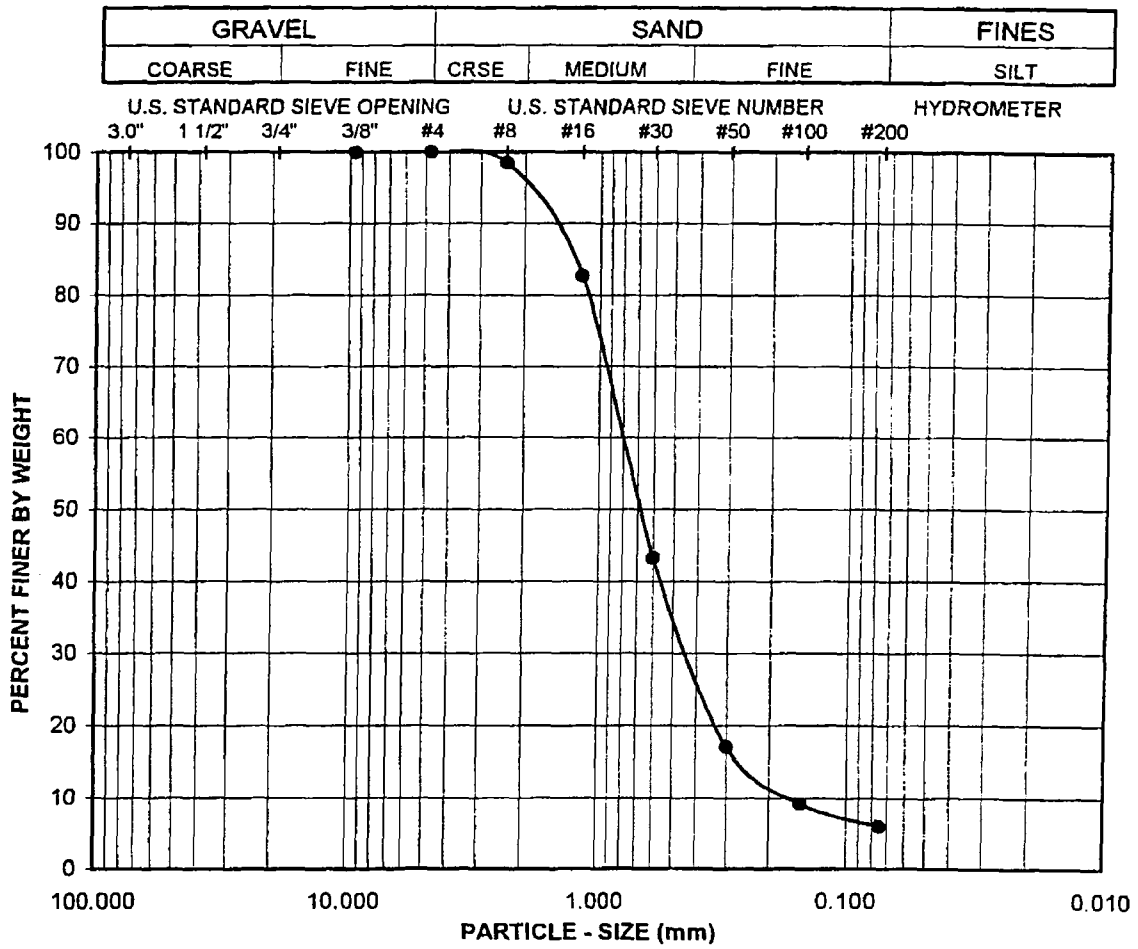
After Wet Sieve	Container No.	954
	Wt. of Dry Soil + Container (gm.)	1137.70
	Wt. of Container (gm.)	108.88
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	1028.82

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	0.17	100.0
#8	2.360	16.93	98.5
#16	1.180	188.79	82.7
#30	0.600	621.20	43.2
#50	0.300	906.10	17.1
#100	0.150	993.80	9.1
#200	0.075	1027.80	6.0
PAN			

GRAVEL:	0 %	Liquid Limit:	
SAND:	94 %	Plastic Limit	
FINES:	6 %	Plasticity Index:	
GRP. SYMBOL:	SP-SM	Cu = D60/D10 =	4.71
		Cc = $(D30)^2/(D60*D10)$ =	1.49

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK222	AA3-MW09	80-81.5	SP-SM	0 : 94 : 6	,N/A,

Visual Sample Description:
Olive yellow poorly graded sand with silt (SP-SM)

Terrastat Labs, Inc.

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

12-02

SA LK222.xls

Teratest Labs, Inc.

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/10/02
Sample ID:	LK224	Depth (ft.):	6-6.5		
Exploration Location:	AA3-MW10				

Visual Sample Description: Brown clayey sand with gravel (SC)g

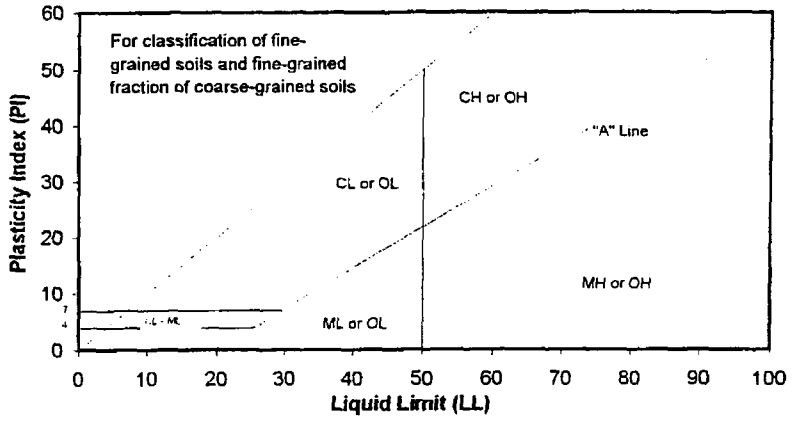
		Moisture Content of Total Air - Dry Soil	
Container No.:	RX-21	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	712.50	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	74.15	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	638.35	Moisture Content (%)	0.00

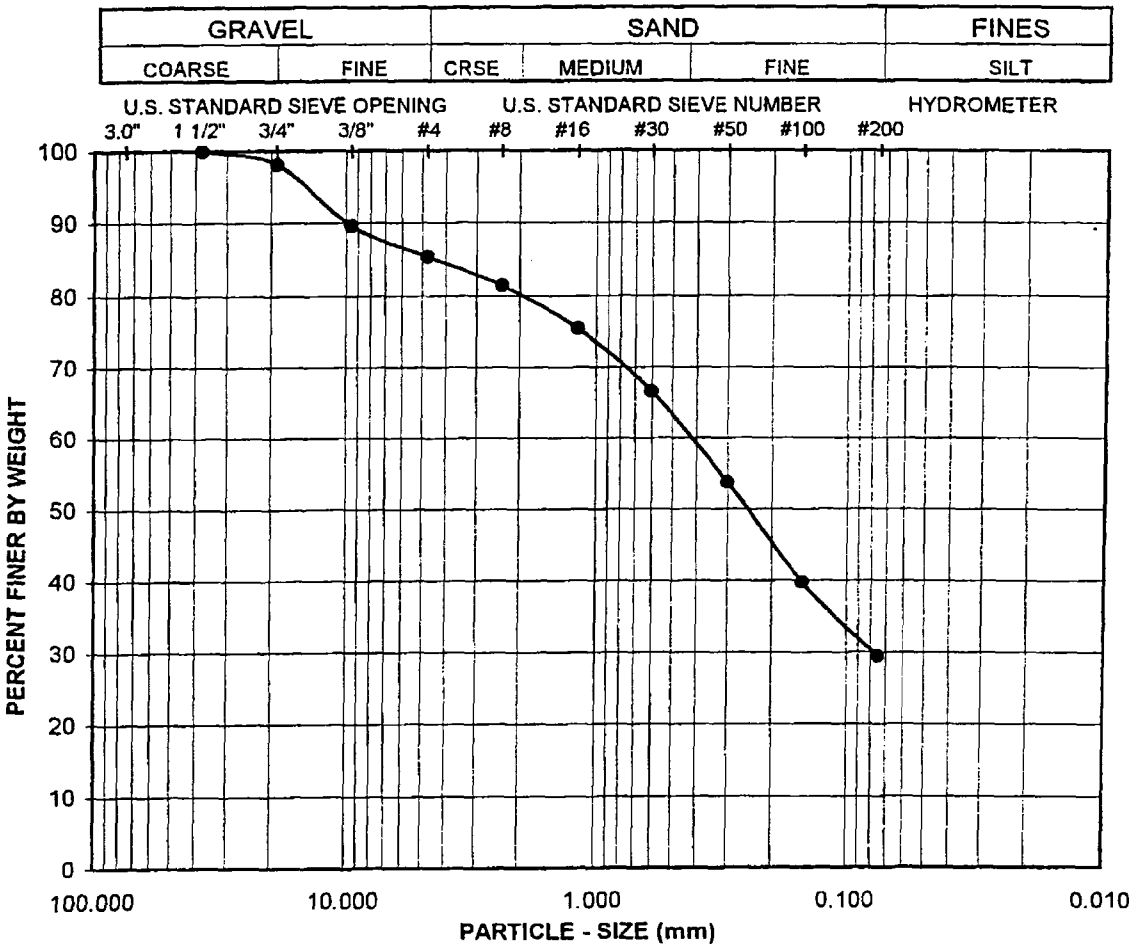
After Wet Sieve	Container No.	RX-21
	Wt. of Dry Soil + Container (gm.)	530.20
	Wt. of Container (gm.)	74.15
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	456.05

U. S. Sieve Size (in.)	(mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	100.0
3/4"	19.000	12.28	98.1
3/8"	9.500	66.40	89.6
#4	4.750	93.00	85.4
#8	2.360	118.58	81.4
#16	1.180	156.91	75.4
#30	0.600	213.76	66.5
#50	0.300	295.76	53.7
#100	0.150	384.95	39.7
#200	0.075	450.83	29.4
PAN			

GRAVEL:	15 %	Liquid Limit:	
SAND:	56 %	Plastic Limit	
FINES:	29 %	Plasticity Index:	
GRP. SYMBOL:	(SC)g	Cu = D60/D10 =	
		Cc = $(D30)^2/(D60*D10)$ =	

Remarks: Insufficient sample mass available to meet the ASTM specification for this material





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK224	AA3-MW10	6-6.5	(SC)g	15 : 56 : 29	,N/A,

Visual Sample Description:
Brown clayey sand with gravel (SC)g

Terratest Labs, Inc.

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

12-02

SA LK224 xls

Teralast Labs, Inc.
A LEIGHTON GROUP COMPANY

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/10/02
Sample ID:	LK227	Depth (ft.):	20.5-21		
Exploration Location:	AA3-MW10				

Visual Sample Description: Brown poorly graded sand with silt (SP-SM)

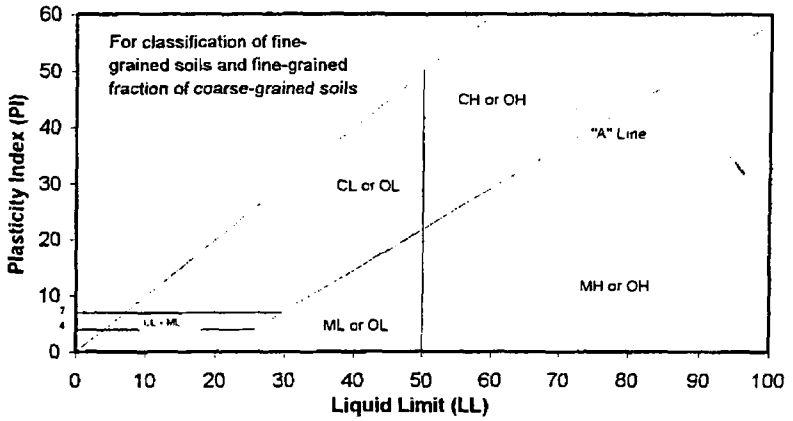
		Moisture Content of Total Air - Dry Soil	
Container No.:	757	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	483.61	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	76.07	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	407.54	Moisture Content (%)	0.00

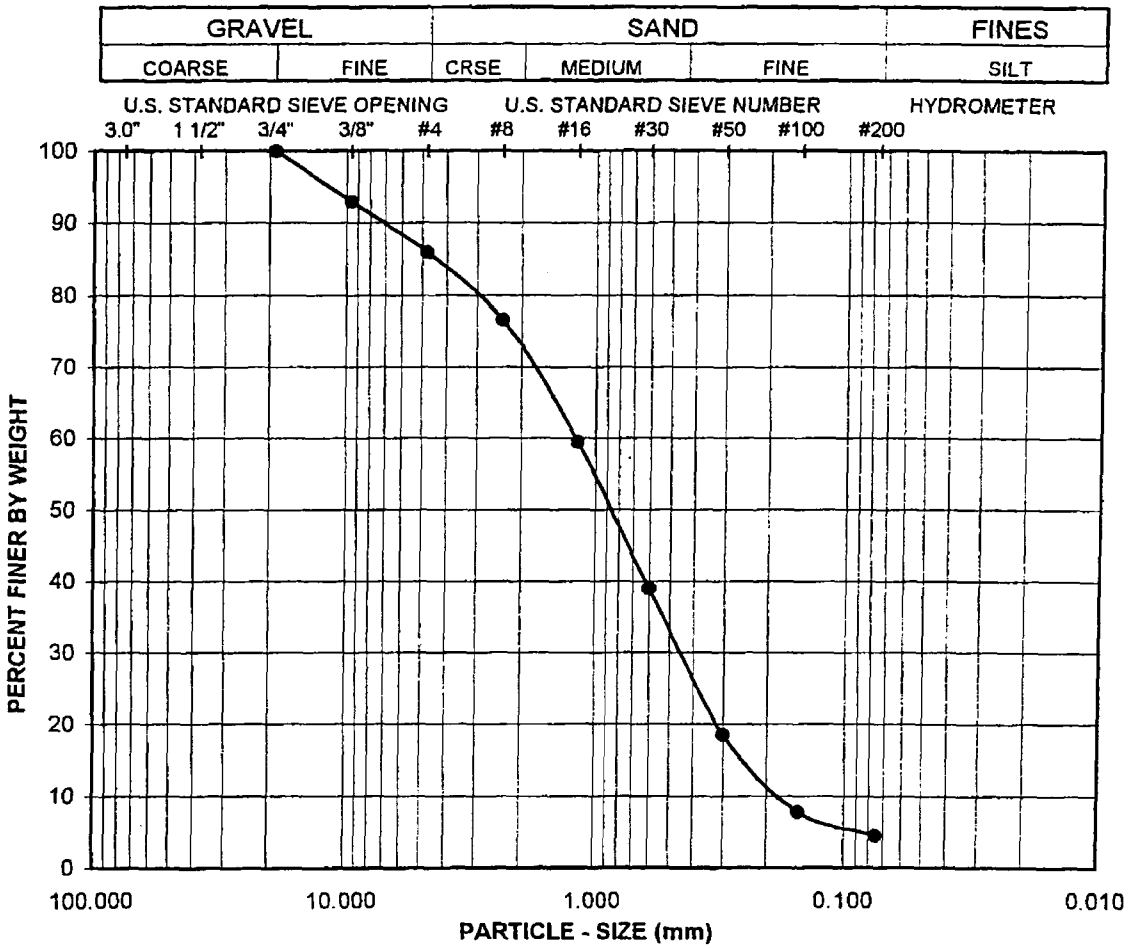
After Wet Sieve	Container No.	757
	Wt. of Dry Soil + Container (gm.)	465.67
	Wt. of Container (gm.)	76.07
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	389.60

U. S. Sieve Size (in.)	(mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	28.92	92.9
#4	4.750	57.52	85.9
#8	2.360	95.83	76.5
#16	1.180	165.47	59.4
#30	0.600	248.45	39.0
#50	0.300	332.25	18.5
#100	0.150	375.66	7.8
#200	0.075	389.14	4.5
PAN			

GRAVEL:	14 %	Liquid Limit:	
SAND:	81 %	Plastic Limit	
FINES:	5 %	Plasticity Index:	
GRP. SYMBOL:	SP-SM	Cu = D60/D10 =	6.67
		Cc = $(D30)^2/(D60*D10)$ =	0.94

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK227	AA3-MW10	20.5-21	SP-SM	14 : 81 : 5	, N/A,

Visual Sample Description:
Brown poorly graded sand with silt (SP-SM)

Terrasient Labs, Inc.

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

12-02

SA LK227.xls

Teralast Labs, Inc.

PARTICLE-SIZE ANALYSIS of SOILS

ASTM D 422

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/10/02
Sample ID:	LK229	Depth (ft.):	31-31.5		
Exploration Location:	AA3-MW10				

Visual Sample Description: Pale yellow poorly graded sand with silt (SP-SM)

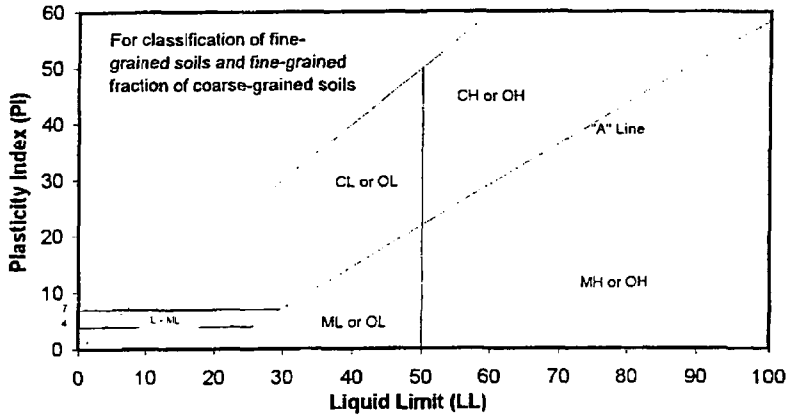
		Moisture Content of Total Air - Dry Soil	
Container No.:	780	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	689.90	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	75.60	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	614.30	Moisture Content (%)	0.00

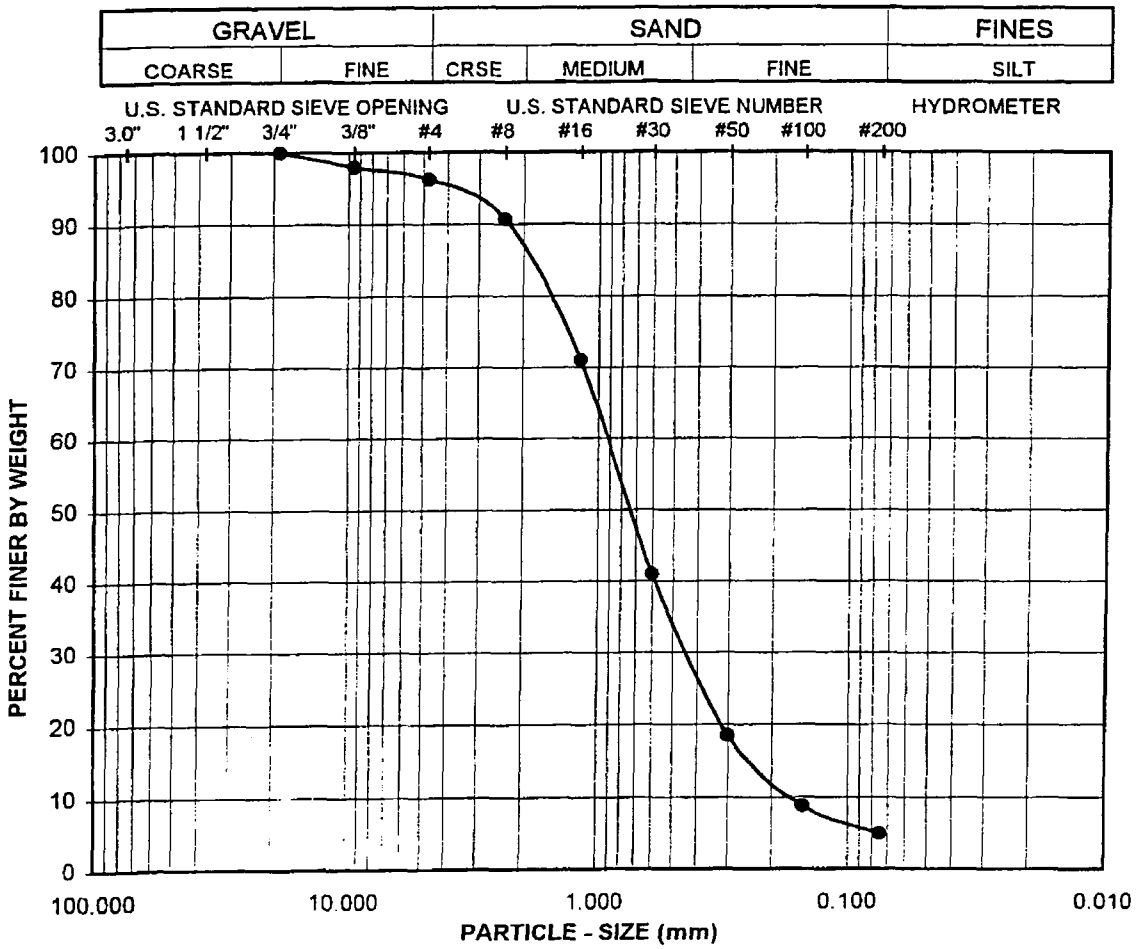
After Wet Sieve	Container No.	780
	Wt. of Dry Soil + Container (gm.)	660.90
	Wt. of Container (gm.)	75.60
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	585.30

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	12.07	98.0
#4	4.750	22.70	96.3
#8	2.360	57.40	90.7
#16	1.180	178.27	71.0
#30	0.600	362.17	41.0
#50	0.300	500.38	18.5
#100	0.150	560.03	8.8
#200	0.075	584.17	4.9
PAN			

GRAVEL:	4 %	Liquid Limit:	
SAND:	91 %	Plastic Limit	
FINES:	5 %	Plasticity Index:	
GRP. SYMBOL:	SP-SM	Cu = D60/D10 =	5.29
		Cc = $(D30)^2/(D60*D10)$ =	1.32

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK229	AA3-MW10	31-31.5	SP-SM	4 : 91 : 5	, N/A,

Visual Sample Description:
Pale yellow poorly graded sand with silt (SP-SM)

Project No.: 37380 / CTO 0078
Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE
ASTM D 4318, D 422

12-02

SA LK229.xls

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/10/02
Sample ID:	LK231	Depth (ft.):	41-41.5		
Exploration Location:	AA3-MW10				

Visual Sample Description: Olive poorly graded sand with silt (SP-SM)

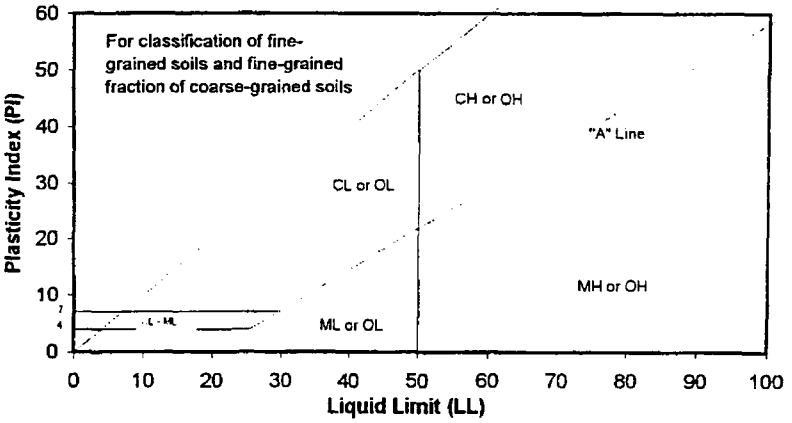
		Moisture Content of Total Air - Dry Soil	
Container No.:	538	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	537.20	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	82.24	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	454.96	Moisture Content (%)	0.00

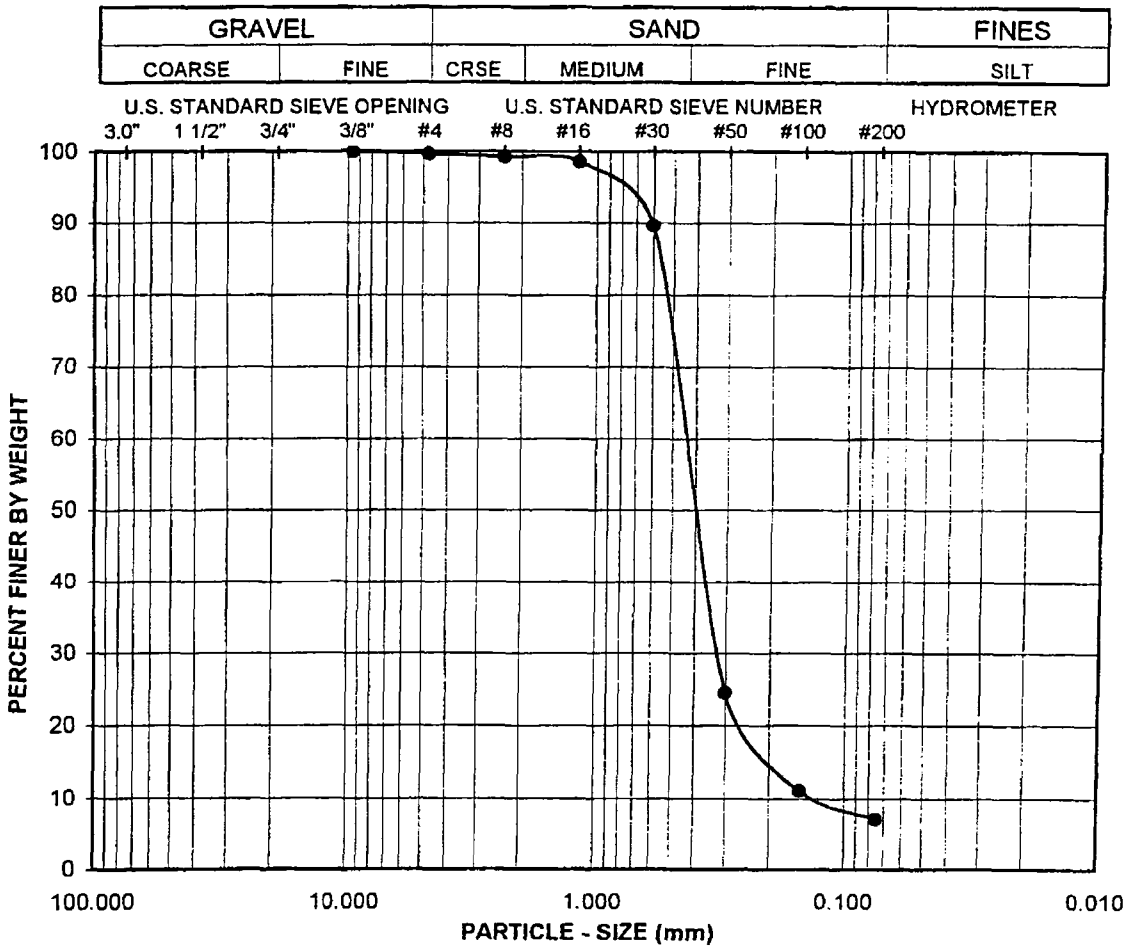
After Wet Sieve	Container No.	538
	Wt. of Dry Soil + Container (gm.)	506.20
	Wt. of Container (gm.)	82.24
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	423.96

U. S. Sieve Size (in.)	(mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	1.51	99.7
#8	2.360	3.56	99.2
#16	1.180	6.34	98.6
#30	0.600	47.43	89.6
#50	0.300	343.56	24.5
#100	0.150	404.39	11.1
#200	0.075	422.86	7.1
PAN			

GRAVEL:	0 %	Liquid Limit:	
SAND:	93 %	Plastic Limit	
FINES:	7 %	Plasticity Index:	
GRP. SYMBOL:	SP-SM	Cu = D60/D10 =	3.14
		Cc = (D30)²/(D60*D10) =	1.77

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK231	AA3-MW10	41-41.5	SP-SM	0 : 93 : 7	, N/A,

Visual Sample Description:
Olive poorly graded sand with silt (SP-SM)

Project No.: 37380 / CTO 0078
Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE
ASTM D 4318, D 422

12-02

SA LK231.xls

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	Anomaly Area 3, Former MCAS El Toro, CA	Tested By:	ACS	Date:	12/02/02
Project No.:	37380 / CTO 0078	Checked By:	LF	Date:	12/10/02
Sample ID:	LK232	Depth (ft.):	45		
Exploration Location:	AA3-MW10				

Visual Sample Description: Olive yellow poorly graded sand (SP)

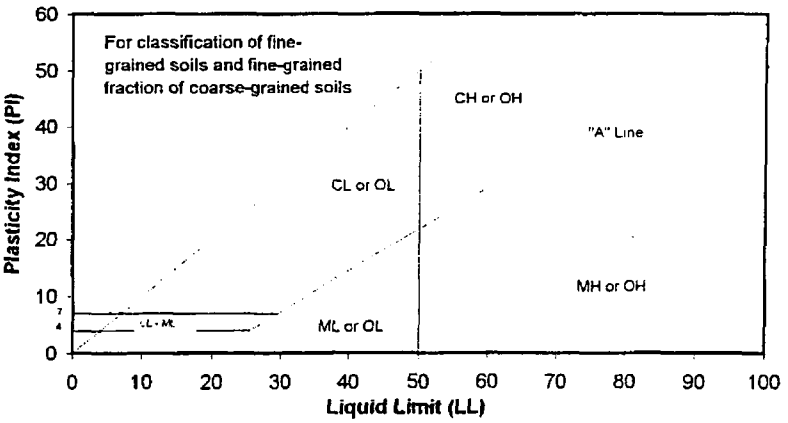
		Moisture Content of Total Air - Dry Soil	
Container No.:	535	Wt. of Air-Dry Soil + Cont. (gm.)	0.00
Wt. of Air Dry Soil+Cont.(gm.)	653.60	Wt. of Dry Soil + Cont. (gm.)	0.00
Wt. of Container (gm.)	82.22	Wt. of Container No._____ (gm.)	1.00
Dry Wt. of Soil (gm.)	571.38	Moisture Content (%)	0.00

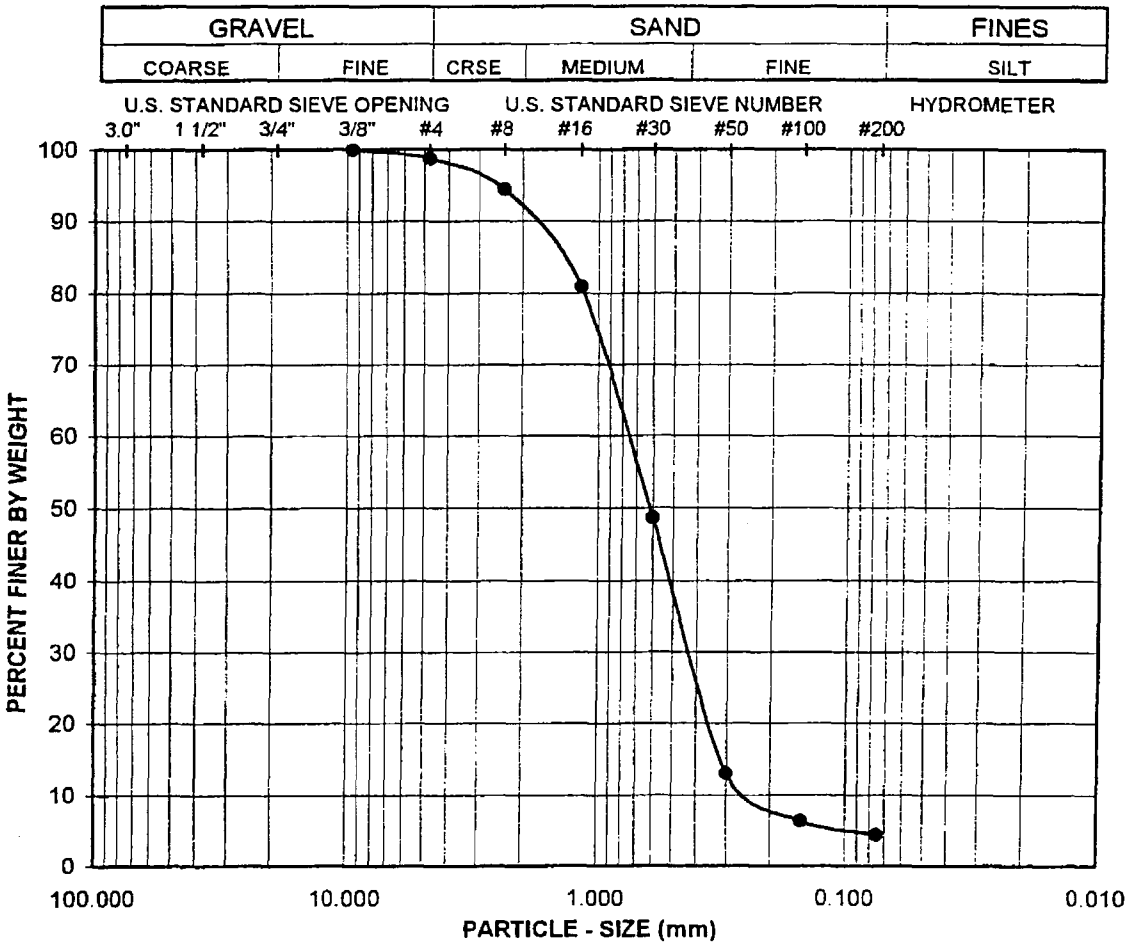
After Wet Sieve	Container No.	535
	Wt. of Dry Soil + Container (gm.)	628.99
	Wt. of Container (gm.)	82.22
	Dry Wt. of Soil Retained on # 200 Sieve (gm.)	546.77

U. S. Sieve Size (in.)	(mm.)	Cumulative Weight Dry Soil Retained (gm.)	Percent Passing (%)
6"	152.400	0.00	
3"	75.000	0.00	
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	7.34	98.7
#8	2.360	32.28	94.4
#16	1.180	109.36	80.9
#30	0.600	293.87	48.6
#50	0.300	497.32	13.0
#100	0.150	535.51	6.3
#200	0.075	546.25	4.4
PAN			

GRAVEL:	1 %	Liquid Limit:	
SAND:	95 %	Plastic Limit	
FINES:	4 %	Plasticity Index:	
GRP. SYMBOL:	SP	Cu = D60/D10 =	2.85
		Cc = $(D30)^2/(D60*D10)$ =	1.01

Remarks:





Sample ID:	Exploration Location:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
LK232	AA3-MW10	45	SP	1 : 95 : 4	, N/A,

Visual Sample Description:
Olive yellow poorly graded sand (SP)

Terratest Labs, Inc.

Project No.: 37380 / CTO 0078

Anomaly Area 3, Former MCAS El Toro, CA

ATTERBERG LIMITS, PARTICLE - SIZE CURVE

ASTM D 4318, D 422

12-02

SA LK232.xls

Appendix G
Response to Comments

Document Title:

Draft Final Remedial Investigation/Feasibility Study Report, Operable Unit 2C, Anomaly Area 3, Former Marine Corps Air Station, El Toro, California. April 2008.

Reviewer: Quang Than, Remedial Project Manager, Brownfields and Environmental Restoration Program, Department of Toxic Substances Control, comments transmitted via Email dated July 23, 2008, Wednesday, 18:12 pm.

Comment No.	Section/ Page No.	Comment	Response
GENERAL COMMENT			
1.		DTSC has reviewed the subject document and found that it has adequately incorporated the Navy's responses to DTSC's comments on the draft document. The California Department of Fish and Game also found the subject document acceptable and requested that upon release, a copy of the Final RI/FS be sent to their agency.	Comments Noted.

Document Title:

Draft Final, Remedial Investigation/Feasibility Study Report, Operable Unit 2C, Anomaly Area 3, Former Marine Corps Air Station, El Toro, California. April 2008.

Reviewer: John Broderick, Remedial Project Manager, California Regional Water Quality Control Board, comments dated August 1, 2008.

Comment No.	Section/ Page No.	Comment	Response
GENERAL COMMENT			
1.		You will recall that in our previous letters of January 26, 2004, July 26, 2004, February 16, 2006, and September 17, 2007 (copies enclosed) we advised you that we disagree with your determination of the Anomaly Area 3 (AA3) landfill site as a CERCLA release site. The AA3 site is a former borrow pit that was backfilled with construction wastes and an unknown amount of Class III municipal solid waste (MSW). Four and one half feet of soil covers the site, except for isolated areas having only 2 feet of soil cover. **Because this site contains MSW, it is therefore subject to the requirements of California Code of Regulations (CCR) Title 27**, which include regulations covering groundwater monitoring, erosion control, and landfill cover construction. In the report, the Navy concluded that the landfill debris (waste) was not impacting the groundwater quality at the site; however, waste has been determined to be in contact with the groundwater. The Navy also concluded that "surface sediments at the site are not impacting water quality in the adjacent Aqua Chinon Wash." The conclusion appears to be based on the analytical results for soil and water samples that were collected both upstream and downstream of the landfill, but does not address the adequacy of erosion and sediment runoff controls at the landfill. According to the report, volatile organic compounds (VOCs) were not detected in ambient air samples and soil gas samples that were collected outside of the debris placement boundary or the waste footprint. VOCs were not detected in surface soil gas samples that were collected within the waste unit soil cover, but both methane and carbon monoxide were detected. VOCs were detected in soil gas samples that were collected within, or associated with, the debris itself.	The following responses address the following five issues raised in California Regional Water Quality control Board, Santa Ana Region's (RWQCB's) comments: 1. Classification of Anomaly Area 3 (AA 3) as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site 2. Applicability of state and federal solid waste regulations at California Code of Regulations (CCR) Title (tit.) 27 and Code of Federal Regulations (CFR) tit. 40 part 258 3. Evaluation of applicable or relevant and appropriate requirement (ARAR) status of landfill regulations at AA 3 including hazardous waste landfill regulations at CCR tit. 22 4. Applicability of CCR tit. 27, Section 20240(c) 5. Potential impact of landfill debris on surface water and groundwater at AA 3 ***Classification of AA 3 as a CERCLA Site*** The Navy notes RWQCB's differing opinion on the classification of AA 3 as a CERCLA release site. The following rationale is provided for classifying AA 3 as a CERCLA release site. As presented in the Remedial Investigation/Feasibility Study (RI/FS) Report, AA 3 is a former debris disposal area that was backfilled with predominantly construction debris. The debris that has been encountered at AA 3 includes concrete, rebar, metallic debris, metal/plastic pipes, and wood. Low concentrations of CERCLA hazardous substances have been reported in surface/subsurface soils at AA3 including semi-volatile organic compounds, dioxins, and furans. AA 3 was not a permitted solid-waste disposal facility/landfill. Therefore, it is appropriate to address AA 3 under CERCLA, since releases

Document Title:

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Reviewer: John Broderick, Remedial Project Manager, California Regional Water Quality Control Board, comments dated August 1, 2008.

Comment No.	Section/ Page No.	Comment	Response
		The CERCLA cancer risk was calculated for residential and industrial receptors to be within the 10^{-5} and 10^{-6} range; i.e. it is within the acceptable management range. The non-cancer results did not exceed 1. Three remedial alternatives for the AA3 site were evaluated: 1) no action, which is required to be evaluated under CERCLA; 2) limited grading of the site; and 3) installation of a landfill cap. Four versions of landfill cap designs were included in this evaluation. We have the following comments: The Navy has **not provided sufficient basis** for its conclusion that the waste at Site AA3, which is currently in contact with groundwater or within 5 feet of groundwater, has not historically impacted, and is not currently impacting, groundwater quality at the site. Moreover, CCR Title 27, Section 20240 (c), specifically requires a minimum of 5 feet of separation between the base of the waste and the highest anticipated elevation of groundwater. • **11.3 ARARs Evaluation, Page 11-3:** The Navy has identified the State's hazardous waste landfill regulations (CCR Title 22) as the ARARs (applicable, relevant and appropriate requirements) for this landfill site. **Unit AA3 was used for disposal of general industrial waste and MSW, with a minor component of unknown and possibly hazardous waste.** Several other disposal units that were previously investigated at the Base were used in a similar fashion. As you are aware, we have consistently objected to the citing of hazardous waste landfill regulations as ARARs for the MSW landfill sites at the former MCAS El Toro. We acknowledge that, in some respects, the State's hazardous waste landfill requirements (CCR Title 22) are more stringent than the requirements for MSW landfill sites, because the threat to human health and the environment is typically greater at a	that occurred at AA 3 meet the following definition for releases under Section 101(22) of CERCLA: *"The term 'release' means any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles containing any hazardous substance or pollutant or contaminant)....."* Since CERCLA releases have occurred at AA 3, it is Navy's position that the response action evaluation process under CERCLA is appropriate for AA 3. As part of this process, the Navy as the lead federal agency for CERCLA response selection at former MCAS El Toro, has the authority to select an appropriate remedy for AA 3, based on risk assessment results, pursuant to Sections 104 and 120 of CERCLA, Executive Order 12580, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR part 300). The Navy is committed to selecting a response action for AA 3 under CERCLA that is protective of human-health and the environment (including groundwater and surface water) per the requirements of the Federal Facility Agreement (FFA) and in consultation with the Lead Regulatory Agency, the United States Environmental Protection Agency (U.S. EPA), and state regulatory agencies including the RWQCB and the California Department of Toxic Substances Control (DTSC). The Navy intends to address AA 3 under CERCLA; the response action at AA 3 will meet the substantive requirements of the State and Federal solid waste landfill regulations at CCR tit. 27 and 40 CFR Part 258, respectively, and hazardous waste landfill regulations at CCR tit. 22, to the extent that these regulations are determined to be ARARs for the response action. The Navy has performed an ARARs evaluation of all CCR tit. 27 regulations that were identified by the state as potential state ARARs for AA 3 in the RI/FS. In addition, the Navy has performed an ARARs evaluation of the pertinent solid waste landfill regulations at 40 CFR Part 258 in the RI/FS (see discussion below for details). ***Applicability of State and Federal Solid Waste Regulations*** The RWQCB notes that MSW was placed in landfill unit AA 3 after 1988. Therefore, the State and federal solid waste landfill regulations at CCR tit. 27 and 40 CFR Part 258, are the applicable regulations for this site, outside of

Document Title:

Draft Final, Remedial Investigation/Feasibility Study Report, Operable Unit 2C, Anomaly Area 3, Former Marine Corps Air Station, El Toro, California. April 2008.
Reviewer: John Broderick, Remedial Project Manager, California Regional Water Quality Control Board, comments dated August 1, 2008.

Comment No.	Section/ Page No.	Comment	Response
		hazardous waste landfill than an MSW landfill. However, your CERCLA risk assessment demonstrates that the hazardous risk associated with the AA3 landfill is not above the risk management range, and does not necessarily require any remedial action for the protection of human health. More appropriately, you must recognize that this landfill is an MSW landfill, and you have already determined that the waste is either in contact with groundwater, or is within 5 feet of historical high groundwater levels. In summary, MSW was placed in landfill unit AA3 after 1988. Therefore, the State and federal solid waste landfill regulations, CCR Title 27 and 40 CFR Part 258, are the applicable regulations for this site, outside of CERCLA requirements. Any closure or remedial action undertaken for this site must conform to and comply with the State and federal solid waste landfill requirements. Be advised that, should you omit CCR Title 27 and 40 CFR Part 258 as ARARs for landfill site AA3, you will be required to proceed with landfill remediation and closure for the protection of water quality under these same regulations, after you have completed the CERCLA response action.	CERCLA requirements. Subchapter 4 of CCR tit. 27 presents the requirements for development of closure/post-closure maintenance plans for solid waste landfills. The scope and applicability of this subchapter is discussed in Section 21770(b) of CCR tit. 27: *"(b) The regulations contained in this Subchapter apply to all solid waste landfills required to be permitted pursuant to PRC Section 44001 et seq. that were operating on or after January 1, 1988."* The Navy has reviewed historical aerial photographs of AA 3 from 1970 to 1992. The photographs dated 26 July 1988 and 20 January 1992 and a topographic map dated 5 November 1990 show AA 3 as an area that is filled in and graded. This evidence indicates that placement of construction debris at AA 3 occurred prior to 1988. In addition, AA 3 was not permitted pursuant to Public Resources Code (PRC) Section 44001 et seq. The purpose, scope, and applicability of requirements at 40 CFR Part 258 are presented in 40 CFR Section 258.1. 40 CFR Section 258.1(c) states that the minimum criteria established by 40 CFR Part 258 for municipal solid waste landfill (MSWLF) units do not apply to MSWLF units that do not receive waste after October 9, 1991. Construction debris placement occurred prior to 1988 and AA 3 did not receive debris after October 9, 1991. Therefore, the requirements of 40 CFR Part 258 are not applicable to AA 3. However, the substantive provisions of these regulations may potentially be relevant and appropriate for some of the remedial alternatives for AA 3. The Navy has determined that AA 3 does not constitute a new or existing classified solid waste management unit per CCR tit. 27. AA 3 is more akin to a closed, abandoned, or inactive (CAI) unit defined under CCR tit. 27. ***Evaluation of ARAR status of Landfill Regulations including Hazardous Waste Landfill Regulations at CCR tit. 22*** The preamble to the NCP indicates that state regulations that are components of a federally authorized or delegated state program are generally considered federal requirements and potential federal ARARs for the purposes of ARARs analysis (55 Fed. Reg. 8666, 8742 [1990]). The State of California has received final approval of its State Hazardous Waste Management Program (CCR tit. 22, div. 4.5). The regulations of CCR tit. 22, div. 4.5 (including landfill closure regulations) are therefore a source of

Document Title:

Draft Final, Remedial Investigation/Feasibility Study Report, Operable Unit 2C, Anomaly Area 3, Former Marine Corps Air Station, El Toro, California. April 2008.
Reviewer: John Broderick, Remedial Project Manager, California Regional Water Quality Control Board, comments dated August 1, 2008.

Comment No.	Section/ Page No.	Comment	Response
			potential federal ARARs for CERCLA response actions. The Navy is responsible for identifying federal ARARs at AA 3 as the lead federal agency. Pursuant to this, the hazardous waste landfill regulations at CCR tit. 22 were determined to be potential "relevant and appropriate" federal ARARs for the response action at AA 3. The Navy also determined that landfill closure and post-closure requirements at CCR tit. 27 and 40 C.F.R. 258 are potential ARARs for the remedial action at AA 3. Therefore, a stringency comparison was conducted for overlapping regulations at CCR tits. 22 and 27, and 40 C.F.R. 258 and the most stringent of the three regulations were identified as potential ARARs for AA 3 in the RI/FS Report (see attached Table H-7 from Appendix H). ***Applicability of CCR Tit. 27, Section 20240(C)*** Please note that Appendix H of the RI/FS Report presents an evaluation of the ARAR status of CCR tit. 27 Section 20240(c) and concludes that it does not constitute an ARAR for the remedial action at AA 3. Section 20240(c) of CCR tit. 27 states the following: *"Five-Foot Separation -**All new landfills, waste piles, and surface impoundments** shall be sited, designed, constructed, and operated to ensure that wastes will be a minimum of five feet (5 ft.) above the highest anticipated elevation of underlying ground water. **Existing landfills,** waste piles, and surface impoundments **shall be operated** to ensure that wastes will be a minimum of five feet (5 ft.) above the highest anticipated elevation of underlying ground water. For new and existing land treatment units, the base of the treatment zone shall be a minimum of five feet (5 ft.) above the highest anticipated elevation of underlying ground water and dischargers shall not be entitled to exemption under s20080(b)."* The above text indicates that Section 20240(c) of CCR tit. 27 applies to the following three scenarios: 1. Siting, design, construction, and operation of new landfills, waste piles, and surface impoundments; 2. **"Operating"** existing landfills, waste piles, and surface impoundments; and 3. New and existing land treatment units. Based on the Navy's evaluation, none of these three scenarios regarding the

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Draft Final, Remedial Investigation/Feasibility Study Report, Operable Unit 2C, Anomaly Area 3, Former Marine Corps Air Station, El Toro, California. April 2008.
Reviewer: John Broderick, Remedial Project Manager, California Regional Water Quality Control Board, comments dated August 1, 2008.

Comment No.	Section/ Page No.	Comment	Response
			applicability of Section 20240(c) of CCR tit. 27 to AA 3 are satisfied. Although AA 3 was historically a debris disposal area, it did not receive wastes after 1988. AA 3 is presently inactive and not in operation. Therefore, the requirements of CCR tit. 27, Section 20240(c) are not applicable to AA 3 whether the remedial action is conducted under CERCLA or outside of CERCLA. Furthermore, the substantive requirements of CCR tit. 27, Section 20240(c) are not relevant and appropriate for AA 3 for the remedial alternatives presented in the RI/FS Report based on the criteria for determining relevance and appropriateness listed in 40 C.F.R. Section 300.400(g)(2). The activities regulated by CCR tit. 27, Section 20240(c) are not sufficiently similar to the remedial alternatives developed for AA 3 to be relevant and appropriate and are not well suited to the site pursuant to 40 C.F.R. Section 300.400(g)(2)(i) and (iv) of the NCP. ***Potential Impact of Landfill Debris on Surface Water and Groundwater*** The RI concluded that based on the current conditions at the site, AA 3 was not impacting surface water quality. Due to the proximity of AA 3 to Agua Chinon Wash and based on the evaluation of the potential impacts during a 100-year storm event, all of the response alternatives (except Alternative 1, No action) include provisions to minimize the effects of erosion. The alternatives include grading to improve site drainage and dikes to prevent flooding/erosion during 100-year storm events. The groundwater sampling and statistical analysis conducted by the Navy indicate that there is no statistically significant release to groundwater at the point of compliance established for AA 3. Therefore, AA 3 is not currently impacting groundwater quality at the point of compliance. Groundwater monitoring at AA 3 was conducted in accordance with the Agency-approved Removal Site Evaluation (RSE) Work Plan (Earth Tech 2002). The constituents analyzed were those that could potentially pose a threat to human-health and/or the environment. Results indicated that these constituents do not pose a threat to human-health and/or the environment. A review of concentrations of naturally-occurring constituents, namely metals, indicates that debris placement activities have not adversely impacted groundwater quality. To confirm this conclusion, the DON conducted supplemental groundwater monitoring (ninth round) from all upgradient and downgradient wells in

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Draft Final, Remedial Investigation/Feasibility Study Report, Operable Unit 2C, Anomaly Area 3, Former Marine Corps Air Station, El Toro, California. April 2008.
Reviewer: John Broderick, Remedial Project Manager, California Regional Water Quality Control Board, comments dated August 1, 2008.

Comment No.	Section/ Page No.	Comment	Response
			February 2007 in accordance with the agency-concurred Sampling and Analysis Plan (SAP) Addendum #1 (Earth Tech 2007). This supplemental groundwater monitoring was performed based on RWQCB comments and included analyses for general minerals in addition to constituents that could potentially pose a threat to human-health and/or the environment. A statistical evaluation conducted using DUMPstat incorporated data from the supplemental sampling event and from eight previous monitoring rounds, and data from selected station-wide monitoring wells. This evaluation confirmed conclusions presented in the Draft RI/FS Report, i.e. there was no statistically significant release at the point of compliance. The monitoring results and statistical evaluation are presented in the Final Technical Memorandum, Anomaly Area 3, Supplemental Groundwater Monitoring (Earth Tech 2008). Regulatory agencies reviewed this Report and concurred with the conclusions and recommendations; a copy of this document was included as Appendix M of the Draft Final RI/FS Report.

References:

- *Final Work Plan Phase II Remedial Investigation/Feasibility Study*, MCAS El Toro (BNI 1995)
- *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites* (EPA 1991)
- *Presumptive Remedy for CERCLA Municipal Landfill Sites* (EPA 1993)
- Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills (EPA 1996)
- Final Work Plan, Removal Site Evaluation, Anomaly Area 3, Former Marine Corps Air Station El Toro, California (Earth Tech 2002)
- Final Sampling and Analysis Plan Addendum #1, Removal Site Evaluation, Operable Unit – 2C, Anomaly Area 3, Former Marine Corps Air Station El Toro, California (Earth Tech 2007)
- Final Technical Memorandum, Anomaly Area 3, Supplemental Groundwater Monitoring for Former Marine Corps Air Station El Toro, California (Earth Tech 2008).

Document Title:

Draft Final Remedial Investigation/Feasibility Study Report, Operable Unit 2C, Anomaly Area 3, Former Marine Corps Air Station, El Toro, California. April 2008.
Reviewer: Rich Muza, Remedial Project Manager, Federal Facility and Site Cleanup Branch comments dated June 24, 2008.

Comment No.	Section/ Page No.	Comment	Response
SPECIFIC COMMENTS			
1.	Section 8.5.6, General	EPA's previous comment #11 was adequately addressed by inclusion of a vapor intrusion assessment to consider potential indoor air risks arising from off-gassing of soil vapor or ground-water contamination into any future buildings on the site. This [vapor intrusion] VI assessment was performed using EPA's version of the Johnson-Ettinger model and incorporated what appears to be a mix of EPA and Cal/EPA DTSC default values. The risks predicted by this modeling are within the lower end of the Superfund target acceptable risk range. However, because this VI assessment addresses a future exposure scenario, there are inherent uncertainties in the risk estimate; these uncertainties are acknowledged in DTSC's "Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air" (December 2004, Interim Final): "Making a reasonable prediction for vapor intrusion into future buildings is difficult. Many variables may alter subsurface vapor concentrations and the physical properties of the subsurface in the future, including but not limited to: 1) vapor concentrations in the subsurface may increase, accumulating directly under the foundation of a future building, 2) moisture content of the vadose zone directly under a building may decrease due to the inability of rainwater to infiltrate under the building, and 3) air permeability and moisture content of the subsurface may be altered due to construction activities associated with building construction, thereby altering the subsurface air permeability and significantly increasing the potential for vapor intrusion to indoor air. Additionally, there may be significant variability in the quality of foundation materials as well as the construction quality of future buildings." Furthermore, construction activities may create preferential vapor migration pathways not addressed by the Johnson-Ettinger model. Although generally useful, the Johnson-Ettinger model does <u>not</u> accurately predict indoor air concentrations at a small percentage of sites. This observation may be due to the existence of preferential pathways for vapor migration through the subsurface and into buildings which are not incorporated into the model. Additional uncertainty with	Comment Noted. With the exception of Alternative 1, No Action and Alternative 4 – Clean Closure, the remedial alternatives include institutional controls (ICs) that would provide notifications that the site had been used for disposal of debris and would prohibit construction of residences or any permanently occupied facility for human habitation or any land disturbing activities that would compromise the integrity of the cover or monitoring equipment.

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Reviewer: Rich Muza, Remedial Project Manager, Federal Facility and Site Cleanup Branch comments dated June 24, 2008.

Comment No.	Section/ Page No.	Comment	Response
		the Johnson-Ettinger model is introduced by the use of soil matrix and ground-water concentrations as the input data for VOCs migrating to indoor air; the use of soil vapor concentration data for input is much preferred for Johnson-Ettinger modeling of the vapor intrusion pathway. For these reasons, EPA recommends that installation, during construction, of a vapor barrier and sub-slab depressurization system be considered for any buildings that might be constructed at the site in the future. A simple, inexpensive vapor barrier/depressurization system is described by the California Integrated Waste Management Board at 27 CCR 21190(g). It is Region 9's experience that adding this type of appropriate engineering control to the design and construction of any future development at a VI site is a prudent and cost-effective way to ensure protection of public health -- and mitigate potential liabilities -- in the face of the uncertainties attendant upon the potential for vapor intrusion in this type of contamination situation. If there is a potential for future construction of buildings at AA-3, EPA recommends that the deed to this property include a requirement for installation of vapor barrier and sub-slab depressurization systems during construction. Otherwise, EPA recommends that institutional controls be put in place such that there will be no potential for building on this site in the future.	
2.	Previous EPA Comment #46: Table 13-7	For Alternative 2 there are conflicting statements made under the criteria "Long-Term Effectiveness and Permanence" and "Reduction of Toxicity, Mobility, or Volume through Treatment" with regard to infiltration potential. It is recommended that this issue be clarified. This previous comment was adequately addressed in the RTCs but the response was not incorporated into the changes made to the table.	The previous response to U.S. EPA's comment #46 indicated the statement under the *Reduction of Toxicity, Mobility, or Volume through Treatment* would be revised to read: "Does not significantly reduce existing infiltration potential or production of leachate." However, during the preparation of the Draft Final Remedial Investigation/Feasibility Study (RI/FS) Report, the text under the criteria of *Reduction of Toxicity, Mobility, or Volume through Treatment* was revised to read: "*Reduces infiltration and potential of leachate. No reduction in the volume of landfill materials. Installation of landfill gas controls in the form of vertical wells and horizontal trenches prevents potential landfill gases from migrating beyond the 100-foot buffer zone.* " The term "Reduces" was used in lieu of "Does not

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Reviewer: Rich Muza, Remedial Project Manager, Federal Facility and Site Cleanup Branch comments dated June 24, 2008.

Comment No.	Section/ Page No.	Comment	Response
			significantly reduce existing" in the text. As a result of this rephrasing, the rating of Alternative 2 was changed from "Low" to "Moderate" since Alternative 1 (No Action) was rated as "Low." This new statement and revised rating in the Draft Final version of the Report also reflects the fact that grading to promote efficient drainage and minimize infiltration would be performed as part of Alternative 2.
3.	Previous EPA Comment #47: Table 13-7	Under the criteria "Reduction of Toxicity, Mobility, or Volume through Treatment", Alternative 2 is rated "low" which is the same rating as that for the "no action" alternative. However, Alternative 2 would include the installation of landfill gas controls. It is recommended that the assigned rating for Alternative 2 be reconsidered. This previous comment was adequately addressed in the RTCs but the response was not incorporated into the changes made to the table.	The previous response to U.S. EPA comment #47 stated: "Rating scales will be revised to be more representative. Rating scales will include Low, Low-Moderate, Moderate, Moderate-High, and High. The rating for Alternative 2 will be revised to 'Low-Moderate'." As stated in response to comment #2 above, during the preparation of the Draft Final RI/FS, the rating for this criterion was revised to "moderate" to reflect the fact that grading to promote efficient drainage and minimize infiltration would be performed as part of Alternative 2.

DEPARTMENT OF THE NAVY
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
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5090
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June 28, 2004

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Fellow Federal Facility Agreement (FFA) Representatives:

Subj: RESPONSE TO COMMENTS ON DRAFT EXPANDED SITE INSPECTION REPORT, ANOMALY AREA 3, FORMER MARINE CORPS AIR STATION (MCAS) EL TORO, CALIFORNIA

The Navy has reviewed comments by the United States Environmental Protection Agency (EPA), California Department of Toxic Substances Control (DTSC), and California Regional Water Quality Control Board, Santa Ana Region (RWQCB) on the Draft Expanded Site Inspection Report (ESI), Anomaly Area 3, Former Marine Corps Air Station (MCAS) El Toro, California (November 2003) and is hereby submitting its Response to Comments (RTCs) for your records. The responses were discussed at the Base Realignment and Closure (BRAC) Cleanup Team (BCT) meeting held on May 26, 2004.

The Navy agrees that sampling and analysis conducted at Anomaly Area 3 have documented a release of low concentrations of hazardous substances from the site, including volatile organic compounds, semi-volatile organic compounds, petroleum hydrocarbons, and metals detected in groundwater, soil, or soil gas at the site. The Navy further agrees that additional site characterization of Anomaly Area 3 pursuant to

a Remedial Investigation/Feasibility Study (RI/FS) is required and that a no further action determination is not appropriate at this time.

The Navy intends to address this site pursuant to its authority under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Defense Environmental Restoration Program (DERP) as provided by the Federal Facility Agreement (FFA). Anomaly Area 3 will be integrated into the remedy selection process for Installation Restoration Program (IRP) Site 3.

The FFA is the appropriate framework and process for resolving the RWQCB concerns expressed in their comments. The Navy proposes to undertake an RI/FS addressing Anomaly Area 3 and any necessary additional CERCLA response actions pursuant to the FFA. The RWQCB is a signatory to the FFA and the Navy presumes that the RWQCB will abide by its terms and conditions. The RWQCB will be provided with the opportunity to participate in development of the RI/FS work plan to ensure that its data collection concerns are addressed, and the Navy will request the RWQCB to identify potential "applicable or relevant and appropriate" requirements ("ARARs") administered by the RWQCB as required by CERCLA and the FFA at the appropriate times. The FFA provides an agreed-upon decision-making process for resolution of any disputes that may arise in the course of the remedy selection process.

The Navy proposes Anomaly Area 3 be an agenda topic for discussion at our next BCT meeting of July 28, 2004. Should you have questions or need additional information, please contact Mr. Kamig Ohannessian, Remedial Project Manager, at (619) 532-0796 or me at (619) 532-0784.

Sincerely,

F. ANDREW PISZKIN
Base Realignment and Closure
Environmental Coordinator
By direction of the Commander

Encl: (1) Response to Review Comments by John Broderick (RWQCB) on the Draft Expanded Site Inspection Report, Anomaly Area 3, MCAS El Toro (November 2003).
(2) Response to Review Comments by Nicole Moutoux (EPA) on the Draft Expanded Site Inspection Report, Anomaly Area 3, MCAS El Toro (November 2003).

SENSITIVE RECORD

PORTIONS OF THIS RECORD ARE CONSIDERED SENSITIVE AND ARE NOT AVAILABLE FOR PUBLIC VIEWING

ADDRESS OF PRIVATE CITIZEN

FOR ADDITIONAL INFORMATION, CONTACT:

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5090
Ser 06CC.AP/0604
June 28, 2004

(3) Response to Review Comments by David Murchison (DTSC) on the Draft Expanded Site Inspection Report, Anomaly Area 3, MCAS El Toro (November 2003).
(4) Response to Review Comments by John Christopher (DTSC) on the Draft Expanded Site Inspection Report, Anomaly Area 3, MCAS El Toro (November 2003).
(5) Response to Review Comments by Regina Donohoe and Victoria Lake (California Department of Fish and Game at the request of DTSC) on the Draft Expanded Site Inspection Report, Anomaly Area 3, MCAS El Toro (November 2003).

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Document Title:

(1) Draft Expanded Site Inspection Report, Anomaly Area 3, Former Marine Corps Air Station, El Toro, California, November 2003

Reviewer: Nicole Moutoux, Project Manager, Federal Facilities Cleanup Branch, 12 February 2004

Comment No.	Section/ Page No.	Comment	Response
EPA has reviewed the above-referenced report regarding Anomaly Area 3. Based on the results of this investigation, the Navy recommends No Further Action for Anomaly Area 3 (AA 3). EPA is unable to concur with this conclusion due to various factors which are outlined in our enclosed comments. While this report provides a good first step in characterizing contamination at AA 3, we believe that more information as well as further discussion is needed in order to determine the appropriate action for this site.			
GENERAL COMMENTS			
1.		Since identifying Anomaly Area 3 (AA3), the Navy has stated that the presumptive remedy of capping is the appropriate remedy for AA3. Prior discussions, sampling plans, correspondence with the public and the team have primarily involved the assumption that AA3 was a landfill that must be capped. As such, much of the sampling design was developed in order to support cover design. As you know, under CERCLA, a determination of No Further Action means that the future owner can do anything they like with the property, including digging out the entire contents of AA3. Because contamination was found in the soil gas, subsurface as well as groundwater, unless the Navy plans to conduct a thorough sampling of the contents of the landfill, achieving No Further Action is not a realistic recommendation for this site.	The Navy agrees that the sampling and analysis conducted pursuant to the final removal site evaluation (RSE) work plan (August 2002) has documented a release of low concentrations of hazardous substances at Anomaly Area 3, including volatile organic compounds, semi-volatile organic compounds, petroleum hydrocarbons, and metals detected in groundwater, soil, or soil gas at the site. The Navy further agrees that additional site characterization of Anomaly Area 3 pursuant to a Remedial Investigation/Feasibility Study (RI/FS) is required and that a no further action determination is not appropriate at this time. The Navy intends to address this site pursuant to its authority under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Defense Environmental Restoration Program (DERP) as provided by the Federal Facility Agreement (FFA). As previously agreed by the Base Realignment and Closure (BRAC) Cleanup Team (BCT), Anomaly Area 3 will be integrated into the remedy selection process for Installation Restoration Program (IRP) Site 3. The FFA is the appropriate framework and process for resolving the EPA concerns expressed in their comments. The Navy proposes to undertake a RI/FS addressing Anomaly Area 3 and any necessary additional CERCLA response actions pursuant to the FFA. The FFA provides an agreed-upon decision-making process for resolution of any disputes that may arise in the course of the remedy selection process.

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(1) Draft Expanded Site Inspection Report, Anomaly Area 3, Former Marine Corps Air Station, El Toro, California, November 2003

Reviewer: Nicole Moutoux, Project Manager, Federal Facilities Cleanup Branch, 12 February 2004

Comment No.	Section/ Page No.	Comment	Response
2.		In many instances throughout the report the Navy subtracts background risk from total risk. This practice is not acceptable to EPA. The risk contributed by background is something that may be taken into account when making a risk management decision. However this decision is not made until later in the CERCLA process. In addition, there is language throughout this report, which implies that because the risk is in the "risk range", it is acceptable. This is not appropriate justification and should not be referenced. The point of departure for risk at a specific site may be appropriate and is not a justification for not taking action, particularly at this point in the process.	Consistent with both EPA and Navy policy, the report presents both the total site risk and the risk without background contribution in two phases of the risk evaluation (screening preliminary risk evaluation [PRE] and the site-specific PRE) to provide risk managers and decision makers with the risk attributable to any releases from the site. Text relating to the risk range and point of departure will be modified to reflect that cancer risk is acceptable if it is less than the 10^{-6} point of departure, as specified in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), or may be acceptable if it falls within the 10^{-6} to 10^{-4} range depending on site-specific and other factors considered appropriate for risk point-of-departure analysis (see NCP Preamble).
3.		Analyses of groundwater samples collected in the two groundwater monitoring wells installed in the uppermost aquifer down gradient of the disposal site (MW1 and MW2) indicate that there is a potential on-going release of hexavalent chromium from the site. The average total chromium concentrations detected in samples collected from the down gradient wells is 112 µg/L (maximum 296 µg/L). The average total chromium concentration detected in groundwater samples collected from all other wells at AA 3 is 4 µg/L (maximum 20.1 µg/L). Please revise the report to discuss how the Navy will characterize the extent of this potential release. In addition, the possible presence of an industrial chemical in groundwater down gradient of the site indicates that the site may have been used for the disposal of industrial wastes.	Low concentrations of hazardous contaminants have been released to groundwater at Anomaly Area 3. Based on regulatory comments and concerns, the Navy will continue the CERCLA process at the site and conduct a further investigation. The characterization of the nature and extent of any release at Anomaly Area 3 will be addressed in the RI phase of the CERCLA IRP. The EPA will be provided with the opportunity to participate in development of the RI/FS work plan to ensure that its data collection concerns are addressed.
SPECIFIC COMMENTS			
1.	Section 2.2, Land Use, Page 2-5	This section states that records indicate that some of the borrow pits and trenches were backfilled with construction debris and later covered with 5 feet or more of fill soil. However, on page xi of the Executive Summary and on page 9-11, the text states that 2-5 feet of soil cover was encountered over the construction debris at AA 3. Please explain this discrepancy or revise the document so that the reported depth of fill soil is consistent.	Section 2.2 discusses results and conclusions based on a previous investigation conducted by IT/OHM (IT/OHM 2000). The references to the depth of soil cover in page ix of the executive summary and on page 9-11 reflect updated information based on the results of the RSE investigation. The text in Section 2.2 will be modified to clarify that a 2 to 5-foot soil cover was reported in the RSE investigation.

Document Title:

(1) Draft Expanded Site Inspection Report, Anomaly Area 3, Former Marine Corps Air Station, El Toro, California, November 2003

Reviewer: Nicole Moutoux, Project Manager, Federal Facilities Cleanup Branch, 12 February 2004

Comment No.	Section/ Page No.	Comment	Response
2.	Section 3.4, Geophysical Investigation, Page 3-5	The existence of a large area of elevated electrical conductivity in the central portion of the survey area is mentioned, but its significance is never discussed. Please explain the significance of this elevated electrical conductivity.	This section discusses the results and conclusion of previous geophysical investigation conducted by IT/OHM (IT/OHM 2000). The large area of elevated electrical conductivity in the central portion of the survey area, as reported in the IT/OHM report, refers to an area containing possible imported fill. Since the native soils at the site appear to consist of low-conductivity, clean sands deposited by Agua Chinon wash, it is likely that the conductive soils in the middle of the site are imported fill material (IT/OHM 2000).
3.	Table 3-3, Details of Subsurface Soil Sampling from Trenches – Previous Investigation, Page 3-7	Strong odors, including a petroleum odor at 5 to 7 feet bgs at Trench 2E and a sweet chemical odor at 3 to 5 feet below ground surface (bgs) at Trench 4E, were noted during this investigation. These strong odors below the ground surface may indicate the presence of contamination but are not addressed in later investigations or in this report. Please explain why the presence of these strong odors is not addressed by the investigations, or alternatively, why is it not indicative of contamination at AA 3.	Table 3-3 is a compilation of the results of trench exploration at AA 3 site as part of previous investigations (IT/OHM 2000). To address the presence of odors below ground surface, soil samples were collected during the IT/OHM field investigation, and the results are presented in Table 3-4 of the report and summarized as follows. At Trench 2E, a soil sample from a location with strong odor (20242-1102) was collected at 4 feet bgs and analyzed for a suite of analyses (TPH diesel and gasoline, VOCs, SVOCs, metals, perchlorate, asbestos, dioxins and furans). Detected analytes include TPH as diesel (5,600 mg/kg), acetone (100 µg/kg), methylene chloride (9.2 µg/kg) and inorganic compounds. At Trench 4E, a soil sample (20242-1109) was collected at 6 feet bgs and analyzed for the same suite of analyses. Detected analytes include TPH as diesel (170 mg/kg), acetone (46J µg/kg), low concentrations of dioxins and furans, and inorganic compounds. These data were incorporated into the risk assessment data set.

Document Title:

(1) Draft Expanded Site Inspection Report, Anomaly Area 3, Former Marine Corps Air Station, El Toro, California, November 2003

Reviewer: Nicole Moutoux, Project Manager, Federal Facilities Cleanup Branch, 12 February 2004

Comment No.	Section/ Page No.	Comment	Response
4.	Section 4.5.2, Ambient Air Sampling, Page 4-10	Ambient air sampling was "conducted at the perimeter of the debris to assess the potential impact offgas (sic) emissions on the surrounding air quality, and to assess the background levels of constituents in air and meet the requirements of SCQAMD Rule 1150.1." Please explain how site emissions were differentiated from background levels.	Ambient air samples were collected over a 24 hour period at locations upwind and downwind of the site. These results were used to evaluate impact to ambient air quality. In addition, the integrated air sample results were compared to the ambient air samples collected upwind and downwind of the site. The evaluation of these data is presented in the following sections of the report: Sections 4.5.2, 4.5.3, and 6.2.1 through 6.2.3.
5.	Section 4.5.3, Integrated Surface Air Sampling, Page 4-13	Please explain why a multigas meter and photoionization detector were used during sampling in Grids 1-4 but not Grids 5-8.	The text will be revised to indicate that a flame ionization detector (FID) and not a PID was used. In addition, the text will also explain why the FID measurements were not recorded in the field. SCAQMD Rule 1150.1 does not specify the use of multigas meter and a FID. However, RSE sampling design specified that all samples containing more than 50 ppmv volatile organic compounds as methane, as reported by a field instrument, should be submitted to the laboratory for analysis. Even though the FID field readings from Grids 1 though 4 were all less than 50 ppmv, a field decision was made to submit all samples collected from 8 grids (~50,000 square foot grids) to the laboratory for analysis. Since a decision that all samples would be sent to the laboratory was made, field FID measurements were ceased after Grid 4.
6.	Section 4.6, Soil Gas Sampling, Page 4-14	This section states that "approximately 33 boreholes... were drilled." Please explain why this number is an approximation and why the exact number of boreholes is unknown, or change this sentence to indicate the exact number of boreholes that were drilled.	The sentence will be corrected to read "'Thirty-three boreholes...were drilled....."
7.	Section 4.7.2, Soil Cover Thickness Evaluation, Page 4-16	This section states that "continuous core soil samples were collected at critical locations to evaluate the thickness of fill soil." Please provide greater detail about these "critical locations," including how many there were and how they were chosen as the critical locations.	The sentence will be revised to remove reference to critical locations, and to state continuous cores were collected at locations to provide coverage of the entire site.

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Reviewer: Nicole Moutoux, Project Manager, Federal Facilities Cleanup Branch, 12 February 2004

Comment No.	Section/ Page No.	Comment	Response
8.	Table 4-3, Lithology of Continuous Core Soil Samples-RSE Investigation, Page 4-17	In the Lithology column, many of the descriptions specify "No debris." However, the descriptions that do not specify "No debris" also do not specify if there was debris, and if so, the nature of this debris. Please revise the table to indicate whether debris was found at the locations where the descriptions do not specify "No debris" as well as what type of debris was encountered.	The table will be revised to include the nature of the debris, when found.
9.	Section 4.10, Surface Water Sampling, Page 4-20	According to this section, the surface water samples results were evaluated based on comparison to groundwater quality criteria. Please explain why it is appropriate to compare these results to groundwater quality criteria as opposed to ecological screening levels.	In accordance with the final work plan, the threshold levels that were used as screening criteria to evaluate the necessity of further assessment of detected analytes in surface water (page 4-9 of the final work plan [August 2002]) are the federal and California MCLs or drinking water advisory thresholds. In absence of MCLs, EPA Region 9 PRGs for tap water were used. However, for the ecological risk assessment, surface water results were evaluated against ecological screening values.
10.	Section 4.11, Analytical Laboratory Date Validation, Page 4-21	The phrase "method blank issues' is vague. Please explain in greater detail the adjustment of reporting limits for methylene chloride and TPH.	A brief paragraph detailing the adjustment of reporting limits for methylene chloride and TPH will be provided in the revised text.

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Comment No.	Section/ Page No.	Comment	Response
11.	Section 5.3, Refined Hydrogeology of the Site and Figure 5-6, Groundwater Equipotential Map	Groundwater monitoring well MW10, although installed downgradient of the landfill, do not appear to be screened in the same water-bearing unit as MW1 and MW2. Figure 5-4 indicates that MW1 and MW2 are screened in alluvium where as MW10 is screened in bedrock. In addition, the groundwater elevation in MW10 is anomalously high compared to the groundwater elevations in MW1 and MW2. The way the equipotentials are drawn in Figure 5-4, MW1, which has been impacted by site constituents, is shown as being upgradient of the landfill, which is clearly not correct. Please redraw the groundwater equipotential map without using data from MW10 and any other monitoring well not installed in the uppermost water-bearing stratum at the site.	During the comment period for the draft RSE work plan for the site, the proposed well network for the AA 3 site was refined based on DSTC GSU's concern that there might be a possibility of more than one aquifer at the site (please refer to Appendix B of the final work plan). In response to GSU's comment, the Navy suggested installing a dual nested well at MW09 location (MW09A and MW09B) with one well screened in the alluvium and one screened in the bedrock. MW10 was also proposed to be screened in the bedrock. It was proposed that if there was more than one aquifer present beneath the site, then the groundwater gradient in alluvium would be estimated using wells MW09A, MW01 and MW02, and the groundwater gradient in the bedrock would be estimated from wells MW09B, MW10 and MW04. However, in the field, bedrock was not encountered at MW09B and therefore, MW09B was also screened in the alluvium. MW10 was screened in the bedrock. Table 5-1 presents the historical depth-to-groundwater readings for all wells at the site. The groundwater elevation at MW10 (426.28 feet above MSL) is not anomalously high when compare to MW01 (431.81 feet above MSL) and MW02 (421.00 feet above MSL) [December 2002 gauging event]. Groundwater equipotential lines on Figure 5-6 were drawn using data from all wells since the bedrock and alluvial aquifers encountered at the site appeared to be hydraulically connected.
12.	Table 5-7, Wildlife Species Documented On and Adjacent to AA 3	Please use bold text or some other method to denote any State or federally-endangered animals listed in Table 5-7.	The suggestion will be incorporated in the revised text.

Document Title:

(1) Draft Expanded Site Inspection Report, Anomaly Area 3, Former Marine Corps Air Station, El Toro, California, November 2003

Reviewer: Nicole Moutoux, Project Manager, Federal Facilities Cleanup Branch, 12 February 2004

Comment No.	Section/ Page No.	Comment	Response
13.	Section 6.1, Physical Extent of Debris Placement Area, Page 6-2	According to this section, "Based on the definition of inert waste in the State of California Public Resource Code Section PRC 48007 *'inert waste' means rock, concrete, brick, sand, soil and cured asphalt only'*, the debris encountered in AA3 site trenches would be classified as inert construction debris." It seems that since waste encountered includes wire, metallic debris, PVC tubing, asbestos pipes, and other materials not included in this definition of inert waste, not all of the debris encountered should be considered inert construction debris. For example, Title 22 Section 66261.24 indicates that if the pipe is greater than 2 percent asbestos, it is considered to be hazardous waste, Please address this inconsistency.	Comment Noted. The text will be revised to state that the waste encountered was construction related debris.
14.	Section 6.2.2, Integrated Surface Air Sampling Results, Page 6-18	The concentrations of detected analytes are compared to median and maximum concentrations published by California Air Resources Board for statewide landfill testing. Please also compare the concentrations to residential preliminary remediation goals (PRGs).	The RSE evaluation was based on the DQO methodology (a method that supports decision making by developing sampling designs for data collection activities). Step 3 of this process refers to the identification of the inputs to the Project Decision. The threshold levels that were used as screening criteria to evaluate the necessity of further assessment of detected analytes in air (page 4-9 of the final work plan [August 2002]) are the CARB study median concentrations that were proposed for the integrated and ambient air samples in the Final Work Plan Phase II Remedial Investigation/Feasibility Study (BNI 1995). As requested, the concentrations of detected analytes will be compared to the residential PRGs.

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Reviewer: Nicole Moutoux, Project Manager, Federal Facilities Cleanup Branch, 12 February 2004

Comment No.	Section/ Page No.	Comment	Response
15.	Section 6.3.2, Subsurface Soil Gas Sampling Results, Page 6-23	At a depth of 15 feet bgs, three locations (HA16, HA18, and HA21) exceeded the Title 27 CCR stipulated LEL of 50,000 ppmv for methane. This exceedance is noted, but no remedial action to reduce methane levels is suggested and the report concludes that the installation of a landfill gas collection system at AA 3 is not warranted. Please explain how these exceedances will be addressed.	The methane concentrations at HA14, HA18 and HA21 locations appear to be localized and do not appear to be migrating. Soil gas samples collected at locations 10 feet above and 50 feet laterally from these exceedance locations (15 feet samples collected at HA14, HA18, and HA21) did not show any methane detections, suggesting a limited volume of methane in a localized area. Title 27 requires response actions when the methane LEL of 50,000 ppmv is exceeded at the site boundary. The Navy has recently discussed and reached agreement with the California Integrated Waste Management Board (CIWMB) and California Department of Toxic Substances Control (DTSC) and other FFA Signatories regarding proposed engineering and institutional controls pertaining to landfill gas control measures at Installation Restoration Program (IRP) Site 3 (Original Station Landfill), IRP Site 5 (Perimeter Road Landfill), and Anomaly Area 3. The proposed engineering and institutional controls will be incorporated into the appropriate CERCLA documents (e.g., FS Addendum and revised Draft Proposed Plan for IRP Sites 3 and 5) for review and comment by fellow FFA Signatories. The Proposed Plan will then be published for public review and comment following regulatory concurrence.
16.	Section 6.3.4, Summary of Nature and Extent of Chemical Contamination -Subsurface Soil Gas, Page 6-28	This section states that "The detection of several VOCs in the perimeter soil vapor wells was inconsistent with the non-detect VOC results in all of the shallow and subsurface soil gas samples collected from within the debris placement boundary." Please provide an explanation for this inconsistency. Please also address whether the different methods used (soil vapor wells vs. direct push technology) may play a role.	The detection of VOCs in the perimeter soil gas samples were attributed to well construction rather than from the waste placement area. This premise is supported by Round 2, 3 and 4 perimeter soil gas sampling results during which very low VOC concentrations were detected.

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Comment No.	Section/ Page No.	Comment	Response
17.	Table 6-8, Summary of Detected Analytes – Subsurface Soil Gas (15 feet bgs) Survey – RSE Investigation, 6-31	Please include locations HA16 and HA18, with methane concentrations exceeding 5 percent, in this table.	Table 6-8 is a summary of analytical results of samples that were sent to a fixed laboratory for analysis. Since the samples collected from HA16 and HA18 were not sent to the laboratory for analysis, they are not presented in this table. However, Table 6-7 presents the field screening results of all subsurface soil gas samples collected, including samples from HA16 and HA18.
18.	Section 6.4.2, Subsurface Soil Sampling – Previous Investigation, Page 6-69	This section states that "the metals not listed in Table 6-19 but detected include... lead (3 detections; 24.6 to 677 mg/kg)." Table 6-19 does list lead, and indicates that there were 24 detections (2.22 to 677 mg/kg). Please revise so that the tables and text are consistent.	The text will be revised to include all metal detections.
19.	Sections 6.5.5, Summary of Groundwater Sampling Results, Page 6-72	This section concludes that there is no impact to the groundwater from the site. Given the detection and/or MCL exceedances of several chemicals and metals, the likelihood that some of the waste is in direct contact with the groundwater, as well as the fact that the entire contents of the landfill is not known, the conclusion that "the site did not receive any debris that could cause chemical contamination in the groundwater" is not supported by the results presented in this report.	Please see the response to General Comment #3. Low concentrations of hazardous contaminants have been released to groundwater at Anomaly Area 3. Based on regulatory comments and concerns, the Navy will continue the CERCLA process at the site and conduct a further investigation. The characterization of the nature and extent of any release at Anomaly Area 3 will be addressed in the RI phase of the CERCLA IRP. The EPA will be provided with the opportunity to participate in development of the RI/FS work plan to ensure that its data collection concerns are addressed.

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Comment No.	Section/ Page No.	Comment	Response
20.	Section 7.2.2, Sample Reporting Limit Evaluation, Page 7-3	The process described here is inconsistent with the values presented in Table 7-1. The text notes that the screening criteria for analytes detected in groundwater are the federal maximum contaminant level (MCL). However, with the exception of the screening criteria for petroleum hydrocarbons, all of the screening values for analytes in groundwater represent the tap water PRGs. Please correct the text. In addition, the text here states that for soils, "essentially all of the chemicals exhibited a predominance of reporting limits at or less than the screening criteria." However, according to the information presented in Table 7-1, the frequency that the reporting limit exceeded the applicable screening criteria (defined as FOE in the footnotes to Table 7-1) typically exceeds 50 percent and appears to be 100 percent for a substantial number of analytes. Please clarify this discrepancy.	The text will be corrected to rectify this inconsistency and discrepancy.
21.	Section 7.2.3.2, Elevated Reported Limits, Page 7-4	Please provide a summary of data that were not included in the risk assessment because of elevated detection limits.	A summary table of the data excluded from the risk assessment due to detection limit concerns will be added to the report.
22.	Section 7.2.3.2, Summary Statistics for Sample Data, Page 7-15	A uniform assumption that all data are lognormally distributed is not appropriate. A 95 percent upper confidence limit (UCL) on the arithmetic mean based on a lognormal distribution should only be calculated when the data can be shown to approximate a lognormal distribution. Further, when the data do not appear to fit either a normal or lognormal distribution, the assumption that they represent a single population should be carefully reexamined. Alternate methods for calculating exposure point concentrations for data that are neither normally nor lognormally distributed are presented in EPA, 2002a, and should be used in place for simply assuming a lognormal distribution when calculating the exposure point concentration.	The Navy recognizes that a uniform assumption of lognormality may not accurately represent the data set being evaluated. However, in most instances, the assumption will result in an over-estimation of the 95 percent UCL and subsequent over-estimation of the associated risk. The data sets will be re-evaluated as suggested using the EPA ProUCL program for estimating the 95 percent UCL using normal, lognormal, or bootstrap procedures as appropriate.

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Comment No.	Section/ Page No.	Comment	Response
23.	Section 7.4.2, Conceptual Site Model, Page 7-38	Exposure to contaminants in groundwater should be evaluated as a complete pathway for the residential scenario. While Section 7.4.3.2.4 notes that exposure to groundwater could be a complete pathway if used as a source of domestic water, no further explanation is provided as to why exposure to groundwater was not considered for future residents despite the fact that the report notes on page 7-1 that groundwater is classified as a potential drinking water source.	Comment Noted. Exposure to groundwater will be evaluated as a complete pathway.
24.	Figure 7-1, Conceptual Site Model, Page 7-35	According the matrix, exposure to contaminants in groundwater is considered incomplete via bioaccumulation and consumption of food, while the associated rationale states that exposure to groundwater is potentially complete if it is pumped for agricultural purposes. Further explanation is needed why use of groundwater for irrigation of food crops (either locally or in backyard gardens) should not be evaluated as a complete exposure pathway.	See response to Specific Comment #23.
25.	Section 7.4.4, Estimation of Exposure Point Concentrations Page 7-38	It is not clear why the exposure point concentration is described here as the concentration "upon which further action is predicated." EPA defines the exposure point concentration as the average concentration contacted at the exposure points over the duration of the exposure period. It does not represent a level on which to base further action. In addition this approach is contrary to EPA policy on the separation of risk assessment and risk management. Please revise the definition of the exposure point concentration. As noted in our previous comment, a uniform assumption of a lognormal distribution is not appropriate. Use of the Land method to calculate a 95 percent UCL should only be done when the data clearly fit a true lognormal distribution.	Acknowledged. The text will be revised to delete the term "upon which further action is predicated", since the qualification appears to mislead the reviewer. The intent was that the EPC was the basis of the risk characterization and if this risk were above an acceptable value, then this EPC would be the basis for developing a response action. Also, please see response to Specific Comment #22.
26	Section 7.5.1.2, Toxicity Values for Carcinogens, Pages 7-41 to 7-42	For completeness, this section should also present a description of the current weight of evidence narrative system (i.e., "known/likely," "cannot be determined," and "not likely") for classifying human carcinogenic potential as described in the Guidelines for Carcinogen Risk Assessment (EPA, 1999). In addition, the statement that "data are not yet sufficient to apply the 'threshold' concept in the development of risk assessments for carcinogen" should be clarified or deleted. For certain chemicals (e.g., chloroform). EPA uses a threshold for evaluating potential carcinogenic effects.	Acknowledged. The text will be modified to be consistent with the reviewer's comments.

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Reviewer: Nicole Moutoux, Project Manager, Federal Facilities Cleanup Branch, 12 February 2004

Comment No.	Section/ Page No.	Comment	Response
27.	Section 7.5.1.3, Availability of Toxicity Values, Page 7-42	The discussion here regarding the "dose of the toxicant that reaches the target organ" is incorrect and misleading. EPA toxicity criteria for evaluating oral and inhalation exposures are based on an external dose. As such, pharmacokinetic processes that would account for a differential dose at the site of injury are accounted for by comparing the applied dose to the measured effect. Hence, the information presented in the second paragraph should be deleted, particularly in light of the fact that toxicity values are not presented anywhere in the PRE.	It is true that toxicity indices (i.e., cancer slope factors and non-cancer reference doses) are based on the "applied" dose. As such if the dose applied to determine the toxicity indices is administered via an exposure medium that is similar or the same as that which will result in exposure, no bioavailability correction would be necessary. However, this seldom holds true. Specifically, the determination of the cancer slope factor and non-cancer reference doses for arsenic are based on water exposures; clearly a medium that presents the chemical to a receptor in a highly bioavailable form. Alternatively, exposures via a soil medium will tend to be much less available relative to the chemical in the water medium. The "dose" discussion in the text will be retained.
28.	Tables 7-4 to 7-7, Screening PRE Results	The footnotes to these tables describe the calculation of the 95 percent UCL of the mean for lognormally distributed data, and state that the H-static was obtained from EPA, 1992. A review of the cited reference reveals that values of the H-static are not provided. Please provide the correct reference.	The values of the H-statistic will be provided.
29.	Table 7-4 to 7-7, Screening PRE Results	Soil Screening Levels (SSLs) for the protection of groundwater are not used in the calculation of carcinogenic risk and noncarcinogenic hazard, and their derivation and relevance to the PRE are not described in Section 7. We recommend that the columns relating to the SSLs be deleted from these tables.	The columns relating to the SSLs will be deleted.

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Comment No.	Section/ Page No.	Comment	Response
30	Tables 7-4 to 7-7, Screening PRE Results	Consistent with EPA guidance on risk assessment (EPA, 1989), estimates of noncarcinogenic hazard should be segregated by target organ whenever the total hazard index exceeds 1.	The screening PRE noncancer hazard indices (HIs) presented in tables 7-4 through 7-7 range from <1 to a maximum of 1.6 for the Maximum Exposure Point Concentration (Max-EPC)-based risk evaluation. The maximum HI for the Reasonable Maximum Exposure-Point Concentration (RME-EPC)-based risk evaluation is 1.1. Of note, a significant portion of the RME-EPC-based HI is attributable to metals (iron [49%], arsenic [13%], aluminum [12%], and manganese [10%]). The RME-EPCs of these metals are all below their respective background concentrations. Further, as presented in Table 7-17 of the site-specific PRE section, the Max-EPC- and RME-EPC-based HIs are all <1. This indicates that upon refinement of exposure scenarios, the HIs are less than 1 and target organ speciation is not required. However, as requested, target organ speciation will be performed in the screening PRE where HI exceeds 1.
31.	Table 7-4 to 7-7, Screening PRE Results	Unless it can be reliably demonstrated that exposure to subsurface soils (defines here as depth 1-10 feet) can occur exclusive of exposure to surface soils, risk and hazard should be calculated based on exposure to surface soil (0-1 foot, representing undisturbed site conditions) and surface and subsurface soil combined (0-10 feet). Further, in accordance with EPA guidance (EPA, 1989) estimates of risk should be presented to only one significant figure in these tables and the accompanying text. Use of excessive significant figures implies a greater degree of precision than is inherent in the calculation presented here.	As suggested, the risks will be re-evaluated using combined data from surface and subsurface soils (i.e., from 0 to 10 feet bgs). The significant figures in cumulative site risk will be rounded to one significant figure throughout the text.

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Comment No.	Section/ Page No.	Comment	Response
32.	Section 7.5.4, Results of the Screening PRE, Page 7-57	The text in this section states that if the estimated cumulative cancer risk was less than 1E-6, the hazard index was less than 1, and the exposure point concentration for lead was less than the Region 9 PRG of 400 mg/kg, then no further action was recommended for the site. However, protection of human health is not the sole criterion for determining whether contamination warrants a remedial response. As noted in Section 1, the objectives of the SI report include evaluating impacts to human health and the environment. Please revise the text in this section to correctly note that a determination of no threat to human health is not in and of itself sufficient justification for a recommendation of no further action.	Acknowledged. The text will be revised accordingly.
33.	Section 7.6.1, Site-Specific PRE, Selection of COPCs, Page 7-59	As noted elsewhere in this section, the Region 9 PRGs are not descriptive of many of the exposure scenarios considered in the site-specific PRE. Hence, it is not appropriate to use the PRGs as a risk-based screening level for the selection of COPCs for these evaluations. Receptor-specific PRGs should be calculated using the equation presented on page 7-63 (as well as calculation PRGs for noncarcinogenic effects). The resulting values may then be used to calculate risk and hazard estimates for the appropriate receptors.	The site/receptor specific PRGs will be estimated and subsequently used as risk-based screening levels for the selection of receptor-specific COPCs. The risk and hazard estimates will be calculated for these receptor-specific COPCs.
34.	Section 7.6.2, Receptors Selection and Exposure Factors, Construction / Utility Workers, Page 7-60	In accordance with EPA guidance (EPA, 2002b), a soil ingestion rate of 330 mg/day should be used for the construction worker rather than 100 mg/day suggested here.	The soil ingestion rate will be modified as suggested.

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Comment No.	Section/ Page No.	Comment	Response
35.	Table 7-8, Exposure Factors for Site-specific PRE	Provide references for each of the values presented in this table. In addition the particulate emission factor (PEF) included in the PRG derivations addresses only dust particles arising due to wind, and does not address dust generated via intrusive operations or vehicular traffic. A methodology for developing a PEF for assessing inhalation exposures reflective of a construction or utility worker may be found in the Supplemental Guidance for Developing Soil Screening Levels (EPA, 2002b), and should be used for these receptors.	It is true that activity specific PEFs may be developed to characterize risk during such activities. However, on balance, the extent to which these activities dominate an exposure scenario are limited by the frequency of occurrence relative to other exposure routes (i.e., oral, dermal). With the possible exception of the construction worker, other site-specific receptors are not anticipated to be substantially exposed to particles via inhalation over that which might be assumed by the use of default PEF. As for construction workers, there may be occasions wherein particles are suspended via other than wind erosional processes. However, these events are not expected to be typical and representative of the reasonable maximum exposures. Text will be added to the report to clarify these considerations.
36.	Section 7.6.3.1, Site Specific PRG Model, Page 7-63	Of the 19 terms presented in the equation in this section, only two are defined. Please provide an explanation of the remaining terms. In addition, values for each of the terms not provided in Table 7-8 (e.g., cancer slop factors, absorption factor) should be provided in a table included in the SI, as insufficient information is provided to verify the derivation of the receptor-specific PRGs presented in Table 7-13 through 7-14. Also, please ensure that the acronyms used to define each of the terms in this equation are consistent with those presented in Table 7-8.	Terms and acronyms in equations will be clearly defined and made consistent.
37.	Section 7.7.1, Uncertainties in Exposure Assessment, Page 7-83 to 7-84	This discussion should provide additional information regarding the impacts of judgmental sampling on the exposure assessment. Exposure point concentrations in this PRE have generally been calculated as the 95 percent UCL. One of the underlying assumptions regarding calculation of the UCL is that the samples represent a randomly drawn subset of the population, which is clearly not the case, here. In addition, additional information is needed regarding the fact that sampling was limited for certain analytes (i.e., only two samples were analyzed for dioxins).	Acknowledged. The text will be revised accordingly.

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Reviewer: Nicole Moutoux, Project Manager, Federal Facilities Cleanup Branch, 12 February 2004

Comment No.	Section/ Page No.	Comment	Response
38.	Table 7-9 and 7-10, Site-Specific PRE, Residential Scenario	It is not clear why the residential scenario was reevaluated in the site-specific PRE using only a limited set of contaminants of potential concern. A residential scenario is not described in Section 7.6.2, Receptor Selection and Exposure Pathways for the site-specific PRE, and site-specific exposure values are not presented in Table 7-8 for a residential receptor. A comparison of the information presented in Tables 7-9 and 7-10 with Table 7-4 and 7-5 reveals that the site-specific PRE for residential receptors is simply a reiteration of the screening PRE with a reduced COPC list. Since they provide no additional information, Tables 7-9 and 7-10 should be deleted.	In accordance with the final work plan, the site-specific PRE was conducted by using a subset (COPCs that exceed their respective PRGs) of the original detected COPCs list. Therefore, even though the calculated risks are not significantly different, they will be retained for site-specific PRE completeness.
39.	Section 7.8, Risk Management Considerations Page 7-85	While consideration of the NCP risk range is an integral part of the remedial decision process, the discussion of the risk management range within the risk assessment itself is inappropriate and inconsistent with EPA policy. Use of the "balancing criteria" is only appropriate at the Feasibility Study phase of the CERCLA process.	The discussion is consistent with RAGS (1989) Section 8.6.1, Page 8-25, "The final discussion of the risk characterization results is a key component of the risk characterization. The discussion provides a means between known effects in humans and those that are predicted to occur based on animal experiments; - level of confidence in the quantitative toxicity information used to estimate risks and presentation of qualitative information on the toxicity of substances not included in the quantitative assessment; - level of confidence in the exposure estimates for key exposure pathways and related exposure parameter assumptions; - the magnitude of the cancer risks and non-cancer hazard indices relative to the Superfund site remediation goals in the NCP (e.g., the cancer risk range of 10^{-4} to 10^{-6} and non-cancer hazard index of 1.0)." Also, see response to General Comment #2.

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Reviewer: Nicole Moutoux, Project Manager, Federal Facilities Cleanup Branch, 12 February 2004

Comment No.	Section/ Page No.	Comment	Response
40.	Section 7.9, Conclusions and Recommen-dations, Page 7-86	This section makes claims regarding the acceptability of the risk posed by contamination at AA 3. As previously noted, the human health risk assessment should present the risk calculations and not include discussion of how the risk could be managed. Such discussion should be reserved for the Feasibility Study. Please remove these references from this section.	As implied in the response to Specific Comment #39, it is incumbent on the risk assessment to attempt to put the results in a reasonable context. This does not preclude risk managers from articulating their own risk management considerations and, in fact, may provide useful information that may help in this regard. As requested, references to the acceptability of risk posed by potential exposure to contamination will be revised to be consistent with the response to General Comment #2.
41.	Section 8 Ecological Risk Assessment, Page 8-1	Please note that the conclusion that there is no significant ecological risk is based on current conditions. If a future owner disturbs the contents of the landfill, conditions could change such that potential contaminants in the landfill could become available to the sensitive species in the area.	Comment noted.
42.	Section 8.2.7, Toxicity Evaluation, Page 8-24	The EPA 2003a references is for IRIS. There does not appear to be a citation for the EPA EcoSSLs. There are a number of instances in the text where this has happened.	EPA Eco SSL reference has been added to the reference list.
43.	Section 8.2.7, Toxicity Evaluation, Page 8-24	The definition of TRV is incorrect. A Toxicity Reference Values (TRV) is a dose level at which a particular biological effect may occur in an organism, based on laboratory toxicological investigations. The definition in the text refers to a No Observed Adverse Effect Level (NOAEL) which is not the same as a TRV.	The statement about the TRV is not intended to be a definition of a TRV. It describes how the term is used in the SRA. The sentence will be reworded as follows: "For purposes of this screening assessment, the TRV of a chemical is equivalent to the exposure-specific, literature-derived NOAEL of that chemical for a particular plant or animal species of concern as published in the peer-reviewed toxicology literature. If a measured TRV was not available, other endpoints were selected and extrapolated to a NOAEL equivalent."

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Comment No.	Section/ Page No.	Comment	Response
44.	Section 8.2.7.1, Taxonomic Extrapolation, Page 8-25	It is not acceptable practice to extrapolate from mammals to birds or birds to mammals.	The SRA does not include extrapolation from birds to mammals. The mammalian database for toxicity studies is more complete for mammals than birds. Rather than leave large gaps in the toxicity data used to assess birds in this SRA, existing mammalian toxicity data is used. An uncertainty factor of 10 is assigned to toxicity data derived from laboratory mammals if the species of concern is a bird. This assumes that birds are always more sensitive to organic chemicals than mammals.
45.	Section 8.2.7.2, Endpoint Extrapolation, Page 8-25	Please cite a reference for the extrapolation of subchronic to chronic (0.5).	The actual adjustment that is used is to divide the subchronic NOAEL by 5 (same as multiply by 0.2), not multiply by 0.5. The selection of 5 as a subchronic-to-chronic extrapolation factor is based on the footnote in EPA EcoRAGS, 1997 on page 1-11. "For over 50 percent of the compounds tested, the chronic NOAEL was less than the 90-day (subchronic) NOAEL by a factor of 2 or less. However, in a few cases, the chronic NOAEL was up to a factor of 10 less than the subchronic NOAEL...". The extrapolation factor of 5 was selected as a reasonable value between 2 and 10 because the majority of measured differences between subchronic and chronic toxicity values was a factor of 2 or less.
46.	Section 8.3.2.1, Hazard Quotients, Page 8-31	Surface water should be screened against the Cal Toxics values.	The Navy will compare the surface water data to the California toxicity values for fresh water. It should be noted that the national recommended water quality criteria (EPA 2002) are similar to the California toxicity values, and in some cases, are more stringent than the toxicity values.
47.	Section 8.4.6.1 Soil, Page 8-48, next to last paragraph	There appears to be a typo in the units for the dioxins.	Units were corrected to pg/g.

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Reviewer: Nicole Moutoux, Project Manager, Federal Facilities Cleanup Branch, 12 February 2004

Comment No.	Section/ Page No.	Comment	Response
48.	Section 9.11, Conclusions and Recommendations, Page 9-13	The report indicates that, "...no further investigation is warranted and site closure is recommended." The results of the initial investigations were that waste, some of it hazardous (asbestos) and not all of it inert (soil gas containing up to 23 percent methane was collected in the central portion of the site and high concentrations of a solvent, tetrahydrafuran, were detected in a number of soil gas probes), was disposed to land at AA 3 and that risk to human and ecological receptors have resulted from this disposal and that hazardous constituents have degraded groundwater quality down gradient of the landfill. Hence, it is appropriate for this site to continue through the CERCLA process to a record of decision. Because it has been shown that there is risk to human health above 1E-6, it is not appropriate to propose No Further Action at this stage.	Based on the results of investigations to date, there is sufficient sampling to document a low level release of hazardous substances at Anomaly Area 3, including volatile organic compounds, semi-volatile organic compounds, petroleum hydrocarbons, and metals detected in groundwater, soil, or soil gas at the site. The Navy agrees that additional site characterization of Anomaly Area 3 is required and that a no further action determination is not appropriate at this time. The additional site characterization at Anomaly Area 3 will be conducted pursuant to a RI/FS. It is appropriate for this site to continue through the FFA framework and process for resolving the concerns expressed by EPA in their comments. The Navy proposes to undertake a RI/FS addressing Anomaly Area 3 and any necessary additional CERCLA response actions pursuant to the FFA.
49.	Appendix B, Borehole and Well Logs	For completeness, please include the well logs for Wells MW01 – MW04.	The well logs for Wells MW01 through MW04 will be included in the report.
ERRATA			
1.	Section 3.5, Exploratory Trenching and Subsurface Soil Sampling, Page 3-5	Please revise "Subsurface oil sampling" to read "Subsurface soil sampling."	The sentence will be revised.
2.	Section 3.5.1, Radiological Screening During Trenching	This section references Section 3.3.2. There is no Section 3.3.2 in this report. The correct reference is probably Section 3.7. Please correct this discrepancy.	The suggested changes will be incorporated.
3.	Figure 5-4, Geologic Cross Section B-B', Page 5-9	"ML" – a code used in the figure-is not included in the Legend. Please add it to the Legend.	The suggestion will be incorporated.

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Reviewer: Nicole Moutoux, Project Manager, Federal Facilities Cleanup Branch, 12 February 2004

Comment No.	Section/ Page No.	Comment	Response
4.	Figure 5-11, Soil Property Characterization Data Versus Depth, Page 3-35	Some of the symbols used in the figure are not defined. Please add the symbols and their definitions to the figure.	The suggestion will be incorporated.
5.	Figure 5-12, Soil Property Characterization Data Versus Elevation, Page 5-37	Some of the symbols used in the figure are not defined. Please add the symbols and their definitions to the figure.	The suggestion will be incorporated.
6.	Section 5.5.3.1, Jurisdictional Criteria, Page 5-43	The reference for the court decision regarding an intrastate waters site in Illinois currently reads: "(Cite Reference)". Please replace this with the actual reference.	The suggestion will be incorporated.
7.	Section 5.5.5.3, Habitat, Page 5-46	This section states that "Most of the site (9.60 acres with AA 3) is 'ruderal' vegetation. Earlier in the document, AA 3 is described as encompassing approximately 9 acres, but according to this section, it is larger than 9.60 acres. Please resolve this inconsistency.	The text will be updated to maintain consistency in the area of the site.
8.	Table 7-1	Abbreviations for stereochemistry should not be capitalized (e.g., M/P Cresol should be m-/p-cresol). This becomes particularly confused when using the letter n, as a capital N is used to denote the presence of nitrogen in the molecule. Hence, the compounds N-Nitroso-n-propylamine and di-n-butylphthalate are not the same as N-Nitroso-N-propylamine and di-N-butylphthalate shown in Table 7-1. In addition, benzo(g,h,i)perylene should be corrected to benzo(g,h,l)perylene.	Comment noted and the suggestion will be incorporated.
9.	Appendix D	Please verify the units for the initial and final canister pressures. The values are probably reported in inches of mercury vacuum and not psi.	Units will be verified and revised in the next version of the report.

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Reviewer: John P. Christopher, Ph.D., D.A.B.T., Staff Toxicologist, Human & Ecological Task Division (HERD), 11 February 2004

Comment No.	Section/ Page No.	Comment	Response
GENERAL COMMENTS			
1.		**Overall:** This screening risk assessment does not conform to DTSC guidance for such documents. However, because the document is complete and clearly written, we were able to assemble useful risk estimates ourselves. The document can become acceptable upon adequate responses to our specific comments below.	Comment Noted.
		Methods for Screening Risk Assessment: The Navy has used a method for identifying chemicals of concern, which is not approved by DTSC. This method involves eliminating potential chemicals of concern by comparing maximum detected concentrations to Preliminary Remediation Goals (PRG) for the residential setting published by USEPA Region 9. DTSC has informed the Navy on numerous occasions that we do not favor this method. All detected organic chemicals must remain in the risk assessment. In this memorandum, we re-analyze the Navy's results with DTSC's method. The results are similar to those shown by the Navy, but they are rendered in a form more useful and familiar to risk managers in DTSC.	The risk assessment was performed in accordance with the final removal site evaluation work plan (August 2002), which was reviewed and concurred with by the Federal Facility Agreement (FFA) representatives, including DTSC. In accordance with the final work plan and as indicated in Section 7.5, page 7-39 of the ESI report, for a particular medium, any detected chemical was considered a COPC for the site. Please refer to Tables 7-4 through 7-7 (Screening Risk Tables). Also in accordance with the final work plan, the COPCs list for the site-specific risk assessment included only those detected chemicals that exceeded their respective PRGs (MCLs for water) (Section 7.6, page 7-59 of the ESI report).
		Soil Horizons: The Navy presented one set of estimates for 0-1 ft bgs and another for 1-10 ft bgs, which is useful and informative. The risk assessment would have been improved if risks would have been summarized as well for 0-10 ft below ground surface (bgs). Because the risk estimates for the two soil horizons were approximately the same, this need not be corrected for the final report.	The risks will be re-evaluated using the combined data from the surface and subsurface soil horizons (i.e., from 0 to 10 feet bgs).
SPECIFIC COMMENTS			
1.	Tables 7-2 & 7-3, pp. 7-17 ff.:	For the dozens of chemicals which were not detected, the Navy presents in these tables geometric means, geometric standard deviations, 95% upper confidence limits (95UCL) on these means, and the H-statistics used in Land's equation for calculating of the 95UCL. This need not be corrected for this report, but the Navy should upgrade its software to show such values only when a chemical is detected at least twice.	Acknowledged. The summary tables will be revised to only include 95% UCL values for data sets having more than two detections.

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Reviewer: John P. Christopher, Ph.D., D.A.B.T., Staff Toxicologist, Human & Ecological Task Division (HERD), 11 February 2004

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2.	Conceptual Site Model, Figure 7-1, p. 7-35	Bioaccumulation of chemicals into homegrown produce is shown as an incomplete pathway in this diagram. If this parcel were released for unrestricted use, residential backyard gardening could occur. Thus, this pathway be listed as potentially complete and possibly be evaluated for bioaccumulative substances, such as organic chemicals with ***log KOW*** = 3.	The risk assessment will be revised to address the potential for bioaccumulation of chemicals into homegrown produce and will be evaluated for bioaccumulative chemicals with log Kow equal to or greater than 3.
3.	Normal *vs.* Lognormal Distributions, Sec. 7.4.4, p. 7-38	The Navy assumes that all detected chemicals are lognormally distributed. We strongly urge against this assumption. Misidentifying the distribution can lead to significant errors in estimation of exposure point concentrations. The Navy should upgrade its software package for exploratory data analysis to include testing first for normality, then for lognormality, and estimating the 95UCL with the appropriate method for each. If data are neither normal nor lognormal, we recommend using non-parametric procedures such as the bootstrap for estimating the 95UCL.	The Navy recognizes that a uniform assumption of lognormality may not accurately represent the data set being evaluated. However, in most instances, the assumption will result in an over-estimation of the 95 percent UCL and subsequent over-estimation of the associated risk. The data sets will be re-evaluated as suggested using the EPA ProUCL program for estimating the 95 percent UCL using normal, lognormal, or bootstrap procedures as appropriate.
4.	Comparison of Detected Chemicals to PRGs, Sec. 7.5, p. 7-39	Ordinarily, DTSC does not permit elimination of detected chemicals, excepting inorganic constituents within their respective ambient ranges. In Anomaly Area 3, the Navy wants to eliminate several carcinogens whose ratios to their respective PRGs approach 1.0. This would lead to an underestimate of the screening risk. For example, we find in Tables 7-4 through 7-7 several carcinogenic polycyclic aromatic hydrocarbons (PAH) whose maximum detected concentrations (C_{MAX}) approach their respective PRGs. The recommended method for assessing this class of chemicals is to calculate the number of benzo(a)pyrene equivalents (BaPeq) by summing the ratios of the C_{MAX} values to their respective PRGs. Thus, elimination of any carcinogenic PAHs underestimates the carcinogenicity of the class. In the following table we show a summary of incremental risk and hazards as DTSC would have preferred to see it. In each case, arsenic, beryllium, and cadmium have been removed as chemicals of concern, because their C_{MAX} values fall within their respective ranges of ambient values. Iron is also removed, because it is an essential nutrient. Including nutrients and metals within the range of background can be a useful tool for informing the public of all the risks in their environment. However, the site-related incremental risk should be the principal basis	Acknowledged. The contribution to risk from compounds with concentrations less than the PRGs is presented in the screening risk tables. These screening risk tables present all detected constituents: of note is that the two PAHs with concentrations less than PRG have a combined risk of 9×10^{-7}. However, to aid risk managers, a risk summary table using the BaPeq will be added to the report.

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		for decisions on remediation.	

SUMMARY OF SCREENING RISK AND HAZARD ESTIMATES FOR ANOMALY AREA 3, FORMER MARINE CORPS AIR STATION EL TORO

Depth	Cancer Risk		Non-Cancer Hazard	
	Total	Drivers	Total*	Drivers
Residential Setting				
0-1 ft bgs	3.0 E-5	BaPeq – 2.3 E-5 (76%) Dioxins – 4.2 E-6 (14%)	0.56	(None >1.0)
1-10 ft bgs	5.7 E-6	BaPeq – 5 E-6 (88%) Dioxins – 1.1 E-7 (2%)	0.23	(None >1.0)
Industrial Setting				
0-1 ft bgs	8.5 E-6	BaPeq – 6.8 E-6 (80%) Dioxins – 1.2 E-6 (14%)	0.46	(None >1.0)
1-10 ft bgs	1.7 E-6	BaPeq – 1.5 E-6 (89%)	0.02	(None >1.0)

* - Does not include As, Be, or Fe.

5.	Site-Specific Risk Evaluation, Sec. 7.6, pp. 7-59 ff.	We do not find this section useful, because arsenic was not eliminated as a chemical of concern and several important carcinogenic PAH were eliminated. We strongly recommend that risk managers use the table above as their primary guide in evaluating human health risks in their risk management decisions.	Acknowledged. The primary purpose of the site specific risk evaluation is to provide risk managers with a range of risk values for different exposure scenarios. The section provides the risk with and without the contribution of arsenic. As indicated in the response to Specific Comment #4, BaPeq values will be added to the risk summary tables.
6.	Recommen-dations, Sec. 7.9, p. 7-86	We agree with the Navy that cancer risks for Anomaly Area 3 are approximately 1 E-5 for the residential setting and 5 E-6 for the industrial setting. The main risk drivers are BaPeq and dioxins. Non-carcinogenic hazards fall below the benchmark of 1.0.	Acknowledged.

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GENERAL COMMENTS			
1.		The soil gas sampling effort was performed without using either a Navy Standard Operating Procedure, or a local government protocol, such as the Los Angeles Regional Water Quality Control Board's Interim Guidance for Active Soil Gas investigations. This severely limits the value of the reported data. Certain key investigative elements that ensure data quality were apparently not included in the investigation. These include: 1) the performance of purge-volume testing, 2) field measurement of purge rates, vacuum, and purge volumes, 3) the use of tracer gas to detect leaks, and 4) the use of Tedlar® bags for sample collection. The Report lacks any specific discussion of field procedures. The contractor should revise the Report to discuss the soil gas sampling methods in detail, and provide complete field observations. If these procedures and observations were not substantially equal to or more reliable than standard guidance, the contractor should re-perform the soil gas sampling field work following the current DTSC and Water Board guidance found at: http//www.dtsc.ca.gov/PolicyAndProcedures/SiteCleanup/SMBR_ADV_activesoilgasinvst.pdf	Following extensive discussions with Federal Facility Agreement (FFA) representatives (including DTSC) during the work plan preparation phase, the soil gas sampling protocol was established in the final removal site evaluation work plan (August 2002) and was employed at Anomaly Area 3. The final work plan, which was reviewed and concurred with by the FFA representatives, included a sampling and analysis plan (Appendix A) with a standard operating procedure for soil gas investigation (Attachment 1 to Appendix A). The soil gas sampling protocol was based on then-available published guidance from the Los Angeles Regional Water Quality Control Board (LARWQCB 1997). The DTSC advisory guidance referenced in the reviewer's comment was published in January 2003, i.e., several months after the issuance of the final work plan and after completion of the field investigation. The final work plan also included site-specific data quality objectives (DQOs), which have been achieved during the field investigation. The report will be revised to include more specific details of the soil gas survey at AA 3 to document compliance with the controlling document, i.e., the final work plan. However, in summary, soil gas sampling was conducted as follows. At each location, a soil gas sampling probe was advanced to the first soil gas sampling interval of 5 feet bgs. A bentonite seal was placed at the surface around the stainless steel probes and hydrated. The soil gas evacuation from the sampling interval was initiated and fixed gas readings were recorded using a landfill gas monitor - field instrument (GEM 500) during evacuation. Approximately 3 tedlar bags of soil gas were evacuated from each hole before sample collection. Carbon dioxide and oxygen values, as well as detectable concentrations of methane, were

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			monitored to qualitatively evaluate whether the subsurface readings were affected by ambient air. After the readings stabilized and data suggested that the soil gas sample was not affected by ambient air, soil gas sample was collected in a tedlar bag for analysis. Deeper soil gas samples were collected by advancing a probe adjacent to the first one to a particular sampling interval (i.e., 15 feet bgs or 25 feet bgs) and similar soil gas sampling procedures were employed.
2.		Subsurface soil vapor data shows that a substantial body of waste contains methane at concentrations above the LEL. The shallow soil gas data did not show detectable methane. GSU is concerned that the shallow soil gas data may have been compromised as noted in Comment 1, above. GSU notes that the waste is in continuous contact with groundwater. This strongly suggests that methane production and accumulation in the subsurface is likely to continue, presenting a potential hazard in the event of a release to the surface or a subsurface migration.	Shallow and subsurface soil gas sampling was conducted per the final work plan, and site-specific DQOs were achieved (see response to Comment 1). Based on the data collected, only 3 samples out of 43 subsurface soil gas samples (forty-two 15 feet bgs samples and one 25 feet bgs sample) had concentrations exceeding the LEL. Methane was found to be vertically confined to the subsurface (deeper than 5 feet) and laterally confined to the central portion of the debris placement boundary, and not migrating. The Navy has recently discussed and reached agreement with the California Integrated Waste Management Board (CIWMB) and DTSC and other FFA Signatories regarding proposed engineering and institutional controls pertaining to landfill gas control measures at Installation Restoration Program (IRP) Site 3 (Original Station Landfill), IRP Site 5 (Perimeter Road Landfill), and Anomaly Area 3. The proposed engineering and institutional controls will be incorporated into the appropriate CERCLA documents (e.g., FS Addendum and revised Draft Proposed Plan for IRP Sites 3 and 5) for review and comment by fellow FFA Signatories. The Proposed Plan will then be published for public review and comment following regulatory concurrence.

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3.		GSU does not concur that the debris at the site is inert. GSU is of the opinion that active decomposition and generation of methane in the waste has been demonstrated.	Comment Noted. The text will be revised to state that the waste encountered was construction related debris. The Draft report states that predominantly inert construction debris was encountered. This conclusion was, in part, based on trenching activity that shows a significant portion of the debris encountered was inert (concrete, rebar, and asphalt) with varying amounts of wood. In addition, the area with methane reading is confined to the central portion of the site and represents approximately 4 percent of the debris. Please see response to General Comment #2.
4.		GSU concurs that the lateral limits of waste placement have been adequately determined.	Comment Noted.
5.		GSU points out that the base of Agua Chinon wash lies well above a substantial portion of the waste, and that a small unlined tributary of Agua Chinon Wash crosses the site at the eastern margin. GSU is concerned that wet season recharge of groundwater into the body of waste may easily occur resulting in accelerated methane generation and the displacement of methane vertically and laterally from its current documented positions. GSU requests that the contractor make provision for monitoring groundwater elevations on a continuous basis, and for repeating shallow soil vapor testing in the event that groundwater elevation at the site rises significantly.	Comment Noted. Continuous monitoring of the groundwater elevations will be initiated and the perimeter gas probes will be used to monitor lateral migration of methane. The Navy has recently discussed and reached agreement with CIWMB and DTSC and other FFA Signatories regarding proposed engineering and institutional controls pertaining to landfill gas control measures at IRP Site 3 (Original Station Landfill), IRP Site 5 (Perimeter Road Landfill), and Anomaly Area 3. The proposed engineering and institutional controls will be incorporated into the appropriate CERCLA documents (e.g., FS Addendum and revised Draft Proposed Plan for IRP Sites 3 and 5) for review and comment by fellow FFA Signatories. The Proposed Plan will then be published for public review and comment following regulatory concurrence.
6.		GSU notes that, while groundwater analytical data has not documented contaminants at concentrations above MCLs, the data do show the presence of contaminants that probably originate in the waste. GSU recommends that additional groundwater investigation to characterize and monitor this contamination should be performed.	The Navy concurs that groundwater analytical data indicate a release of low concentrations of hazardous contaminants at this site. The Navy will conduct further investigations to characterize this release through the CERCLA RI/FS process.

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7.		GSU reiterates the request for groundwater sampling within the saturated volume of waste at the site.	As stated in the Navy's response to DTSC's comment on the work plan, the Navy did not propose to install wells within the limits of the waste placement area due to the risk of providing a conduit for downward migration. However, the Navy will consider such a well while developing an approach to further investigate the groundwater through the CERCLA RI/FS process.
SPECIFIC COMMENTS			
8.		During a site visit on October 18, 2002, GSU observed cone-penetrometer operations at the site. GSU notes that vertical seismic profiling was being carried out at that time. GSU notes the subject report does not discuss this part of the investigation. The contractor should explain why this data was not discussed in the Report.	Extensive data that was collected as part of the cone penetrometer testing, including the vertical seismic profiling, is presented in Appendix C of the ESI Report, and the field investigation and preliminary discussion of the results are presented in Sections 4.4.3 and 5.4, respectively. The primary purpose of these data was to evaluate subsurface conditions in support of a response action. A more detailed evaluation will be presented in the RI/FS process.
9.	Section 4.6 Soil Gas Sampling page 4-14	The section asserts that "Details of this soil gas survey, including borehole logs detailing the field screening parameter (using landfill gas monitor and handheld FID) concentration details and soil gas survey report, are presented in Appendix E of this report." GSU notes that most of this information is not in Appendix E. The contractor should supply the subject information as part of the Appendix or correct the text.	The text will be corrected to indicate that only the laboratory results associated with the soil gas survey are presented in Appendix E of the ESI Report. The text will also be revised to indicate that the borehole logs are presented in Appendix B of the Draft report.
10.		During a site visit noted above, GSU observed an open manhole in the eastern part of the site. GSU suggested in the field that this manhole be investigated and addressed as a safety issue. GSU points out that the manhole may connect to a conduit that allows the escape of methane from the subsurface. The contractor should consider and address this issue.	During a site visit with the CIWMB representative on 8 April 2004, it was observed that a manhole cover had been placed on the manhole, and methane was not detected.

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GENERAL COMMENTS			
1.		Please indicate on all tables whether soil analytical data is on a wet or dry weight basis. All soil data should be on a dry weight basis for use in the ERA. Please also indicate whether surface water analytical data is on a dissolved or total basis for inorganics (e.g., Table 8-10).	The table notes for the tables will be updated to indicate that the soil analytical data are on a dry weight basis. Surface water analytical data are presented on a total basis for inorganics.
SPECIFIC COMMENTS			
1.	Section 5.5. On page 5-55, second paragraph from the bottom,	There is a reference to "disturbed wetlands". There is no mention of this habitat type under Section 5.5.6.3, Wetlands and Waters of the U.S. Are the disturbed wetlands the same or different from the mulefat scrub and headcut drainage discussed in Section 5.5.6.3? If they are different, please provide additional description of the disturbed wetland habitat type and depict them on Figure 5-13. This comment also applies to similar paragraphs in Section 8.2.1.2.	Section 5.5.6 discusses Sensitive Resources at AA 3 and Section 5.5.6.2 discusses the habitats found at the site in particular. The different habitats found at the site include mixed sage scrub and mulefat scrub as shown in Figure 5-13. The mulefat scrub habitat at AA 3 site is in wetland landscape scenario (outside the AA 3 site boundary). The reference to disturbed wetlands in Section 5.5.6.2 will be removed since the section presents only habitat information. The disturbed wetland reference applies to Sections 5.5.6.3 and 8.2.1.2.
2.	Section 8.2.2.3	It is stated on page 8-13 that water at the site is ephemeral, and no aquatic communities are present in the area of AA3. Table 5-7 indicates the Pacific tree frog was documented on or adjacent to AA3. If frogs are utilizing ephemeral water for breeding, water concentrations should also be compared to amphibian toxicity screening benchmarks (e.g., http://dsppsd. communication.gc.ca/Collection/CW69-5-357E.pdf).	The documentation is a compilation of studies and does not suggest criteria. Since larvae are expected to be the most sensitive life stage, water quality criteria developed to protect a variety of aquatic life should be adequately protective for screening purposes.

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3.	Table 8-4	Allowing declines in mammal and bird populations is not consistent with State law that prohibits take of non-game birds and mammals by poison (Title 14 California Code of Regulations and Fish and Game Code Section 3005). The assessment endpoints should be reworded. For example, "decline in small mammal populations" should be replaced with "survival, growth and reproduction of omnivorous mammals". Additionally, the presence of special status birds and mammals (i.e., coastal California gnatcatcher, cactus wren and San Diego wood rat) adjacent to the site indicates protection should be at the individual level. Section 8.4.1 acknowledges that special status species may use part of the site and that protection at the individual level has been adopted. Table 8-4 text should be modified, as suggested above, to indicate that assessment endpoints were at the individual level.	Table 8-4 will be modified to indicate assessment endpoints were survival, growth, and reproduction. NOAEL-based toxicity values will be used to calculate the soil benchmark concentrations; therefore, terrestrial receptors will be evaluated at the individual level.
4.	Section 8.2.4 and Tables 8-6 and 8 -13	The response to comments (Appendix L10, page 22 of 27, #6) states that the soil ingestion rate for the ornate shrew will be revised to 6%. Please change the 2% value in Tables 8-6 and 8-13 (and Appendix L2) to reflect this revision.	Soil intake will be changed to 6 percent in Tables 8-6 and 8-13. The correct value of 0.06 (6%) was previously used in the calculations.
5.	Section 8.2.4 and Tables 8-6 and 8 -13	The response to comments (Appendix L10, page 22 of 27, #8) states that the soil ingestion rate for the woodcock is not representative of ground-feeding birds because of its probing behavior. However, a non-probing ground feeding bird, the wild turkey was reported to have a soil ingestion rate of 9.3% (Beyer et al., 1994). Beyer et al. (1994) note that earthworms and other soil invertebrates contain a significant amount of soil and contribute to the estimated soil ingestion of soil invertebrate feeding animals, such as the woodcock. Earthworm bioaccumulation models (Sample et al., 1999) are based on depurated worms and do not account for soil exposure. Therefore, it is recommended that soil ingestion rates for soil invertebrate feeding birds be based on the proportion of their diet that is composed of soil invertebrates (e.g., 10% for 100% soil invertebrate feeder; 7.5% for 75% soil invertebrates in diet). The recent Eco-SSL (U.S. EPA, 2003) effort used wild turkey ingestion rates to model the mourning dove ingestion rate, indicating the proposed 2% soil ingestion rate is an underestimation.	A soil ingestion rate of 9.3 percent of the total diet will be used to reassess the potential for adverse effects through ingestion pathways.
6.	Tables 8-6 and Tables 8-13	For each receptor, please distinguish whether the animal diet partition factor is for invertebrates or vertebrates.	Tables 8-6 and 8-13 will be updated as requested. The food chain model will also be updated with the new parameters.

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7.	Appendix L2	Please specify what body weights were used to calculate the maximum and mean food ingestion rates so that estimates can be verified.	We assume that the comment was regarding the calculation of the food intake. Maximum body weights were used to calculate maximum food intake and mean body weights were used to calculate mean food intake.
8.	Page 8-23 and Appendix L3	The prey to predator bioconcentration factors were not provided in Appendix L3 as stated on page 8-23. Please provide a table of these values.	A column showing BTFa will be added to Appendix L3.
9.	Appendices L3-1 and L3-2	Please describe how plant bioaccumulation factors (BAFs) were derived from Bechtel Jacobs Co., LLC (1998). Values listed for these inorganics do not match soil-uptake-factors listed in the summary statistics tables in the cited reference. Were regression equations used? Bechtel Jacobs Co., LLC (1998) also has plant bioaccumulation factors for other metals (Appendix D) that are greater than the values proposed by Strenge and Peterson (1989) and Napier et al. (1980). In the Eco-SSL effort (USEPA, 2003), updated plant bioaccumulation factors are also provided for inorganics. Please provide justification why these older citations provide more defensible uptake factors for plants. For the organics, please provide the Kow used to develop the plant BAFs from the Eco-SSL model (USEPA, 2003) so that calculations can be verified.	The regression equations were used to calculate a tissue concentration based on the maximum COPEC EPC for As, Cd, Cu, Pb, Hg, Ni, Se, and Zn. The tissue concentration was divided by the EPC to obtain the BCF value. BCFs for remaining metals will be taken from EPA EcoSSL document.
10.	Appendices L3-1 and L3-2	Please describe how invertebrate BAFs were derived from Sample et al. (1998). Values listed for these inorganics do not match soil- uptake-factors listed in the summary statistics tables in the cited reference or in the peer-reviewed journal article that was subsequently released (Sample et al., 1999). Were regression equations used? Sample et al. (1998) also provide invertebrate BAFs for other metals (Appendix C) that are based on empirical data for an element, rather than an average of several metals. In USEPA's Eco-SSL effort (USEPA, 2003), updated invertebrate bioaccumulation factors are also provided for inorganics Please provide justification why these older citations provide more defensible uptake factors for invertebrates.	The regression equations were used to calculate a tissue concentration based on the maximum COPEC EPC for As, Cd, Ch, Cu, Pb, Hg, Mn, Ni, Se, and Zn. . The tissue concentration was divided by the EPC to obtain the BCF value. BCFs for remaining metals will be taken from EPA EcoSSL document.

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11.	Section 8.2.6.3	The groundwater pathway is considered incomplete unless it discharges to the surface. Plants, including trees, may be exposed to groundwater, depending on the depth of the groundwater. Please address whether groundwater is a potentially complete exposure pathway to plants at AA3.	The shallowest groundwater at the site is approximately 24 feet below the ground surface and the depth ranges down to approximately 65 feet below the ground surface. This is not within the range of the feeder roots of most plants. However, for the revised text, the ecological risk evaluation for the site will consider the potential for complete groundwater pathway for plants at AA 3.
12.	Section 8.2.7 and Appendix L-4	For the mammal and bird toxicity reference values (TRVs) where BTAG values were replaced with Eco-SSL values (EPA, 2003; i.e., cadmium, cobalt and lead for mammals and cadmium and lead for birds), the BTAG low TRV values should be used to calculate alternate hazard quotient calculations. The DTSC project manager can then compare these values to the hazard quotients derived from the Eco-SSL TRVs when remedial decisions are being made. Hazard quotient calculations using the BTAG high TRV values may also be provided to bracket the range of risk estimates.	The TRVs provided in the document should be adequate for making the decisions as to whether to proceed with the next step in the BERA. Risk ranges can be considered during considerations of response actions.
13.	Section 8.2.7 and Appendix L-4	The mammal TRV for methylene chloride (1200 mg/kg/d) represents a lowest observed effect level for centrilobular necrosis (ATSDR, 2000) and is not acceptable for screening purposes. The ORNL benchmark (Sample et al., 1986; 5.85 mg/kg/d) was derived from the IRIS no-observed effect level for liver toxicity (http://toxnet.nlm.nih.gov/) and should be utilized for deriving the bird and mammal TRVs. This change, however, is unlikely to affect the risk conclusions for this chemical.	The methylene chloride TRVs were updated as suggested.
14.	Section 8.2.7 and Appendix L-4	The avian TRV for polycyclic aromatic hydrocarbons is based on a secondary source (Eisler, 1987). The original source (Patton and Dieter, 1979) should be cited for clarity.	The citation was changed to Patton and Dieter as suggested.
15.	Table 8-8	The nickel hazard quotient for the ornate shrew does not match the value in Table L5-1. Please correct Table 8-8.	All HQ values have been recalculated and updated.

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16.	Table 8-10	The California Toxics Rule Criteria (U.S. EPA, 2000), rather than the National Ambient Water Quality Criteria, are generally used for evaluating surface water quality but I will defer to the Regional Water Quality Control Board on this issue.	Comment Noted. The Navy will compare the surface water data to the California toxicity values for fresh water. It should be noted that the national recommended water quality criteria (EPA 2002) are similar to the California toxicity values, and in some cases, are more stringent than the toxicity values.
17.	Section 8.4.3.3	Please provide citations to support the statement that "normally a population responds to increased mortality by increasing natality through density dependent population regulation mechanisms mediated through the endocrine system". While comparison to low observed adverse effect levels is acceptable, mortality to individual bird and mammals must be considered significant (see Comment #3).	The role of density-dependent population regulation in maintaining a steady state in population numbers is discussed in a study by Odum (1971). Natural populations fluctuate through time and normally can respond to increased mortality by increasing natality (within limits).
18.	Section 8.4.6.1, first paragraph, last sentence	Please delete the phrase "that would cause adverse effects to wildlife at AA3". Risk to ecological receptors may be significant at background concentrations (e.g. lead risks to wildlife). However, risk management decisions are generally made such that remedial action objectives do not reach below background concentrations. This comment also applies to the same sentence on page 9-8.	The last sentence in first paragraph was edited as requested. Statements like "that would cause adverse effects to wildlife at AA 3" will be revised to "None of these COPECs are attributable to site activities". As plant and animal communities develop through time in a specific locality, they are expected to adapt to local background soil concentrations. Therefore, even though laboratory toxicity studies may suggest that an adverse effect could occur, local populations are not expected to experience adverse effects from soil chemicals at historically background levels.
19.	Section 8.4.6.1, second to the last paragraph, first sentence	The units for the dioxin concentration (9.9 mg/kg) should be changed from mg/kg to pg/g or ng/kg.	Units for dioxin corrected to pg/g.
20.	Section 8.4.6.2, first paragraph, last sentence	Please delete the last sentence as it is not consistent with the previous sentence (see also comment 18).	The last sentence in Section 8.4.6.2 was deleted. Please see discussion in response to Comment 18.

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Conclusions

DFG-OSPR requests that the document be revised based on the comments provided herein. If the recommendation in this document for no further action is accepted, consideration should be given to ensuring that the current soil cover over the landfill remains intact to prevent exposure of burrowing animals or deep-rooted shrubs to potential contamination in the subsurface, uncharacterized areas of the landfill. If remedial activities are proposed, DFG-OSPR should be contacted to discuss further wildlife surveys and measures to avoid or minimize impacts to special-status wildlife species and waters of the United States, including wetlands. If you have any questions or require further details, please contact Regina Donohoe by phone at (831) 649-7150 or e-mail (rdonohoe@ospr.dfg.ca.gov).

ument Title:

(1) Draft Expanded Site Inspection Report, Anomaly Area 3, Former Marine Corps Air Station, El Toro, California, November 2003

Reviewer: John Broderick, California Regional Water Quality Control Board, 26 January 2004

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SPECIFIC COMMENTS			
1.	Section 2.2: LAND USE, Page 2-5	This section identifies borrow pits and trenches that were used as disposal sites for construction debris from 1972 to 1988. The disposal areas are now covered with a soil layer that is up to five feet thick. The California Code of Regulations, Title 27, Section 20164 (27 CCR 20164) defines construction and demolition wastes as "the waste building materials, packaging and rubble resulting from construction, remodeling, repair and demolition operations on pavements, houses, commercial buildings and other structures." In addition, as described in detail below, the results of your investigation demonstrates that the demolition waste that was placed in Anomaly Area 3 does not meet the criteria for 27 CCR definition as inert material. The disposal pits and trenches are, therefore, a non-hazardous solid waste landfill site.	The description of the waste placed in Anomaly Area 3 will be corrected so that it does not conflict with criteria defined in 27 CCR for inert material.
2.	Table 3-1: Summary of Detected Analytes Exceeding MCLs-Groundwater Sampling – Previous, Page 3-2	There is sufficient sampling to document a release from one or more of the landfill units that comprise Anomaly Area 3. We do not believe that those releases have been fully characterized. The scope of this investigation is not compatible with the methodology required under 27 CCR 20425 for determining contaminant releases to groundwater from a non-hazardous solid waste landfill. While we recognize that the Navy may not consider these releases to be significant under CERCLA definitions, the degradation of water quality is a violation of the Porter-Cologne Water Quality Control Act and the Water Quality Control Plan for the Santa Ana Region, and must be dealt with in accordance with procedures set forth in 27 CCR for contaminant releases from landfills.	The Navy agrees that the sampling and analysis conducted pursuant to the final removal site evaluation (RSE) work plan (August 2002) documents a release of hazardous substances from Anomaly Area 3 to groundwater. The Navy further agrees that additional site characterization of Anomaly Area 3 is required and that a no further action determination is not appropriate at this time. The additional site characterization at Anomaly Area 3 will be conducted pursuant to a Remedial Investigation/Feasibility Study (RI/FS). The Navy intends to address this site pursuant to its authority under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Defense Environmental Restoration Program (DERP) as provided by the Federal Facility Agreement (FFA). As previously agreed by the Base Realignment and Closure (BRAC) Cleanup Team (BCT), Anomaly Area 3 will be integrated into the remedy selection process for Installation Restoration Program (IRP) Site 3. The FFA is the appropriate framework and process for resolving the concerns expressed by the Santa Ana Regional Water Quality Control Board (RWQCB) in their comments. The Navy proposes to undertake a RI/FS

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			addressing Anomaly Area 3 and any necessary additional CERCLA response actions pursuant to the FFA. The RWQCB is a signatory to the FFA and the Navy presumes that the RWQCB will abide by its terms and conditions. The RWQCB will be provided with the opportunity to participate in development of the RI/FS work plan to ensure that its data collection concerns are addressed, and the Navy will request the RWQCB to identify potential "applicable or relevant and appropriate" requirements ("ARARs") administered by the RWQCB as required by CERCLA and the FFA at the appropriate times. The FFA provides an agreed-upon decision-making process for resolution of any disputes that may arise in the course of the remedy selection process.
3.	Section: 3.4 GEOPHYSI-CAL INVESTIGA-TION, Page 3 5	This section described the results of geophysical characterization of the waste, which indicates the presence of varying amounts of both buried debris and metal debris. Unless further testing reveals the presence of hazardous wastes, this material is likely non-hazardous solid waste per 27 CCR 20220.	Based on the results of investigations to date, there is sufficient sampling to document a low level release of hazardous substances at Anomaly Area 3, including volatile organic compounds, semi-volatile organic compounds, petroleum hydrocarbons, and metals detected in groundwater, soil, or soil gas at the site.
4.	Table 3-3: Details of Subsurface Soil Sampling from Trenches – Previous Investigation, page 3-7	Under the *Material Found* heading, all of the identified debris appears to be non-hazardous solid waste per 27- CCR 20220.	Based on the results of investigations to date, there is sufficient sampling to document a low level release of hazardous substances at Anomaly Area 3, including volatile organic compounds, semi-volatile organic compounds, petroleum hydrocarbons, and metals detected in groundwater, soil, or soil gas at the site.

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5.	Section 6.1: PHYSICAL EXTENT OF DEBRIS PLACEMENT AREA, Page 6-2	The third paragraph states that domestic refuse is not present, and that the refuse encountered would be classified as inert waste per State law definition. Contrary to this statement, Table 3.3 for Trench Number H4 identifies domestic refuse as "found". Shallow and deep soil gas sampling has been conducted at perimeter and interior locations at this landfill site. Methane and other volatile organic compounds have been detected in soil gas samples and in air samples that were collected above the landfill surface. Groundwater monitoring results indicate that a contaminant release has occurred at this landfill site. Please note that by definition, inert waste is material that will not decompose. The presence of landfill gas and groundwater contamination demonstrates that the material placed in the landfill is not inert waste, and has adversely impacted water quality.	The text will be revised to state the waste is predominantly construction related with isolated pockets of domestic refuse in the form of milk containers (found in one trench explored during previous investigation). The Navy concurs that groundwater monitoring results indicate that a contaminant release has occurred at this site. The Navy will conduct further investigations to characterize this release through the CERCLA RI/FS process.
6.	Section 6.5.5: Summary of Groundwater Sampling Results, Page 6-72	The statistical data that you presented are based on analytical results for water quality evaluation are described in 27 CCR 20415(e)(6) et seq. Specific programs for these analyses are available from various technical sources. If you are unable to locate the necessary information for appropriate statistical analysis, our staff would be happy to assist you by providing the names of several acceptable statistical methods for analysis of groundwater quality data. Please be aware that additional data will be required for any such method, as four individual data points from four separate years will not enable you to run a meaningful statistical analysis of groundwater quality.	The groundwater data summary in this section is a simple summary of the range of concentrations detected from the wells at the site (minimum and maximum) and the frequency of detections. The Navy will collect additional groundwater data and utilize appropriate statistical evaluation tools in the RI. The RWQCB will be provided with the opportunity to participate in development of the RI/FS work plan to ensure that its data collection concerns are addressed.

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7.	Section 6.5.5: Summary of Groundwater Sampling Results, Page 6-72	This groundwater investigation focused on CERCLA-listed contaminants. Low detections of volatile organic compounds, semi-volatile organic compounds, petroleum hydrocarbons, and metals were identified in groundwater at this landfill site, indicating that a release to groundwater has occurred. Pursuant to 27 CCR 20425, the landfill must enter into an evaluation monitoring program to provide full characterization of the nature and extent of this release.	The Navy agrees that low concentrations of hazardous substances have been released to groundwater at Anomaly Area 3. Based on regulatory comments and concerns, the Navy agrees to continue the CERCLA process at the site and conduct a further investigation. The characterization of the nature and extent of any release at Anomaly Area 3 will be addressed in the RI phase of the CERCLA IRP. The RWQCB will be provided with the opportunity to participate in development of the RI/FS work plan to ensure that its data collection concerns are addressed, and the Navy will request the RWQCB to identify potential ARARs administered by the RWQCB as required by CERCLA and the FFA at the appropriate times. See the response to Specific Comment No. 2.
8.	Section 6.5.5: Summary of Groundwater Sampling Results, Page 6-72 and Section 9.6	Evaluation of Groundwater Quality, Page 9-2: Based on the data you provided, it is evident that the landfill waste at this site is situated within, or in close proximity to, the groundwater. According to 27 CCR 20240(c), "Existing landfills shall be operated to ensure that wastes will be a minimum of five feet (5 ft.) above the highest anticipated elevation of underlying ground water."	Comment Noted. This citation will be evaluated as part of developing potential response action alternatives as part of the FS phase of the CERCLA process. The Navy will request the RWQCB to identify potential ARARs administered by the RWQCB as required by CERCLA and the FFA at the appropriate times.
9.	Section 6.5.5: Summary of Groundwater Sampling Results, Page 6-72 and Section 9.6: Evaluation of Groundwater Quality, Page 9-2	As indicated in our comments above, we believe that your investigations have documented the occurrence of contaminant releases from this landfill site; therefore, we cannot concur with your assertion that the groundwater has not been impacted. This release will need further assessment consistent with the procedures outlined in 27 CCR.	The Navy agrees that further assessment is required at Anomaly Area 3. It is appropriate for this site to continue through the FFA framework and process for resolving the concerns expressed by RWQCB in their comments. The Navy proposes to undertake a RI/FS addressing Anomaly Area 3 and any necessary additional CERCLA response actions pursuant to the FFA.

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10.	Section 9.8: Evaluation of Surface Water Quality, Page 9-3	Water quality impacts resulting from the release of contaminants at concentrations above their respective regulatory thresholds are identified in your report. Evaluation and corrective action to address the identified contaminant release is appropriate.	Please see the Navy's responses to Specific Comments No. 2, 7, and 9. The Navy proposes to undertake a RI/FS addressing Anomaly Area 3 and any necessary additional CERCLA response actions pursuant to the FFA.

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Draft Remedial Investigation / Feasibility Study (RI/FS) Report, Operable Unit 2C – Anomaly Area 3, Former Marine Corps Air Station (MCAS) El Toro, California, December 2005

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Comment No.	Section/ Page No.	Comment	Response
1.	Figure 3-1	The actual locations of the ground-water monitoring wells (i.e., MW01, MW02, MW03, and MW04) and vadose zone monitoring wells (i.e., PZ1, PZ2, and PZ3) are not shown on the figure. It is recommended that this omission be corrected in the Draft Final RI/FS Report.	Well locations will be added to Figure 3-1, as recommended.
2.	Section 3.7.2.2, Page 3-17	Under the "Risk" bullet, there are some incorrect notations. The NCP defined risk range is 10^{-4} to 10^{-6}, not 10^{-6} to 10^{-6} as presented, and the radionuclide of concern is Ra-226, not Ra-266 as noted. It is recommended that these notations be corrected.	The "Risk" bullet in Section 3.7.2.2, page 3-17 will be corrected to indicate that the risk from exposure to concentrations of Radium (Ra)-226 is within the National Oil and Hazardous Substances Contingency Plan's (NCP's) risk management range of 10^{-4} to 10^{-6}.
3.	Section 4.4.1.1, Page 4-9	The boreholes AA 3-BH02 and AA 3-BH-03 are not located on Figure 4-1 as cited in the text. It is recommended that the citation of the figure be presented only for the boreholes that were actually completed in the 2005 efforts.	Figure 4-1 will be revised to include borehole locations BH02 and BH03, as recommended.
4.	Section 5.2, Page 5-2	"A southwestern topographic low was located along cross section AA 3-2-2', between cross sections AA 3-12-12' and AA 3-13-13'." What is meant by the cross sections referred to in this statement as well as the following statement here in the text? It is recommended that this issue be clarified and that Figure 5-7 be cited here in the text.	Reference to these cross sections can be found on Figure 5-7 and the sentence refers to a pre-debris placement topographic low areas. These topographic features are now identified on Figure 5-7. Figure 5-7 will be cited in this section, as recommended.
5.	Figure 5-14	It is recommended that "obscured" in the Mule fat scrub area be defined here.	The term "obscured" is an artifact of the aerial topographic survey that indicates the surface elevation could not be accurately determined due to dense vegetation (i.e., the mulefat). The term will be deleted.
6.	Section 5.5.6.2, Page 5-62	The second sentence mentions "disturbed wetlands". It is recommended that the meaning of "disturbed" as used here be defined and that the agency and the regulations which describe mule fat scrub as "sensitive" related to its position in drainage be cited.	Disturbed wetlands do not exist at the site and mention of them was in regard to areas typically considered to be "sensitive wetland habitats." The text in Section 5.5.6.2 will be revised to clearly reflect this intent.
7.	Section 6.3.4, Page 6-46	"Additionally, to address the potential for the methane migration, the Navy reached an agreement with the FFA signatories (including CIWMB) regarding engineering and institutional controls pertaining to the landfill gas at AA-3". It is recommended that a citation within	The citation will be incorporated as recommended.

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		this report or reference to another document be provided here that includes the agreement on this issue. (i.e., CIWMB agreement letter in Appendix L).	
8.	Section 7.1.1.2, Page 7-2	"A local geological map (see Figure 5-1) was created using the U.S. Geological Survey digital geologic map database of the Santa Ana 30-foot by 60-foot quadrangle..." The proper citation is "30° by 60° quadrangle". It is recommended that this error be corrected.	The citation will be revised as recommended.
9.	Section 7.1.1.2, Page 7-3	"It is just beyond Well MW02 that the Wash joins the IMZ with the increase in hydraulic gradient probably associated with rapid increase in gradient associated with entry into that groundwater environment as also observed at Site 2." What is meant by this statement? It is recommended that this issue be clarified in the Draft Final RI Report.	The statement in Section 7.1.1.2, will be revised to read: "The wash empties into the Irvine Management Zone (IMZ) just beyond (west of) Well MW02. The increase in hydraulic gradient is probably associated with flow over the Basin Boundary Fault, which defines the northern limit of the IMZ in this part of the basin. At Site 3, the water level elevation in well 03DGMW64A was 195.33 feet above MSL during March 2005, a drop of over 200 feet in elevation across (west of) this fault. Similarly at Site 2, the water level elevation in well 02NEW02 (east of the fault), was 432.23 feet above MSL in March 2005, with much lower water level elevations in wells 02NEW07 (366.92) and 05DGM67A (263.23) located west of the fault (CDM 2005)."
10.	Section 7.1.2.4, Page 7-5	There are numerous references as to contaminants of concern (COCs) exceeding their respective maximum contaminant levels (MCLs). However, some of the COCs cited do not have promulgated MCLS and the levels being used for assessment are some other standard or reference number. It is recommended that this issue be clarified.	Section 7.1.2.4 provides a summary evaluation, for the conceptual site model, of groundwater contaminants of potential concern (COPC) concentrations relative to promulgated standards such as federal and California MCLs. Comparison to other assessment thresholds such as human health is discussed in Section 8 of the RI Report.
11.	Section 8.4.3.1, Page 8-36	The potential for indoor inhalation exposures to future on-site residents via vapor intrusion requires a more detailed assessment than is currently incorporated in the draft document. As demonstrated by the data in both the integrated air sampling results table (Table 6-4) and the perimeter soil gas sampling results table (F-2), volatile organic compounds (VOCs) are being released from the landfill, both laterally in soil vapor and upward to ambient air.	Comment noted. An evaluation of soil vapor migration and the potential for migration and inhalation of VOCs into indoor air from soil and groundwater will be added to the Report and will include an evaluation of reporting limits. For the evaluation of vapor migration from soil, analytical results from the vadose zone will

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		Some of these VOC concentration exceed risk-based screening levels addressing the potential for vapor intrusion into any future homes or buildings on or immediately adjacent to the site (e.g., benzene concentrations ranging up to 43 ppb were detected in the integrated surface air sampling conducted a few inches above the soil surface and benzene concentrations ranging up to 0.007 ug/l (7 ug/m3) were detected in the perimeter soil gas samples). The potential for vapor intrusion requires a more detailed assessment than is accomplished by the statement "Inhalation of VOCs in indoor air...is considered insignificant". However, the data set most appropriate for a more detailed assessment of this vapor intrusion potential, the on-site shallow soil gas survey results (Table E-2), is not informative because the analytical method employed was not sensitive enough to rule out the presence of VOC concentrations of potential concern regarding vapor intrusion (i.e., limits of detection were 1,000 to 5,000 ug/m3 for most of the VOCs). It is recommended that the DON provide further assessment of the potential for indoor air inhalation exposures via vapor intrusion in a revised risk assessment.	be used. This evaluation will provide risk managers with risk estimates should residential use of this area be adopted. It should be noted that this is an unlikely pathway/scenario given that it is anticipated that this area will have restrictions on residential construction.
12.	Section 8.5.1.1, Page 8-55	The draft document states "any chemical for which the Region IX PRG was predicted on a provisional toxicity value will be listed in the uncertainty section...and the effect on the risk estimates will be discussed in the terms of bias high or bias low". (Please provide a copy of the email "policy" statement cited as the Department of Navy 2004: Policy on Using Provisional Toxicity Factors.) This approach effectively eliminates those contaminants from inclusion in the calculations of excess cancer risk, or hazard indices for non-cancer toxicities. This approach conflicts with EPA Superfund and Cal/EPA risk assessment policies (for EPA policy on the use of toxicity values OSWER Directive 9285.7-53, Human Health Toxicity Values in Superfund Risk Assessment, which clearly supports the use of appropriate toxicity values other than those available on the Integrated Risk Information System (IRIS)). This approach also ignores a substantial body of scientific evidence on toxicity and human health risks of many contaminants at Superfund sites. The draft document also misinterprets the concept of "provisional"	Comment noted. The text in this section has been revised to reflect the following hierarchy for toxicity values. Per United States Environmental Protection Agency (U.S. EPA) Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-53 (U.S. EPA 2003), the current hierarchy for human toxicity values is: Tier 1 – U.S. EPA's IRIS Tier 2 – U.S. EPA's Provisional Peer Reviewed Toxicity Values (PPRTVs) Tier 3 – Other Toxicity Values Cal/EPA toxicity values fall under Tier 3. Therefore, the Navy will utilize the Tier 1 (IRIS) values where they exist and will include Cal/EPA toxicity values in a side-by-side comparison so that risk estimates can be compared. The Navy will include these

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		toxicity values (page 8-108). As noted, in the OSWER Directive, provisional toxicity values refer to the toxicity values developed by the EPA Office of Research and Development's National Center for Environmental Assessment. Provisional values are developed by NCEA's Superfund Health Risk Technical Support Center when requested by the Superfund program for chemicals lacking an appropriate IRIS value. The Tier 3 toxicity values referred to in the OSWERD Directive (e.g., Cal/EPA and ATSDR toxicity values) are not "provisional", rather they are toxicity values developed by well-established , rigorous scientific processes and then peer-reviewed before adoption by respected public health agencies. Therefore, it is not appropriate to eliminate from quantitative assessment contaminants which lack an IRIS toxicity value but for which a Tier 3 value exists (e.g., toxicity values developed by Cal/EPA or ATSDR); before these contaminants are eliminated from the risk calculations, their quantitative contribution to risk should be addressed using these Tier I values. It is recommended that this approach be incorporated into the screening and site-specific risk assessment for AA-3. (Note: It is EPA's understanding that the TEQ approach has been used by the DON for a number of other sites and we suggest that the risk assessor contact Patricia Underwood for details.)	Cal/EPA toxicity values in risk calculations for comparison purposes only. Results will be further discussed in both the risk characterization sections of the Risk-Based Screen (RBS) and the Site-Specific Risk-Based Evaluation (SSRBE), and the uncertainty section of the risk assessment. The Dioxin toxicity equivalency quotient (TEQ) will be included in the cumulative risk estimates.
13.	Section 8.5.1.2.1, Page 8-58	Although there were not used in the calculations of risk, the draft document does contain calculations of "B(a)P equivalents" to estimate potential exposures to the full range of PAHs under various different exposure scenarios at the site. B(a)P equivalent concentrations are calculated using relative potency values from the second column of Table 8 (i.e., "Estimated Order of Potential Potencies of Selected PAH Based on Mouse Skin Carcinogenesis") in the Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (page 17: EPA/600/R-93/089); this approach is not consistent with the guidance in the cited document. The provisional Guidance actually directs risk assessors to use the 'order of magnitude' relative potency values presented in the third column of Table 8 (Conclusions, page 8:EPA/600/R-93/089). The text, "Deriving Toxicity Equivalence for B(a)P", implies that use of the RPFs from second column (i.e., non-'order of	Comment noted. As stated, the risk will be lower using the "order of magnitude "relative potency factors (RPFs). The B(a)P equivalents based on the order of magnitude values will be added to the tables and discussed in the uncertainty section.

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		magnitude' RPFs) may have been at the request of DTSC. It is recommended that this issue be clarified.	
14.	Table 8-12	It is recommended that references be provided for the CT exposure assumptions presented in this table.	Comment noted. Sources for the central tendency exposure (CTE) values chosen for each exposure factor will be provided.
15.	Section 8.5.6	Dioxin Assessment—EPA's comment regarding the DON's approach of incorporating only 2,3,7,8-tetrachlorodibenzo-dioxin (2,3,7,8-TCDD) into risk calculations, thus ignoring without reasonable scientific justification the toxicity of all other dioxin/furan congeners, is essentially the same as we provided for the draft risk assessment for Site 1(24 August 2005). Dioxins and furans are a series of highly toxic chlorinated organic compounds formed during combustion. For risk assessment purposes, dioxins and furans are not single analytes but rather a suit of closely related congeners, many of which share a common mechanism of toxicity and carcinogenicity, albeit with varying potencies. The current draft risk assessment inherently makes the assumption that only one of the dioxin/furan congeners found at the site—2.3.7.8-TCDD—contributes to cancer risk. This assumption is present in the risk assessment by virtue of the fact that only the 2,3,7,8-TCDD concentrations are included in the risk calculations. This assumption is scientifically unreasonable and directly conflicts with risk assessment guidance and the standard-of-practice of both EPA and California EPA. This approach also conflicts with the policy of the World Health Organization (WHO) and the consensus of the global scientific community. Since the risk assessment notes that this approach "results in the underestimation of cancer risk" (page 8-109), it appears that this is an attempt to downplay actual risks posed by the contamination at the site. Regarding assessment of risks from the full spectrum of dioxin-like compounds, EPA guidance and the standard-of-practice for Superfund risk assessment are to calculate a 2,3,7,8-TCDD-equivalent concentration using the WHO Toxicity Equivalence Factors and use this 'TEQ concentration' when assessing risks or making comparisons to the dioxin PRG. It is recommended that this approach be incorporated into the screening	Comment noted. Risk estimates will be revised to include the dioxin TEQ, and will include the use of World Health Organization (WHO) TEFs as appropriate.

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		and site-specific risk assessment for AA-3. (Note: It is EPA's understanding that the TEQ approach has been used by the DON for a number of other sites and we suggest that the risk assessor contact Patricia Underwood for details.)	
16.	Section 8.5.6	In accordance with the Region 9 policy on Cal/EPA toxicity values (see Comment 22 below) the screening assessment for lead at AA-3 1 should be based on the Cal-modified PRG value of 150 mg/kg for residential exposures instead of the EPA value of 400 mg/kg. It is recommended that this issue be addressed in a revised risk assessment.	Risk estimates using the Cal/EPA toxicity values will be presented along with the risk estimates using toxicity values recommended by U.S. EPA Region 9. Included in the Cal/EPA evaluation is the recommended PRG of 150 milligrams per kilogram (mg/kg) for lead.
17.	Section 8.5.6, Polycyclic Aromatic Hydrocarbo ns	The situation for polycyclic aromatic hydrocarbons (PAHs) is exactly analogous to that for the dioxins/furans, namely the risk calculations are based on only a single PAH – benzo(a)pyrene (B(a)P) – and thus ignore without reasonable scientific justification the toxicity of all PAHs except for B(a)P. PAHs are a series of toxic polycyclic organic compounds formed during combustion. Many of the PAHs share a common mechanism of toxicity and carcinogenicity with varying potencies. The current draft risk assessment inherently makes the assumption that only one of the PAHs found at the site – B(a)P – contributes to cancer risk. This assumption is present in the risk assessment by virtue of the fact that only the B(a)P concentrations are included in the risk calculations. This assumption is scientifically unreasonable and directly conflicts with specific risk assessment guidance and the standard-of-practice of both EPA, California EPA, and the consensus of the global scientific community. Since the risk assessment notes that this approach "results in the underestimation of cancer risk" (page 8-109), it again appears that this is an attempt to downplay actual risks posed by contamination at the site. It is recommended that PAHs be addressed in the risk assessment as per current practice.	Comment noted. Risk estimates will be revised to include B(a)P equivalents. For the individual carcinogenic polycyclic aromatic hydrocarbons (PAHs), the RPFs, based on B(a)P equivalency, will be used to derive toxicity and estimate risk. A total B(a)P equivalent risk estimate will be provided based on the summation of those risks associated with B(a)P and the other carcinogenic PAHs.
18.	Section 8.5.6.1, Page 8-62	The estimated excess lifetime cancer risk arising from exposure to surface soils (0' - 1' bgs) for the future residential exposure scenario are due primarily to arsenic and B(a)P; risk estimates for subsurface soil exposure are similar. Arsenic, which is present at concentrations comparable to background, account for about 1/3 of	Comment noted. While natural and anthropogenic sources for B(a)P and other carcinogenic PAHs may exist in the area near AA 3, the concentrations of B(a)P exceed the anthropogenic level for

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		these risks and B(a)P equivalents account for about 2/3 of the soil risks. Is there any information available on the local or areal background concentration of B(a)P equivalents that could be used to put these PAH soil levels and associated risk estimates into context? It is recommended that this issue be addressed in a revised risk assessment.	Former MCAS El Toro (BNI 1996). The published background value for MCAS El Toro is less than the U.S. EPA Region 9 PRG of 62 micrograms per kilogram (µg/kg). As a result, B(a)P is considered to be site-related.
19.	Section 8.5.6.3, Page 8-74 & 8-75	Arsenic concentrations in ground water should be discussed in the context of the newly revised MCL for arsenic of 10 ug/l. In this regard, arsenic concentrations at a number of monitoring wells exceed the MCL. It may also be appropriate to discuss the ground-water arsenic levels in the context of naturally-occurring background levels. It is recommended that these issues be addressed in the draft final risk assessment.	Comment noted, but discussion of the MCL for arsenic will be presented in other sections of the RI Report. Risk estimates for arsenic are based on oral reference doses, oral slope factors, and inhalation slope factors presented in IRIS. While final response action decisions for arsenic in groundwater will likely consider the MCL of 10 micrograms per liter (µg/L) and the background concentration, this groundwater standard is not relevant in the risk assessment since it is not included in the risk calculations. Arsenic concentrations in groundwater will be compared to upgradient concentrations as well as data collected from the entire station to provide a context with ambient concentrations.
20.	Tables 8-13, 8-14, 8-15, & 8-16	The manner in which the risk calculations for soil exposure are presented in Tables 8-13, 8-14, 8-15, and 8-16 has the potential to mislead the casual or unsophisticated reader as to the true magnitude of the risk posed by the underlying scenarios. Each table contains an individual row presenting risks summed across all PAHs – labeled "Benzo(a)pyrene Equivalent" – and another summed across all dioxin/furan congeners – labeled "Total 2,3,7,8-TCDD". The inclusion of these rows implies to the reader that these risks will be included in the total risk estimate summed across all contaminants in the tables. However, the totals presented for "Incremental Lifetime Cancer Risk Including/Excluding Background" do <u>not</u> include risk contributions from the summed PAHs and dioxin/furan congeners. For example, in Table 8-13, the RME "Incremental Lifetime Cancer Risk Including Background" is stated to be 2E-5. If one were to include the risks as presented in the table for all of those PAHs and dioxin/furan congeners for which there is	Comment noted. Risk estimates will be revised to include a B(a)P equivalent, which is the total for B(a)P and all carcinogenic PAHs, as well as a dioxin TEQs, which is the total for 2,3,7,8-TCDD and all carcinogenic TCDD congeners.

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		international scientific consensus regarding toxicity values, the risk estimate doubles to 4E-5. It is recommended that these issues be addressed in the draft final risk assessment.	
21.	Tables 8-15 & 8-16	It appears that the Region 9 PRG for residential soils (6.2E-2 mg/kg) has been used for calculating the B(a)P risk for the Industrial Receptor. It is recommended that this issue be addressed in a revised risk assessment.	Comment noted. The correct PRG will be used.
22.	Section 8.6, Cal/EPA Toxicity Values	EPA's comment regarding the DON's approach to Cal/EPA toxicity values is the same as we provided for the draft risk assessment for Site 1 (24 August 2005). In cases where both agencies have developed toxicity values and there is a significant difference (usually interpreted to mean more than 4-fold) between those values, there is a long-standing agreement between Region 9 and Cal/EPA to use the more conservative (i.e., more "health-protective") toxicity value in Superfund risk assessment. In recognition of this policy, this agreement is noted in Section 2.4 of the Background Technical Document for the current Region 9 PRG Table and the table itself contains "Cal-Modified" PRG values for the relevant chemicals. Contaminants for which use of Cal/EPA toxicity values is most appropriate include: • arsenic, • lead, • naphthalene, • benzo(k)fluoranthene, • chrysene, • trichloroethylene It is also noted that the issue of primacy of state values was settled by the EPA Administrator as a result of a Dispute Resolution between Region 9 and DOD regarding Castle Air Force Base. The Administrator determined that the State had the right to compel the use of more stringent values and environmental standards for facilities within their boundary. Furthermore, it is the Region's opinion that the use of the Cal/EPA toxicity values is in DOD's long-term interest in many cases. Since newer Cal/EPA toxicity values often represent more recent, qualitatively better science, it is likely	Risk estimates using the Cal/EPA toxicity values will be presented along with the risk estimates using toxicity values recommended by U.S. EPA Region 9. It is understood that Cal/EPA toxicity values represent Tier III within the U.S. EPA hierarchy and that these values are peer-reviewed and not provisional. A discussion will also be presented in Section 8.8.3, Uncertainties in Toxicity Assessment.

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		that EPA will similarly revise its toxicity values for the same chemicals in the future. When this happens, the revised EPA toxicity values will be incorporated into the 5-year review process and, if sufficiently more conservative, may prompt a corresponding revision of cleanup levels. Also note that OSWER Directive 9285.7-53, Human Health Toxicity Values in Superfund Risk Assessments identifies Cal/EPA toxicity values as Tier III toxicity values, not "provisional" values. It is recommended that these issues be addressed in the Draft Final Report.	
23.	Section 8.6.2, Page 8-81	EPA's comment regarding the DON's approach to construction/utility workers is the same as we provided for the draft risk assessment for Site 1 (24 August 2005). This site-specific risk evaluation makes the assumption that a construction/utility worker's exposure duration is 3 years for the RME scenario and 1 year for the CT scenario. By using these exposure duration values, the risk assessment inherently assumes that MCAS El Toro is the only contaminated property that a construction/utility worker receptor will ever work on; this assumption is unrealistic. The fact that there are a number of contaminated sites on the MCAS El Toro property where construction is anticipated in the future adds extra weight to the importance of this issue (i.e., the same construction workers may be exposed at Site1, AA-3, etc., resulting cumulative exposure durations much longer than are assumed in each site's individual risk assessment). Given the general paucity of previously undeveloped land in Southern California and the recent emphasis by municipalities and government agencies to redevelop 'brownsfield'-type properties, it would be more reasonable to assume that Southern California construction/utility workers routinely encounter contaminated properties. Therefore, in order to generate a soil PRG which achieves a given target risk level over a construction/utility worker's career it would be more appropriate to assume that 50% (RME) to 25% (CT) of that career involves work at contaminated properties. Over a 25 year working career, the corresponding exposure durations would be 12.5 years (RME) and 6.25 years (CT). It is recommended that this issue be addressed in a revised risk	The Navy acknowledges that a construction worker could encounter contamination at locations other than at Anomaly Area 3 (AA 3). However, the Navy disagrees that this information should be reflected in exposure assumptions for AA 3 because this risk assessment focuses on incremental risks posed by AA 3 and does not attempt to estimate lifetime risks for construction workers (or other receptors) who, through exposure at other locations and lifestyle choices, are likely to have a significantly higher lifetime risk. No revisions will be made to the evaluation of the construction worker based on this comment.

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		assessment.	
24.	Section 8.7.3, Page 8-108	See Comment 22 above.	Comment noted. See Response to Comment No.22 above.
25.	Section 9, General	As noted by the California Department of Fish and Game (CADFG) (February 5, 2004), it is important to indicate on all tables whether the soil analytical data is on a wet or dry weight basis. All soil data should be provided on a dry weight basis. Also, an indication of whether the surface-water data provided are on a dissolved or total basis for inorganic analytes is needed. It is recommended that these issues be clarified in the Draft Final Report.	All tables and Appendices related to the ecological risk assessment will be updated with dry weight "dw" designations for soil and sediment data. Surface water data tables will show a "total" designation.
26.	Section 9, General	The ecological risk assessment describes the streams on- and off-site as "intermittent", yet, the nature of the surface water on site is not discussed in the Physical Characteristics part of the document. It is recommended that verification that these streams are intermittent be provided and a description of the average time water occurs in these streams on an annual basis be added.	The following description will be added to Section 9.2.1.1. "Agua Chinon Wash is located along the southeast boundary of the site. It is represented on the USGS quadrangle map as a broken blue line, indicating that it is an intermittent stream. A USGS gaging station is located on the stream approximately 1,000 feet downstream from the southeast corner of the site (USGS Station Number 11048200). Gaging records show that the stream flows in response to precipitation events with long periods of no-flow during the year."
27.	Section 9.2.2.1, Page 9-11	The surface water maximum reporting limits should be compared to the California Toxics Rule Criteria (U.S. EPA, 2000) not the NRWQC values. It is recommended that this correction be made and that a determination of whether the change in these values changes the results of the screening be provided in the Draft Final Report.	The criteria will be checked and cadmium will be updated to reflect the Cal. Toxics Rule Criterion continuous concentration. All other criteria are correct California Toxics numbers. Use of the California Toxics Rule value for cadmium will not change the conclusions presented in the Draft RI/FS.
28.	Section 9.2.2.2 Page 9-13	The statement is made that no organics were found in sediment. Table 6-31 lists petroleum hydrocarbons in one sample. It is recommended that this discrepancy be addressed.	The text will be modified as follows: "No organic chemicals other than total petroleum hydrocarbon (TPH) mixtures were detected in Wash sediments. TPH as a mixture, lacks a sediment ecological screening value and was not assessed quantitatively."
29.	Section 9.2.3.1	EPA Region XI is cited instead of Region IX. It is recommended that	The typing error will be corrected as recommended.

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	Page 9-15	this correction be made.	
30.	Table 9-6	The Navy response to comments of October 2003 included in the November 2003 draft of this document (i.e., Specific Comment #6) states that the soil ingestion rate for the ornate shrew will be revised to 6%. This revision is not reflected in this table. It is recommended that this value be changed while doing the calculations for this receptor and that the appropriate changes be made in this table for the Draft Final Report.	The calculations in the November 2003 draft used the agreed-to soil ingestion rate of 6 percent. This value will be updated in Table 9-6.
31.	Table 9-6	The Navy response to comments of October 2003 included in the November 2003 draft of the previous draft of this document (i.e., Specific Comment #8) states that the soil ingestion rate for the woodcock is not representative of ground-feeding birds because of its probing behavior. As noted in the comments prepared by the CADFG (February 5, 2004), "...a non-probing ground-feeding bird, the wild turkey, was reported to have a soil ingestion rate of 9.3% (Beyer et al., 1994). Beyer et al. (1994) note that earthworms and other soil invertebrates contain a significant amount of soil and contribute to the estimated soil ingestion of soil invertebrate feeding animals, such as the woodcock. Earthworm bioaccumulation models (Sample et al., 1999) are based on depurated worms and do not account for soil exposure. Therefore, it is recommended that soil ingestion rates for soil invertebrate feeding birds be based on the proportion of their diet that is composed of soil invertebrates (e.g., 10% for 100% soil invertebrate feeder; 7.5% for 75% soil invertebrates in diet). The recent Eco-SSL (2003) effort used wild turkey ingestion rates to model the mourning dove ingestion rate, indicating the proposed 2% soil ingestion rate is an underestimation." It is recommended that the Navy respond to this comment by increasing the amount of soil in the diet for Western meadowlark and spotted towhee to an appropriate amount as noted above.	The calculations in the November 2003 draft used the agreed-to soil ingestion rate of 9.3 percent for Towhee and Meadowlark exposures. The soil ingestion rate will be updated to 9.3 percent in Table 9-6.
32.	Section 9.2.6.3, Page 9-26	It is noted on the list of species found on site that the Pacific tree frog exists here. Therefore, it must be assumed that the frog is living and breeding on the site. This assumption would require	The Pacific treefrog is known to wander long distances from surface water sources, so it is not necessary to assume that it is breeding on-site. It may breed in the Agua Chinon Wash area

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		screening against the Cal Toxics Criteria and the appropriate literature parameters for this frog. It is recommended that this issue be addressed in the Draft Final Report.	adjacent to the site during spring rains. Since it is assumed that the larval stage is the most sensitive to surface water chemicals, the treefrog tadpole should be protected by Cal Tox Aquatic life criteria. This screen is presented in Table 9-10.
33.	Section 9.2.6.4, Page 9-26	If the Pacific tree frog is found on site that means that there is enough water on the site through the breeding season (November through July) to support reproduction. This would seem to imply that there is ground-water base flow to the creek and that there is exposure to ground water. It is recommended that either data to support that ground-water base flow to the creek does not occur during these months be provided or that screening against ground-water parameters be completed and presented in the Draft Final Report.	The shallowest groundwater at the site was measured in wells MW 05 and MW 08 at a depth of approximately 26.2 feet below ground surface (bgs). Figure 6-1 presents several cross sections prepared for the site and demonstrates that groundwater does not intersect the bottom of Agua Chinon Wash, thus the Wash is a losing stream in the vicinity of AA 3.
34.	Section 9.2.10.1, Page 9-33	In regard to Hazard Quotients and Table 9-10, as noted previously, the California Toxics Criteria should be used to screen for contaminants in California. It is recommended that this issue be addressed.	The criterion will be updated as requested. See Response to Comment 27 above.
35.	Section 9.3.3.3, Page 9-46	In the first bullet it is recommended that the site being discussed and the acreage involved be corrected.	The Site name will be corrected; the area of the site was correct.
36.	Section 11.3.1, Page 11-4	The tables cited at the end of this section are provided in Appendix H but are labeled as "A-#". It is recommended that this discrepancy be corrected.	Table numbering in Appendix H will be changed from 'A-#' to 'H-#'.
37.	Section 11.3.2, Page 11-4	The tables cited at the end of this section are provided in Appendix H but are labeled as "A-#". It is recommended that this discrepancy be corrected.	Table numbering in Appendix H will be changed from 'A-#' to 'H-#'.
38.	Section 11.3.3, Page 11-4	All of these regulations contain overlapping requirements; therefore, a table comparing the requirements at 40 CFR 258 and CCR Titles 22 and 27 has been added to Appendix A..." The table cited here is Table A-7 in Appendix H of this report. It is recommended that the citation here be clarified.	The citation will be changed to read "All of these regulations contain overlapping requirements; therefore, a table comparing the requirements at 40 CFR 258 and CCR Titles 22 and 27 has been added to Table H-7 of Appendix H..."
39.	Section 11.3.3,	The tables cited at the end of this section are provided in Appendix H but are labeled as "A-#". It is recommended that this discrepancy	Table numbering in Appendix H will be changed from 'A-#' to

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	Page 11-5	be corrected.	'H-#'.
40.	Section 11.6.2, General	This section identifies and screens technology types and process options. The text describing many technologies (e.g., native soil or single-layer covers, single-barrier cover system, surface soil sealing, grading, etc.) suggests that these are potentially applicable at the site and will be retained for further consideration. For other technologies (e.g., asphalt or concrete pavement, composite pavement and liner barriers, revegetation, clean closure, etc.) the discussion does not indicate whether these will be retained for further consideration. Finally, for some technologies (i.e., those under the waste consolidation, ICs/access restrictions, and monitoring headings) the discussion is presented in a manner that it would seem to suggest that these technologies will be required to be applied at the site. It is recommended that the text of this section be revised to clarify the issues raised above.	The presumptive remedy screening process identifies appropriate technologies that are combined into remedial alternatives. Screening criteria include effectiveness in accomplishing the remedial action objectives (RAOs), compliance with ARARs, and implementability. Section 11.6 will be revised to clarify whether technologies identified in the remedy screening process will be retained for further consideration in the remedial alternatives. A sentence will be added to the end of each technology description to clarify whether the technology type will or will not be retained for further consideration. The following technologies will be clarified as follows: A sentence will be added to the discussion of the asphalt or concrete pavement, composite pavement, and liner barrier technologies to state that these types of caps are not retained for further consideration as part of the remedial alternatives for AA 3. A sentence will be added to the discussion of the grading, revegetation, ICs/access restrictions, monitoring, and clean closure technologies to state that these types of caps are retained for further consideration as part of the remedial alternatives for AA 3.
41.	Section 12.2.2, Pages 12-2 & 12-3	There is some discrepancy between what would occur with the existing monitoring wells at AA-3 under Alternative 2. It is stated that "five monitoring wells (four inside and one outside the debris limits) would be abandoned". Later in the section it mentions that "the results from the new monitoring well that was installed within the waste placement area and screened below the waste will verify if the waste is impacting ground water". Is this monitoring well an existing well? What monitoring wells would be abandoned under this alternative? It is recommended that these issues be clarified.	The section will be revised to clarify which wells are to be destroyed and/or replaced.

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42.	Section 12.2.3.3, Page 12-6	"The vegetative cover layer would be composed of the top two feet of existing soil cover, which would be removed and stockpiled prior to compaction of the foundation layer and placement of the GCL." In Alternative 3b, the existing soil cover was to be part of the foundation layer and the vegetative cover layer was to be derived from the proposed borrow source. As these two alternatives are very equivalent in regard to the proposed components, why would the existing soil cover be removed and stockpiled for use as the vegetative cover layer in Alternative 3c and not in Alternative 3b? It is recommended that this issue be clarified.	As in Alternatives 3c and 3d, the top two feet of the existing four-foot-thick soil cover would be removed and stockpiled for use as topsoil for the vegetative cover in Alternative 3b. The text for Alternative 3b will be revised to state this.
43.	Section 12.2.3.4, Page12-11	– "The vegetative cover layer is composed of the top one to two feet of existing soil cover, which would be removed and stockpiled prior to compaction of the foundation layer and placement of the FML." In Alternative 3b, the existing soil cover was to be part of the foundation layer and the vegetative cover layer was to be derived from the proposed borrow source. As these two alternatives are relatively equivalent in regard to the proposed components, why would the existing soil cover be removed and stockpiled for use as the vegetative cover layer in Alternative 3d and not in Alternative 3b? It is recommended that this issue be clarified.	As detailed in Alternatives 3c and 3d, the top two feet of the existing four-foot-thick soil cover would be removed and stockpiled for use as topsoil for the vegetative cover in Alternative 3b. The text for Alternative 3b will be revised to state this.
44.	Table 13-7	Under the criteria "Overall Protection of Human Health and the Environment", Alternatives 3c and 3d are rated the same as Alternative 4 – i.e., "high". While Alternatives 3c and 3d should rate higher for this criteria than the other capping options due to the use of a geosynthetic clay liner and a flexible membrane liner, respectively, to enhance the Title 27 prescriptive cap, Alternative 4 is clean closure of the site. One would expect that clean closure would have the highest rating of all alternatives for the "Overall Protection of Human Health and the Environment" criteria. It is recommended that the assigned ratings for these three alternatives be reconsidered.	Rating scales in Table 13-7 will be reevaluated and revised to be more representative. Rating scales will include Low, Low-Moderate, Moderate, Moderate-High, and High. The rating for Alternatives 3c and 3d with respect to the 'Overall Protection of Human Health and the Environment' criterion will be revised to 'Moderate-High'; Alternative 4 will remain as a 'High' rating.
45.	Table 13-7	Under the criteria "Long-Term Effectiveness and Permanence", Alternative 2 is rated as "moderate" while Alternative 3b, with relatively the same infiltration potential plus the potential for desiccation and cracking of the clay barrier from settlement is rated	The rating will be reevaluated and revised for this criteria.

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		as "moderate-high". In reviewing the various alternatives for this criteria, it would seem that Alternatives 2 and 3b have been assigned ratings that tend to be higher than expected for "Long-Term Effectiveness and Permanence". It is recommended that the assigned ratings for these two alternatives be reconsidered.	
46.	Table 13-7	For Alternative 2 there are conflicting statements made under the criteria "Long-Term Effectiveness and Permanence" and "Reduction of Toxicity, Mobility, or Volume through Treatment" with regard to infiltration potential. It is recommended that this issue be clarified.	The statement under the 'Reduction of Toxicity, Mobility, or Volume through Treatment' will be revised to state; 'Does not significantly reduce existing infiltration potential or production of leachate'.
47.	Table 13-7	Under the criteria "Reduction of Toxicity, Mobility, or Volume through Treatment", Alternative 2 is rated "low" which is the same rating as that for the "no action" alternative. However, Alternative 2 would include the installation of landfill gas controls. It is recommended that the assigned rating for Alternative 2 be reconsidered.	Rating scales will be revised to be more representative. Rating scales will include Low, Low-Moderate, Moderate, Moderate-High, and High. The rating for Alternative 2 will be revised to 'Low-Moderate'.
48.	Table 13-7	Under the criteria "Reduction of Toxicity, Mobility, or Volume through Treatment", the supporting information provided for Alternatives 3b, 3c, and 3d are the same. However, Alternative 3b is rated lower than Alternatives 3c and 3d for this criteria. It is recommended that this discrepancy be clarified.	Alternatives 3b, 3c, and 3d will be revised to a rating of 'Moderate-High'.
49.	Table 13-7	Under the criteria "Reduction of Toxicity, Mobility, or Volume through Treatment", the supporting information provided for Alternative 4 is confusing. This alternative provides for clean closure of the site and would transfer these concerns to another location. The supporting text does not portray these facts. It is recommended that this issue be clarified.	The statement under Alternative 4 will be revised to state, "High degree of reduction in toxicity, mobility, and/or volume of debris at the site due to the complete removal of debris."
50.	Table 13-7	The ratings provided under the "cost" criteria are inverse to those provided in other MCAS El Toro FS evaluations (e.g., Final FS Addendum, OU 3A, IRP Site 8). In other FS documents the least expensive alternative is rated as "low" and the most expensive as "high". It is recommended that this discrepancy be clarified.	For compatibility with evaluations presented in this and in other documents prepared for MCAS El Toro, the cost ratings will remain as presented; lower-cost alternatives will be rated relatively higher than higher-cost alternatives.
51.	Section 13.3.1, Page 13-31	Some of the text in this section is poorly presented. For example, a statement in the opening paragraph implies that the ICs and access restrictions under Alternative 2 will "assure that there will be (a)	This section will be edited for clarity as recommended.

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		pathway for exposure to ground water". An edit of the text of this section is recommended.	
52.	Table 13-10	Why would landfill gas monitoring be included under Alternative 4, clean closure? It is recommended that this issue be clarified.	Table 13-10 will be revised to indicate that landfill gas monitoring is not included under Alternative 4.

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Draft Remedial Investigation / Feasibility Study (RI/FS) Report, Operable Unit 2C – Anomaly Area 3, Former Marine Corps Air Station (MCAS) El Toro, California, SWRCB GEOTRACKER ID: DOD100131500, December 2005.

Reviewer: Mr. John Broderick, California Regional Water Quality Control Board, Santa Ana Region, Dated 16 February 2006

Comment No.	Section/ Page No.	Comment	Response
1.	Section 3.7; Page 3-15 and-16	The section states that at least one or more ground water samples test above drinking water standards, likely the maximum contaminant level (MCL) for that radionuclide concentrations. It is further states the exceedances are naturally occurring. Backup information to evaluate the information and decision for no further evaluation is not supported in the appendix to the report as it should be. Please attach sufficient supporting information for the statement that no further evaluation of radionuclide concentration ground water is required.	Section 3.7.1 refers to Table 3-1, which is a summary of analytes reported in groundwater at concentrations exceeding maximum contaminant levels (MCLs). The results compiled in this table were obtained as part of the investigation conducted by the Department of the Navy (DON) in 1999 and 2000. The DON presented the results to the regulatory agencies in a package titled: "Anomaly Area 3 Technical Information Package (OHM/IT 2000)". The DON also conducted a Phase II evaluation of radionuclides in groundwater at Sites 1, 2, 3, 5, and 17. The results of this Phase II evaluation were submitted to the regulatory agencies as a Technical Memorandum in December 2001 (Earth Tech 2001). This report (Earth Tech 2001) concluded that there was no evidence that the gross alpha and beta emissions reported at Former MCAS El Toro were caused by Marine Corps activities. For Anomaly Area 3 (AA 3), using the California Department of Health Services guidance for evaluating radionuclides in drinking water sources, the reported concentrations would not trigger additional evaluation. In addition, based on a comparison of the upgradient and downgradient concentrations, debris placement activities have not impacted groundwater quality.
2.	Section 6.5; Page 6-75	Groundwater was sampled only for contaminants of concern. General minerals were not sampled regularly for total assessment of the impact of the waste management unit on the underlying groundwater and down gradient beneficial uses. Since the site is a typical compliance site, a solid waste landfill, regular sampling of general mineral parameters should have occurred in addition to sampling contaminants of concern.	Groundwater monitoring at this site was conducted in accordance with the Agency-approved Removal Site Evaluation (RSE) Work Plan (Earth Tech 2002). The constituents analyzed were those that could potentially pose a threat to human-health and/or the environment. Results indicated that these constituents do not pose a threat to human-health and/or the environment. A review of concentrations of naturally-occurring constituents, namely metals, indicates that debris placement activities have not adversely impacted groundwater quality. To confirm this conclusion and in response to agency comments, the DON conducted a supplemental ninth round of groundwater monitoring for analytes including general minerals and metals from all wells at the site to evaluate whether debris placement has affected groundwater at the point of compliance. As detailed in the agency-concurred Sampling and Analysis Plan (SAP) Addendum No.1 to the RSE Work Plan, a statistical evaluation using DUMPStat and data from the supplemental ninth RSE

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Reviewer: Mr. John Broderick, California Regional Water Quality Control Board, Santa Ana Region, Dated 16 February 2006

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			monitoring round (conducted in February 2007) and data from other basewide monitoring wells was conducted to assess whether there was a statistically significant release at the point of compliance at AA 3. Groundwater samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), metals (filtered), and general chemistry parameters (including common cations and anions). Results from the statistical evaluation confirmed conclusions presented in the Draft Remedial Investigation (RI)/Feasibility Study (FS) Report, namely that there was no statistically significant release at the point of compliance. These recent monitoring results and statistical evaluation are presented in the *Draft Letter Report, Anomaly Area 3, Supplemental Groundwater Monitoring at MCAS El Toro,* dated July 2007.
3.	Section 6.7, Page 6-113	Surface water was sampled only for contaminants of concern, also. General minerals and or applicable parameters of concern for assessing the waste management unit's impacts on the down gradient or down stream beneficial uses and total maximum daily loads (TMDL) were not sampled. This sampling should have occurred. The limited surface water sampling completed implies the general area is impacting down gradient surface water quality. The sampling completed was insufficient to demonstrate the waste management unit is not impacting down water stream quality.	The Final RSE Work Plan for AA 3 (Earth Tech 2002) presents sampling suites for all media that were investigated as part of the RSE. The Work Plan proposed that surface water would be sampled and analyzed for a full suite of analytes including petroleum hydrocarbons, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, and perchlorate (Pages 4-17 and A-9 of the Final Work Plan). Surface water analytical results were evaluated based on a comparison to groundwater quality criteria and upstream and downstream concentrations. As noted in Table 6-29, the upstream and downstream concentrations of these constituents were comparable, indicating that AA 3 does not impact surface water in Agua Chinon Wash.
4.	ARARs evaluation	We continue to disagree with your selection of State hazardous waste regulations for items such as groundwater monitoring and water quality protection standard over State solid waste regulations. This waste management unit is a solid waste landfill, not a hazardous waste landfill. Yes, the State regulations for hazardous waste landfills are in several instances more stringent than those for solid waste landfills. But, the State applies the regulations that are applicable for the type of waste disposed of in the unit. We do not concur	The selection of potential applicable or relevant and appropriate requirements (ARARs) for landfill closure and postclosure for remedial action at AA 3 including the requirements of Title 22 of the California Code of Regulations (22 CCR) (hazardous waste regulations) is based on the stringency comparison presented in Table A-7 of Appendix H. This stringency comparison was required since landfill closure and postclosure requirements in the three sets of regulations (Title 40 Code of Federal Regulations, Part 258 [40 C.F.R. 258], 27 CCR, and 22 CCR) were considered to be potential

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Draft Remedial Investigation / Feasibility Study (RI/FS) Report, Operable Unit 2C – Anomaly Area 3, Former Marine Corps Air Station (MCAS) El Toro, California, SWRCB GEOTRACKER ID: DOD100131500, December 2005.

Reviewer: Mr. John Broderick, California Regional Water Quality Control Board, Santa Ana Region, Dated 16 February 2006

Comment No.	Section/ Page No.	Comment	Response
		that you have properly identified all the ARARs for a solid waste landfill regulated under Title 27 of the California Code of Regulations.	ARARs for AA 3. In this context, it should be noted that per the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) preamble, the regulations of 22 CCR, division 4.5 are a source of potential federal ARARs for CERCLA response action at AA 3 (see Section 1.3.1 of Appendix H). The DON concurs that regulations at 27 CCR are a source of potential state ARARs for landfill closure and postclosure at AA 3. Therefore, consistent with the NCP, the requirements of 27 CCR identified by the state as potential state ARARs for AA 3 were compared to equivalent federal provisions at 22 CCR and 40 C.F.R 258, and most stringent of the three regulations were identified as proposed ARARs for the remedial action. Any additional requirements of 27 CCR identified by the state as ARARs in a timely manner per the NCP (40 C.F.R. 300.400[g] and 40 C.F.R. 300.430[e][9]) will be evaluated by the DON for remedial action at AA 3.
5.	Section 13.3.2 Page 13-32	The groundwater investigation demonstrates that the landfill has and is currently impacting the underlying groundwater quality. The investigation also documents that waste is now or has been in the groundwater or is located within five feet of the underlying groundwater. All existing solid wastes landfill units are required by the Title 27 of the California Code of Regulation, Section 20240 (c) to have the base of the waste separated by a minimum of five feet above the highest anticipated elevation of the underlying groundwater. All of the alternatives evaluated in the feasibility study portion of the report do not identify this regulatory requirement and do not propose as part of the remedy actions to comply with the five-foot separation requirement. Therefore, we do not concur with all remedial alternatives except Alternative 1 complies with our applicable relevant and appropriate requirements. In our opinion, none of the remedial alternatives fully complies with our ARARs.	The Navy disagrees that the 5-foot separation requirement specified in 27 CCR Section 20240 constitutes potential ARAR for AA 3 remedial action. The rationale for this determination is presented in Table A-6 of Appendix H and is described below. Since disposal of debris stopped at AA 3 prior to the effective date of 27 CCR, the requirements of 27 CCR Section 20240(c) are not applicable. However, these requirements were evaluated to determine if they were potentially relevant and appropriate. This evaluation indicated that although the requirements at 27 CCR Section 20240 (c) are relevant, they are not appropriate at AA 3 since these requirements pertain to construction and operation of new landfills and operation of existing landfills. Although AA 3 was historically a debris disposal area, it is presently inactive and not in operation. Therefore, the 5-foot separation requirement between debris and the highest anticipated groundwater level is not appropriate for AA 3. A requirement must be both relevant and appropriate in order to constitute an ARAR for a CERCLA site (40 C.F.R. Section 300.400[g][2]). If the requirement is relevant but not appropriate, such a requirement does not constitute an ARAR therefore, the requirements at 27 CCR Section 20240 (c) were

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Reviewer: Mr. John Broderick, California Regional Water Quality Control Board, Santa Ana Region, Dated 16 February 2006

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			determined not to be ARARs for AA 3. Based on results from groundwater monitoring conducted at the site under the RSE process, groundwater quality at the point of compliance has not been impacted by debris placement activities (see Response to Comment 2). In addition, with the exception of the no action alternative, each alternative has a groundwater monitoring program for assessing its effectiveness with respect to the following remedial action objectives (RAOs): Control run-on, run-off, and erosion, minimize infiltration and potential contaminant leaching to groundwater.
6.	Appendix H, Section 2.2.1.2, Page H-2	We do not concur with the statement that no remedial action is required at Anomaly Area 3 site for surface water impacts. We do not believe the site's potential to impact surface water was completely and properly assessed.	As described in Section 4.10 of the RI/FS Report, surface water sampling was conducted as a part of the RSE at AA 3. The sampling locations for surface water runoff were designed to evaluate analyte concentrations in surface water at an upstream location and at a downstream location within Agua Chinon Wash. In accordance with the Agency-approved Work Plan (Earth Tech 2002), and similar to groundwater samples, surface water samples were analyzed for petroleum hydrocarbons, VOCs, SVOCs, metals, and perchlorate. Surface water sample results were evaluated based on a comparison to surface water quality criteria. The comparison indicated that only two metals, aluminum and chromium, were reported at concentrations exceeding their respective MCLs. However, as noted in Table 6-32 of the RI/FS Report, the upstream and downstream concentrations of these constituents are comparable, indicating that AA 3 does not impact surface water quality in Agua Chinon Wash. In addition, remedial alternatives were developed with the objective of preventing surface water in the washes (including Aqua Chinon Wash) from contacting debris placed at the site. The DON believes that AA 3 does not impact surface water in Agua Chinon Wash and that the remedial alternatives proposed in the RI/FS Report would protect surface water by minimizing the potential for buried debris at AA 3 to come in contact with surface water. The continued effectiveness of the selected remedy to isolate buried debris from surface water would be confirmed through the CERCLA 5-year review process, as appropriate. Inspections included as a part of institutional controls (ICs) to assess

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Reviewer: Mr. John Broderick, California Regional Water Quality Control Board, Santa Ana Region, Dated 16 February 2006

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			whether the RAO relating to surface water protection is being met will be added to the alternatives, as appropriate.
General Comment			
		It should be noted, we have stated in our letters of January 26, 2004 and July 26, 2004 our disagreement with the determination that, Anomaly Area 3 is a CERCLA release site. We consider the site a compliance site, a solid waste landfill unit. Furthermore, we will not agree to inclusion under the Federal Facility Agreement of this site. We will not stand in the way of any site environmental benefit or improvements which result from CERCLA remedial actions. We will however, at the end of the CERCLA process hold the property owner responsible for compliance with our regulatory mandates for a solid waste landfill unit.	Comment noted.

Reference:

Earth Tech, Inc. (Earth Tech) 2002. Final Work Plan, Removal Site Evaluation Anomaly Area 3, Former Marine Corps Air Station, El Toro, California. Honolulu. August.

Document Title:

Draft Remedial Investigation / Feasibility Study (RI/FS) Report, Operable Unit 2C – Anomaly Area 3, Former Marine Corps Air Station (MCAS) El Toro, California, December 2005

Reviewer: Mr. Frank Cheng, Remedial Project Manager, Office of Military Facilities, Southern California Operations Branch, DTSC. Dated 21 March 2006

Comment No.	Section/ Page No.	Comment	Response
GENERAL COMMENT			
1.		In general, the report is very complete and accurate. However minor grammatical, spelling, and miscellaneous text errors exist. A thorough review is recommended.	The text will be thoroughly reviewed; grammatical, spelling, and miscellaneous text errors will be corrected.
SPECIFIC COMMENT			
2.	Appendix H Applicable Relevant and Appropriate Requirements (ARARs)	The ARAR analysis is an iterative process. Certain ARARs may no longer apply or additional ARARs may become apparent when the remedial alternatives are more fully developed.	Comment noted. As the lead federal agency, the Department of the Navy (DON) is responsible for identifying and evaluating federal applicable or relevant and appropriate requirements (ARARs) for Anomaly Area 3 (AA 3). The ARARs identified by the state agencies in a timely manner per the National Oil and Hazardous Pollution Contingency Plan (NCP) (Title 40 of the Code of Federal Regulations Sections 300.400[g] and 300.430[e][9]) will be evaluated as potential ARARs by the DON for remedial action alternatives at AA 3.

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Draft Remedial Investigation / Feasibility Study (RI/FS) Report, Operable Unit 2C – Anomaly Area 3, Former Marine Corps Air Station (MCAS) El Toro, California, December 2005

Reviewer: Dr. Regina Donohoe, Staff Toxicologist, California Department of Fish and Game, Dated 2 March 2006

Comment No.	Section/ Page No.	Comment	Response
1.	Section 5.5.5.4	Wetlands and Waters of the U.S. - The vegetation section should describe the commonly occurring mulefat (Baccharis salicifolia) and black willow (Salix goodingii) that occur along Agua Chinon Wash and the easterly side of AA 3. Mulefat is a facultative wetland species, which are usually found in wetlands (67-99% probability). Black willow is an obligate wetland species, which is almost always found in wetlands. This comment applies to the same text in Section 9, Screening Risk Assessment – Ecological.	Descriptive text regarding the plants in the riparian zone of Agua Chinon Wash will be added in Sections 5.5.5.4, Wildlife Survey and 9.2.1.1, Vegetation.
2.	Section 5.5.5.4	Wetlands and Waters of the U.S. - Please describe the characteristics of the disturbed wetland mentioned in Section 5.5.6.2 and show the location of the wetland on the habitat map. This comment applies to the same text in Section 9, Screening Risk Assessment – Ecological.	The potential wetlands on- and off-site are described in Sections 5.5.5.1 and 9.2.1.1. The mulefat scrub, where it occurs at the eroding gully to Agua Chinon Wash, was considered disturbed. The reference to disturbed wetland will be removed from the text.
3.	Section 5.5.6.3	Wetlands and Waters of the U.S. – DFG considers Aqua Chinon Wash and the associated mulefat scrub to be a wetland, and thus the Fish and Game Commission wetlands policy outlined in the ARARs, submitted by DFG-OSPR on September 8, 2005, applies. Measures should be taken to protect these sensitive areas to the extent possible during the remediation effort.	The Department of the Navy (DON) has noted that the Department of Fish and Game considers Agua Chinon Wash and the associated mulefat scrub to be a wetland. However, the California Fish and Game Commission (CFGC) Wetland Policy does not constitute potential an applicable or relevant and appropriate requirement (ARAR) for the remedial action at Anomaly Area 3 (AA 3). In order for a state requirement to qualify as an ARAR under CERCLA, the requirement must be a state law or regulation and must be promulgated (of general applicability and legally enforceable). The CFGC Wetland Policy is not a promulgated regulatory requirement; therefore, it does not constitute a potential ARAR for the remedial action at AA 3. This is confirmed by the following CFGC comment relating to the scope of the Wetland Policy (CFGC 1994): *"The Commission has found the policy and implementation procedures to be nonregulatory in nature. Their intended application is in those circumstances where the Department's role is advisory, as in, but not limited to, the application of the California Environmental Quality Act, National Environmental*

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			Protection Act, California Coastal Act, Clean Water At, and other applicable state and federal laws and regulations." The Department of Fish and Game in their letter to DON (dated September 8 2005) listing potential ARARs for AA 3 had the following comment about the CFGC Wetland Policy: *"This policy is not a regulatory program and should be included as a TBC."* This indicates that Department of Fish and Game agrees that CFGC Wetland Policy is not a potential ARAR. Additionally, since no area within AA 3 meets all three federal criteria for a wetland described in the U.S. Army Corps of Engineers (USACE) Wetlands Delineation Manual (USACE 1987), the DON has determined that the CFGC Wetland Policy does not constitute a to be considered (TBC) requirement for the remedial action at AA 3. The technical guideline in the USACE Wetlands Delineation Manual is based on the wetland definitions promulgated by USACE and U.S. EPA. The United States Fish and Wildlife Service definition of wetland is not promulgated. Although CFGC Wetland Policy does not constitute potential ARAR or TBC for the remedial action at AA 3, measures will be taken to protect sensitive areas during potential response actions.
4.	Section 9.2.3	Assessment Endpoints – The response to our Comment #3 regarding Table 8-4 stated that the table would be modified to indicate that the assessments endpoints were survival, growth, and reproduction, rather than a decline in populations (see Appendix G). However, no changes were made to the current Table 9-4. Please make the change to Table 9-4.	Table 9-4 will be updated as requested.
5.	Section 9.2.4	Selection of Representative Species – The response to our Comment #4 regarding tables 8-6 and 8-13 stated that the soil intake for the	Tables 9-6 and 9-13 will be updated to include data used

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Reviewer: Dr. Regina Donohoe, Staff Toxicologist, California Department of Fish and Game, Dated 2 March 2006

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		ornate shrew would be changed to 6 percent. However, no changes were made to the current Tables 9-6 and 9-13. When risk calculations for ornate shrew were spot checked, it was verified that 6% was used as the soil ingestion rate. Tables 9-6 and 9-13 should provide the correct inputs to the exposure models that were used.	in the calculation of the exposed dose.
6.	Section 9.2.4	Selection of Representative Species – The response to our Comment #5 regarding Tables 8-6 and 8-13 stated that the soil intake for ground feeding birds would be changed to 9.3 percent. When risk calculations for the mourning dove were spot checked, it was verified that 9.3% was used as the soil ingestion rate. Tables 9-6 and 9-13 should provide the correct inputs to the exposure models that were used.	Tables 9-6 and 9-13 will be updated to include data used in the calculation of the exposed dose.
7.	Tables 9-6 and 9-13	The tables show that the diet partition factor was adjusted to account for soil ingestion rate. However, spot-checking of the risk calculations showed that the animal or plants made up 100% of the diet (i.e., they were not adjusted to account for soil ingestion). These calculations are correct and the diet partition factors in Tables 9-6 and 9-13 should be edited to match the exposure modeling. The species profiles in Appendix E.2.2 should also be consistent with these tables.	Tables 9-6 and 9-13 will be updated to include data used in the calculation of the exposed dose.
8.	Section 9.2.7 and Appendix E	For the mammal and bird toxicity reference values (TRVs), DFG-OSPR requested (Comment #12) that alternate hazard quotients be calculated using BTAG values (i.e., cadmium, cobalt and lead for mammals and, cadmium and lead for birds). Since surface soil concentrations at AA 3 for these inorganics are within surface soil background concentrations, these requested alternate hazard quotient calculations were considered unlikely to alter remedial decisions. Spot-checking of risk calculations for lead, using the Eco-SSL TRVs, indicated that risk estimates for birds and mammals were reproducible.	The Navy will continue to select TRVs using the hierarchy: U.S. EPA Eco SSL TRVs first, Navy-BTAG TRVs second, other peer reviewed sources third.
9.	Section 9.2.10.2	Comparison of Surface Soil COPEC Concentrations with Plant and Invertebrate Screening Concentrations – The text in this section does not discuss the cumulative risks for polycyclic aromatic hydrocarbons (PAHs) to plants and soil invertebrates. Based on Table 9-7, the hazard index for this class of compounds is 4, indicating potential risk may be associated with the PAH hotspot at HA 15. Cumulative risks	The polycyclic aromatic hydrocarbons (PAHs) have been grouped into 2 groups based on toxicity relative to phenanthrene or naphthalene (lower toxicity Group 1) or benzo(a)pyrene (higher toxicity Group 2). The cumulative concentrations for each group will be compared to direct contact screening values to estimate

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Reviewer: Dr. Regina Donohoe, Staff Toxicologist, California Department of Fish and Game, Dated 2 March 2006

Comment No.	Section/ Page No.	Comment	Response
		of PAHs are commonly addressed (e.g., Jensen and Sverdrup, 2003) and should be discussed in the ERA for this site.	potential risk from direct contact with PAHs in soil (see Table 9-7).
10.	Section 9.2.10.6	Comparison of Surface Water EPCs with Surface Water Screening Criteria – The response to General Comment #1 indicated that the tables would be updated to indicate that surface water analytical data for inorganics were from unfiltered samples (i.e., total recoverable metals). This has not been done in Table 9-10. Since the water quality criteria are on a dissolved (i.e., filtered) basis for waters with a hardness of 100 mg/l, risks may be overestimated. However, since only two water samples were taken during one sampling event, it is unclear how well the data represents overall site conditions. These uncertainties should be noted in the text and any future surface water monitoring plan should consider analyzing filtered samples to refine risk estimate.	The Column labels in Table 9-10 will be updated to indicate that the metals data are presented on an unfiltered basis. A discussion of the potential over-estimation of risk because total metals were compared to dissolved criteria will be presented in Uncertainty section 9.2.11.2.
11.	Section 9.3.3.3	Refinement of TRVs – On page 9-46 it is stated that the area of Site 1 is approximately 2.08 hectares (5.14 acres). Please correct the text to indicate the acreage for AA 3. Section 2.1 states that AA 3 encompasses 9 acres (3.6 hectares).	The area of the site is 5.14 acres. The text will be revised where appropriate.
12.	Section 9.3.6.1	Soil – The response to our Comment #19 regarding the incorrect unit for dioxin (i.e., 9.9 mg/kg should be 9.9 ng/g) indicated that the text would be corrected. The error remains in the text.	The correction will be made in Section 9.3.6.1.
13.	Appendix H	ARAR Evaluation - The DoN rejected Fish and Game Code section 5650 as an applicable and relevant standard if DoN demonstrates that a CERCLA response action complies with substantive ARARs administered by the State Water Resources Control Board (SWRCB)/Regional Water Quality Control Board (RWQCB), specifically Water Code sections 13263, 13269, and 13160, as referenced in Fish and Game Code section 5650. DON has rejected Water Code sections 13260, 13263, and 13267 as ARARs administered by the SWRCB/RWQCB, and therefore has neglected to demonstrate its willingness to comply with substantive ARARs administered by SWRCB/RWQCB. Fish and Game Code section 5650 needs to be added as an ARAR.	The substantive requirements of the California Fish and Game Code Section 5650(a) will be accepted as potential ARARs for remedial action at AA 3.

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Reviewer: Dr. Regina Donohoe, Staff Toxicologist, California Department of Fish and Game, Dated 2 March 2006

Comment No.	Section/ Page No.	Comment	Response
14.	Section 11.5	General Response Actions – DFG-OSPR would like to point out that institutional controls (ICs) such as signs and fencing do not restrict exposure to ecological receptors. However, DFG-OSPR supports ICs that would restrict exposure of burrowing animals or deep-rooted shrubs to contaminants in the subsurface soils containing debris (e.g., restrictions on excavations).	Comment Noted.

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Draft Remedial Investigation / Feasibility Study (RI/FS) Report, Operable Unit 2C – Anomaly Area 3, Former Marine Corps Air Station (MCAS) El Toro, California, December 2005

Reviewer: Dr. Riz Sarmiento, Staff Toxicologist, Human and Ecological Risk Division, DTSC. Dated 31 January 2006

Comment No.	Section/ Page No.	Comment	Response
GENERAL COMMENT			
		The risk assessment calculated risk and hazard indices based on reasonable maximum exposure (RME) conditions and central tendency exposure (CTE) conditions. However, the basis for the assumed CTE conditions is not well-documented. It is acknowledged that the exposure conditions for the construction/utility worker, escorted visitor, agricultural worker, and recreational user are site-specific, but the uncertainty is compounded by introducing CTE conditions. In addition, HERD is requesting additional information to support the data evaluation process that resulted in the elimination of other COPCs except for arsenic, iron and benzo(a)pyrene. Specific comments pertaining to the data evaluation and other elements in the risk assessment are in the following section.	For each receptor evaluated at Anomaly Area 3 (AA 3), risks were estimated under an average or central tendency exposure (CTE) assumptions. The estimation of these risks requires the use of values for various exposure factors that reflect average or typical exposures. Therefore, the basis for many of the selected values is a mean or median value in a range of possible outcomes. The source for each selected value will be included in the text. The site-specific risk-based evaluation (SSRBE) of surface soil, subsurface soil and sediment only include those chemicals that exceeded Risk Based Screening (RBS) values derived from the residential Preliminary Remediation Goals (PRGs) as these chemicals will be the resulting risk drivers such as arsenic, iron and benzo(a)pyrene (B[a]P); while exposure to other chemicals of potential concern (COPCs) will necessarily occur for all receptors, the concentration to which receptors are exposed (i.e. exposure point concentration [EPC]) is sufficiently low that the exclusion of these chemicals in the risk evaluation of the construction worker, escorted visitor, agricultural worker and recreational user will not dramatically alter final risk estimates. Further discussion will be added to the uncertainty section regarding this point.
SPECIFIC COMMENTS			
1.	Section 8.2.3.2	Sampling Reporting Limit Evaluation - This section cites the Risk Assessment Guidance Superfund (RAGS) (EPA, 1989) to support the elimination of chemicals with reporting limits that exceeded twice the maximum detected concentrations. RAGS recommends the exclusion of samples from the risk assessment if the elevated reporting limits will result in an exposure point concentration (EPC) that is higher than the maximum detected concentration. This is different from eliminating a chemical because its reporting limit is higher than twice the detected concentration. HERD recommends that the evaluation of elevated reporting limits be conducted according to RAGS before chemicals, including polycyclic aromatic	The Risk Assessment Guidance for Superfund (RAGS) recommendation is to limit the effect of reporting limits for non-detected sample results in any calculation of an EPC. By definition, removing the elevated reporting limits for non-detects that are twice the maximum detected concentration will reduce the variability of the data set and give a better EPC estimate based on the mean and any UCL Therefore, when a chemical was both detected and not detected in sample media, a proxy concentration of ½ the reporting limit was assigned when calculating exposure point concentrations

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Reviewer: Dr. Riz Sarmiento, Staff Toxicologist, Human and Ecological Risk Division, DTSC. Dated 31 January 2006

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		hydrocarbons (PAHs), are eliminated from the risk assessment. Please clarify the evaluation of petroleum hydrocarbons (PHC). Table 8-1 shows that the screening criteria for PHC as diesel fuel, gasoline, and motor oil are all 10 mg/kg. It is therefore, unclear why the presence of motor oils at Borehole Location LK026 at a maximum detected concentration of 160 mg/kg "resulted in the exclusion of one diesel fuel result in the surface soil." The approach of eliminating chemicals with detected concentrations that were closer to the method detection limits than the reporting limits is not acceptable. Such data should have had a "J" qualifier and included in the calculation of the EPC.	(such as the 95 percent UCL). If an analyte was not detected in the sample media, then it is not included in the risk assessment. The uncertainty associated with not including these non-detect chemicals in the risk assessment has been added to the uncertainty section. Further clarification has been added. Motor oil was reported at 160 milligrams per kilogram (mg/kg) in surface soil at LK026. The presence of motor oil at this concentration (160 mg/kg) led to an elevated reporting limit of (100 mg/kg) for diesel at this location. The MDC of diesel in surface soil was 39.5 mg/kg therefore this single non-detected sample result at a reporting limit of 100 mg/kg was removed from the data set because it exceeded twice the MDC. No detected chemicals (including "J" qualified data) were eliminated from evaluation as a result of reporting limits exceeding twice the MDC. To clarify, reporting limits and their effects on the identification of COPCs and resulting EPCs, Table 8-1 will be modified and restricted to non-detected chemicals. Table 8-2 will continue to identify non-detected sample results for detected chemicals that were removed from the data set. The uncertainty associated with their removal is further addressed in the uncertainty section.
2.	Section 8.3.3	Chemicals without Toxicity Values - HERD previously commented on other reports submitted by the Navy regarding the use of a surrogate compound in the event that a chemical does not have an available PRG. The following compounds have been used in risk assessments as applicable surrogates: • PRG of pyrene is a recommended surrogate for benzo(g,h,i)perylene • PRG based on the noncarcinogenic effects of naphthalene is a recommended surrogate for 2-methylnaphthalene • PRG for anthracene is a recommended surrogate for phenanthrene The uncertainty associated with the use of surrogates can be	The proposed surrogates (i.e., pyrene for benzo(g,h,i)perylene and anthracene for phenanthrene) have PRGs that are in general, an order of magnitude higher than the MDC for the analyte they are being used as a surrogate for, therefore their use would not have a significant effect on the overall risk quantitation. 2-methylnaphthalene was not detected in any of the nine subsurface soil samples; however, had it been detected, an oral reference dose of 0.004 mg/kg-day presented in IRIS would have been used.

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Reviewer: Dr. Riz Sarmiento, Staff Toxicologist, Human and Ecological Risk Division, DTSC. Dated 31 January 2006

Comment No.	Section/ Page No.	Comment	Response
		discussed in the uncertainty section.	
3.	Tables 8-4 and 8-5	The footnotes state that the cross-mark in the Flag column indicates that a chemical's maximum concentration is the reasonable maximum exposure (RME)-EPC. However, these cross marks are also present when a chemical did not have detected concentrations. Please review these Tables and revise, if necessary.	Comment acknowledged. Non-detected chemicals will be removed from these tables.
4.	Section 8.4.3.1	Incomplete Exposure Pathways - This section identifies several pathways as being "insignificant" relative to other exposure pathways. These pathways include (a) bioaccumulation and consumption of food contaminated with chemicals from subsurface soil leachate, (b) dermal contact with and incidental ingestion of surface water, (c) inhalation of VOCs in indoor air due to migration from subsurface soil and groundwater. Since the term "significant" or "insignificant" is somewhat subjective, please delete them from the evaluation. If the COPCs do not have the potential to bioaccumulate, this could be the rationale for an incomplete pathway. HERD recommends that the potential exposure pathways be defined as complete or incomplete based on the definition of a complete pathway. HERD does not agree with the elimination of the vapor intrusion pathway until the data are re-evaluated based on specific comment 1. At this time, a low frequency of detection, i.e., one to three percent, is used to consider the vapor intrusion pathway as insignificant. This is a particular concern because Table 8-1 shows that the range of reporting limits for the VOC analyses consistently exceeded the groundwater screening criteria. HERD recommends that either one-half of the maximum reporting limit or the maximum detected concentration, whichever is higher, be subjected to a screening indoor air evaluation. As an example, the reporting limit for 1,2-Dichloroethane (DCA) was 5 ug/L. At one-half the reporting limit, the screening indoor air risk for 1,2-DCA is 2.2E-05.	The Navy believes that the relative terms "significant" and "insignificant" should not be eliminated due to the importance of describing exposure pathways that, while they may be potentially complete, contribute little to the overall chemical intake as to be insignificant relative to other exposure pathways. While the distinction between significant and insignificant is subjective, the qualitative comparative evaluation of exposure pathways is important in providing adequate rationale for pathways chosen for quantitative risk evaluation. An evaluation of soil vapor migration and the potential inhalation of VOCs in indoor air will be added to the report and will include an evaluation of reporting limits.
5.	Section 8.4.3.2	Potentially Complete Exposure Pathways - The last bullet in this section indicates that inhalation of VOCs in groundwater by current onsite/offsite residents and future onsite residents will be evaluated. HERD agrees but notes that this statement contradicts the last bullet	Comment acknowledged. The last two bullets in Section 8.4.3.1 have been removed since an evaluation of VOCs in soil and groundwater that have

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Reviewer: Dr. Riz Sarmiento, Staff Toxicologist, Human and Ecological Risk Division, DTSC. Dated 31 January 2006

Comment No.	Section/ Page No.	Comment	Response
		in Section 8.4.3.1 (Incomplete Exposure Pathways). Please delete the last bullet from Section 8.4.3.1 for consistency.	migrated into indoor air has been added.
6.	Page 8-38	HERD recommends that the report addresses the high methane levels detected in eight locations within the central portion of the site. The Navy states that the presence of elevated methane levels (6,000 ppmv to 230,000 ppmv) is a negligible safety hazard because the site is undeveloped "with little or no potential for vapor accumulation to occur." Please provide additional discussion supporting the premise that methane will not accumulate in the subsurface.	Methane gas was reported in subsurface soil at eight locations within the central portion of the site. However these locations were not clustered, which would have indicated a locus of methane gas accumulation. Based on the presence of non-detect locations interspersed among the eight detected locations, the likelihood for a large area of significant methane accumulation is considered low. In addition, concentrations of methane gas at the surface are low and any potential contact/exposure with this gas would only occur in areas where there would be soil disturbance. As detailed in the letter to the California Integrated Waste Management Board (CIWMB) (DON 2004), passive gas controls would be a part of the remedy for the site. The design of the gas control system will be such that it could be changed to active gas controls if the threshold values are exceeded at the perimeter of the site.
7.	Section 8.4.4	Estimation of Exposure Point Concentrations - Please explain why the same exposure point concentration is used in both CTE and RME risk characterization. CTE risk estimates typically apply the average site concentrations whereas RME risk estimates apply the 95% UCL of the mean concentrations. Table 8-14 shows that the number of detects for SVOCs is usually limited to one sample. If a small data set is the rationale for using the same exposure point concentration, but modifying the CTE parameters, (Table 8-19), please add this discussion to the text.	When conducting exposure evaluations for any receptor, the reported concentrations of a chemical in soil do not change – only the exposure pattern or conditions that define the exposure changes. The concentration to which any receptor is potentially exposed (EPC) is expectedly an average concentration with respect to all assumed exposure scenarios. This average concentration does not change with exposure assumptions. The approach for using the UCL of the mean for both the reasonable maximum exposure (RME) and CTE scenarios follows 1992 U.S. EPA *Supplemental Guidance to RAGS: Calculating the Concentration Term*. Memorandum from Larry G. Reed, Director of Hazardous Waste Site Evaluation Division, OERR, OERR 9285.7-081. June 22.
8.	Page 8-39	Dioxins and Furans - The TEFs for each dioxin/furan congeners are presented in Table 8-6 and 8-7. Please correct the text stating that the TEFs are in Tables 8-4 and 8-5.	Comment acknowledged. The text will be revised as requested.

Document Title:

Draft Remedial Investigation / Feasibility Study (RI/FS) Report, Operable Unit 2C – Anomaly Area 3, Former Marine Corps Air Station (MCAS) El Toro, California, December 2005

Reviewer: Dr. Riz Sarmiento, Staff Toxicologist, Human and Ecological Risk Division, DTSC. Dated 31 January 2006

Comment No.	Section/ Page No.	Comment	Response
9.	Tables 8-8 through 8-11	Please revise the relative potency factors (RPFs) for the PAHs by applying the following RPFs recommended by CalEPA/OEHHA for other carcinogenic PAHs relative to benzo(a)pyrene: Benzo(a)anthracene – 0.1 Benzo(b)fluoranthene – 0.1 Benzo(k)fluoranthene – 0.1 Chrysene – 0.01 Dibenz(a,h)anthracene – 0.34 Indeno(1,2,3-cd)pyrene – 0.1	Risk estimates using the Cal/EPA toxicity values will be presented along with the risk estimates using toxicity values recommended by U.S. EPA Region 9. Included in the Cal/EPA evaluation is the recommended relative potency factors for carcinogenic PAHs. Risk estimates using Cal/EPA toxicity values will be discussed in both the risk characterization sections of the Risk-Based Screen (RBS) and the SSRBE, and in the uncertainty section of the risk assessment.
10.	Page 8-54	Please clarify that further evaluation is not warranted if the cumulative, rather than the chemical-specific, cancer risk and hazard index are at or below 10^{-6} and 1, respectively.	Comment acknowledged. If incremental lifetime cancer risks and cumulative noncancer hazard estimates for the residential receptor are below target levels of 10^{-6} and 1 respectively; then cancer and noncancer estimates are necessarily below target levels for other receptors that are potentially exposed to a lesser degree (i.e., receive a smaller chemical intake) such that the latter estimates are not necessary. The paragraph has been revised to more clearly indicate when further evaluation of risks is needed beyond those presented for the residential receptor.
11.	Section 8.5.1.1	Toxicity Values - Please present a chemical's CalEPA-modified toxicity value, when available, along with the EPA toxicity value.	The risk estimates using the Cal/EPA toxicity values will be presented along with the risk estimates using the toxicity values recommended by U.S. EPA Region 9. Risk estimates using Cal/EPA toxicity values will be discussed in both the risk characterization sections of the RBS and the SSRBE, and in the uncertainty section of the risk assessment.
12.	Section 8.5.1.2.1	Deriving Toxicity Equivalence for Dioxins/Furans - The report states that the comparison of the TEQ concentration to the TCDD PRG was excluded from the cumulative risk estimate because the TEFs derived by WHO are provisional. HERD does not agree with this approach and recommends its inclusion on the cumulative risk estimate.	Comment acknowledged. The Dioxin TEQ will be included in all cumulative risk estimates.

Document Title:

Draft Remedial Investigation / Feasibility Study (RI/FS) Report, Operable Unit 2C -- Anomaly Area 3, Former Marine Corps Air Station (MCAS) El Toro, California, December 2005

Reviewer: Dr. Riz Sarmiento, Staff Toxicologist, Human and Ecological Risk Division, DTSC. Dated 31 January 2006

Comment No.	Section/ Page No.	Comment	Response
13.	Table 8-12	Central Tendency Exposure Factors for Residents and Industrial Workers - Please provide the source/sources of the CTE values presented in this Table.	Comment acknowledged. Sources for the CTE values of various exposure factors will be included in this table and discussed in the text.
14.	Tables 8-13 through 8-17	Please include the comparison of the benzo(a)pyrene equivalent concentration to the PRG in the risk estimate.	Comment acknowledged. The B(a)P equivalent will be included in all cumulative risk estimates.
15.	Table 8-19	Please indicate the source/sources of the following assumed CTE parameters of the construction/utility worker, escorted visitor, agricultural worker, and recreational visitor: Inhalation rate Soil ingestion rate Fraction of soil ingested from the source Exposed skin surface area Exposure frequency and duration Soil adherence factors Realizing that most of the exposure conditions are site-specific, the derivation of the exposure parameters is unclear. For example, the soil ingestion rate for the agricultural worker was assumed to be intermediate between occupational and child residential ingestion rates. What is the basis for this assumption? It would seem that the agricultural worker could be doing more active work than an occupational worker or child resident. Another example is the assumption that the expose skin surface area of an agricultural worker is 30 percent than the assumed 3,300 cm^2 assumed for an occupational worker. Based on the nature of the activities of an agricultural worker, HERD recommends a skin surface area of 5700 cm^2. If this was the basis for assuming that the exposed skin surface area for an agricultural worker is equivalent to 30 percent more than the occupational worker, please indicate in the text.	Comment acknowledged. Sources for the CTE values of various exposure factors will be added to the table and discussed in the text, as appropriate. Where professional judgment was used in selecting an exposure factor value (e.g., soil ingestion rate for the agricultural worker), a more complete rationale for the selection will be presented. Specifically for the agricultural worker, a soil ingestion rate was assumed to be greater than a regular occupational worker because of the nature of the work activity. However, due to the typical mechanization of most agricultural equipment, expected soil ingestion rate would likely be lower than that for a child resident because of the latter's closer proximity to soil and expected behaviors such as playing or digging in soil that increase a child's soil ingestion rate. The value of 150 mg/day is the average between the expected soil ingestion rate for a worker in the occupational setting and the child resident. The basis for the skin surface area for the agricultural worker as well as the other assumed exposure factors will be provided in the table(s) and text, as appropriate.

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Draft Remedial Investigation / Feasibility Study (RI/FS) Report, Operable Unit 2C – Anomaly Area 3, Former Marine Corps Air Station (MCAS) El Toro, California, December 2005

Reviewer: Dr. Riz Sarmiento, Staff Toxicologist, Human and Ecological Risk Division, DTSC. Dated 31 January 2006

Comment No.	Section/ Page No.	Comment	Response
16.	Table 8-21	HERD spot-checked the site-specific PRGs. The site-specific PRGs for arsenic and benzo(a)pyrene, based on the RME conditions of an construction/utility worker, were duplicated by HERD if the EPA Region IX toxicity values were used. If the CalEPA toxicity values for arsenic are applied, the site specific PRG for arsenic is 0.8 mg/kg compared to 4.42 mg/kg if the EPA toxicity values were used. HERD recommends that these differences be presented in the report.	The risk estimates using the Cal/EPA toxicity values will be presented along with the risk estimates using the toxicity values recommended by U.S. EPA Region 9. A discussion will also be presented in Section 8.8.3, Uncertainties in Toxicity Assessment.

References:

Earth Tech, Inc. 2001. *Technical Memorandum, Phase II Evaluation of Radionuclides in Groundwater at Former Landfill Sites and the EOD Range, Marine Corps Air Station, El Toro, California. December.*

———. *2002 Final Work Plan, Removal Site Evaluation Anomaly Area 3, Former Marine Corps Air Station, El Toro, California. December.*

Department of Navy, 2004, *Proposed Landfill Gas Control Measures and Postclosure Land use at Installation Restoration Program (IRP) Site 3, IRP Site 5 and Anomaly Area 3, Former Marine Corps Air Station, El Toro, California. June*

DEPARTMENT OF THE NAVY
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SUBJECT: RESPONSES TO ADDITIONAL COMMENTS ON THE DRAFT REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) REPORT FOR OPERABLE UNIT-2C, ANOMALY AREA 3 (AA 3) FOR FORMER MARINE CORPS AIR STATION (MCAS) EL TORO, CALIFORNIA.

Dear Base Realignment and Closure Cleanup Team Members:

This letter transmits responses to additional comments on the draft RI/FS Report for AA 3 at former MCAS El Toro, California. AA 3 was formerly used as borrow area and for disposing of construction debris from Site 3. These additional comments, submitted by the California Department of Toxic Substances Control, are related to the risk assessment performed for the site.

Please submit your comments, if any, by January 02, 2008. We would like to have a meeting on January 07, 2008, to resolve any remaining issues with these responses, if necessary. If you have any questions regarding these responses, or would like to advise us of your availability for the meeting, please contact Mr. James Callian at (619) 532-0779 or me at (619) 532-0952.

Sincerely,

RICK WEISSENBORN
BRAC Environmental Coordinator
By direction of the Director

SENSITIVE RECORD

PORTIONS OF THIS RECORD ARE CONSIDERED SENSITIVE AND ARE NOT AVAILABLE FOR PUBLIC VIEWING

ADDRESS OF PRIVATE CITIZEN

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Enclosure: 1. Responses to Additional Comments on the Draft Remedial Investigation/Feasibility Study (RI/FS) Report, Operable Unit-2C, Anomaly Area 3, Former Marine Corps Air Station (MCAS) El Toro, California. December 2008.

Copy to (w/encl):
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Subcommittee Chair
El Toro Restoration Advisory Board
24922 Muirlands #139
Lake Forest, CA 92630

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Document Title:

Responses to Comments on the Draft Remedial Investigation/Feasibility Study Report, Operable Unit 2C – Anomaly Area 3, Former Marine Corps Air Station El Toro, California. *Comments dated July 19, 2007.*

Reviewer: Riz A. Sarmiento, Ph.D., Staff Toxicologist, California Department of Toxic Substances Control, Human and Ecological Risk Division, Letter dated 19 August 2007.

Comment No.	Section/Page No.	Comment	Response
General Comments			
a.		In response to HERD's request for the rationale behind the selection of chemicals of potential concern (COPC), the Navy indicated that selected COPCs are the analytes that exceeded residential preliminary remediation goals (PRGs). HERD had consistently stated that eliminating a chemical as a COPC because the chemical's concentration did not exceed its PRG is not a recommended approach because simultaneous exposures to more than one chemical is not taken into account. Risk based screening should not be used to limit chemicals identified as COPCs. In general, all detected chemicals (except essential nutrients and inorganics below site-specific background) should be identified as COPCs. Prior to proposing to drop a chemical from the risk assessment, the Navy should provide a list of all detected chemicals (including detection frequency, limits of detection, mean, standard deviation, matrix in which the chemical was detected, location and date. Concluding that a chemical is not a risk driver because its concentration is below its residential PRG should be based on how its chemical-specific risk relates to the cumulative risk. The Navy will provide a list of chemicals that they propose to exclude from the HHRA along with the rationale for doing so. The rationale should not be based on a "brightline" approach (e.g. preliminary cancer risk >l E-07, preliminary HQ>O.l). DTSC and Navy toxicologists should jointly review the list and agree on which detected chemicals (if any) can be excluded from the HHRA based upon toxicity criteria. Except for the response to specific comment #4, as shown below, the remaining specific comments from HERD will be addressed in the revised report.	All reported constituents were evaluated in the initial steps in the Navy's risk screening process. Tables 8-13 and 8-14 together present a summary of this risk screening evaluation. For completeness, Tables 8-13 and 8-14 will be revised to include quantifications of respective cancer risks and hazard indexes (HIs) based on maximum reported concentrations. These tables will also include a summation of the cumulative risks for other exposure scenarios using exposure point concentrations (EPCs). Results from these evaluations will enable risk managers to make decisions also based on the potential contributions of constituents reported at concentrations below their respective preliminary remediation goals (PRGs). In general, constituents that were reported at concentrations below their respective PRGs have risks and/or HIs that are two orders of magnitude below their point of departure for cancer risks (10-6) and/or HI threshold (1), respectively. This would not change the conclusions/etc. of the risk evaluation. An evaluation of reporting limits and screening criteria is provided in Table 8-1. Tables 8-3, 8-4, and 8-5 provide summary statistics (detection frequency, distributional form, 95 percent upper confidence limit [UCL] and the method used to compute the 95 percent UCL). It is the Navy's position that an appropriate quantification of all reported constituents has been performed and the contributions from the constituents that were reported at maximum concentrations but below their respective PRGs were adequately accounted for in the recommendations made in the Report.
Specific Comments			
1.	Section 8.2.3.2, Sample Reporting Limit Evaluation	Comment was addressed adequately. A concentration based on a reporting limit that is more than twice the highest detected concentration is excluded from the calculation of the exposure point concentration (EPC).	Comment Noted.

Document Title:

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Reviewer: Riz A. Sarmiento, Ph.D., Staff Toxicologist, California Department of Toxic Substances Control, Human and Ecological Risk Division, Letter dated 19 August 2007.

Comment No.	Section/Page No.	Comment	Response
2.	Section 8.3.3, Chemicals without Toxicity Values	The explanation addresses the comment.	Comment Noted.
3.	Tables 8-4 and 8-5	Comment will be addressed by removing non-detects from the Tables.	Comment Noted.
4.	Section 8.4.3.1, Incomplete Exposure Pathways	HERD does not agree with the response that the significance/insignificance of a particular exposure pathway could be the justification for including/excluding a potentially complete exposure pathway from further evaluation. All potentially complete pathways, regardless of magnitude, should be included in the evaluation. The purpose of the risk assessment is to quantitatively or semiquantitatively evaluate the extent of exposure through all potentially complete pathways rather than to intuitively or qualitatively conclude that a specific pathway will not change the total dose to a specific chemical. HERD maintains its recommendation to eliminate the term "significant" or "insignificant," and to evaluate all potentially complete pathways.	The risk assessment took these factors into account to establish if, for a specific exposure pathway there was a reasonable likelihood of it being significant or insignificant. To provide supporting rationale for which were considered to be significant or insignificant, the following text has been added to the first paragraph of section 8.4.3. In addition, the subsequent bullets were revised to more concisely rationalize indicate/state what is significant or insignificant. *"Although a receptor may be exposed through various pathways, the degrees of exposure from each of the pathways are not equal, such that some exposure pathways contribute more significantly (i.e., provide a higher relative contribution to the overall chemical intake or dose) while other pathways contribute so little to the overall chemical intake that they are considered insignificant. Factors that determine whether an exposure pathway is insignificant include:* - *the likelihood that the exposure is expected to occur;* - *frequency with which the exposure is expected to occur; and* - *the level or degree of exposure anticipated.* *Each of these factors is weighed for all potentially complete exposure pathways to determine those which are likely to contribute significantly to the overall risk and those exposure pathways which, though may be potentially complete, would contribute so little to the overall risk that they can be omitted from the quantitation of risks. Any exposure pathways identified as insignificant relative to other pathways is due its low probability of occurrence, a low frequency of*

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Reviewer: Riz A. Sarmiento, Ph.D., Staff Toxicologist, California Department of Toxic Substances Control, Human and Ecological Risk Division, Letter dated 19 August 2007.

Comment No.	Section/Page No.	Comment	Response
			occurrence, and/or a low anticipated level of exposure. The rationales for making these determinations are presented below."
5.	Section 8.4.3.2, Potentially Complete Exposure Pathways	Comment adequately addressed.	Comment Noted.
6.	Page 8-38	Comment adequately addressed.	Comment Noted.
7.	Section 8.4.4, Estimation of Exposure Point Concentrations	Comment addressed adequately.	Comment Noted.
8.	Page 8-39, Dioxins and Furans	Comment adequately addressed. The cited Table numbers will be revised for accuracy.	Comment Noted.
9.	Table 8-8 through 8-11	Comment adequately addressed.	Comment Noted.
10.	Page 8-54	Comment will be addressed by clarifying the rationale that will support further evaluation.	Comment Noted.
11.	Section 8.5.1.1, Toxicity Values	Comment will be addressed by presenting risk estimates using both CalEPA-modified toxicity values along with the EPA toxicity values.	Comment Noted.

Document Title:

Responses to Comments on the Draft Remedial Investigation/Feasibility Study Report, Operable Unit 2C – Anomaly Area 3, Former Marine Corps Air Station El Toro, California. *Comments dated July 19, 2007.*

Reviewer: Riz A. Sarmiento, Ph.D., Staff Toxicologist, California Department of Toxic Substances Control, Human and Ecological Risk Division, Letter dated 19 August 2007.

Comment No.	Section/Page No.	Comment	Response
12.	Section 8.5.1.2.1, Deriving Toxicity Equivalence for Dioxins/Furans	Comment addressed. The cumulative risk estimates will include the dioxin TEQs.	Comment Noted.
13.	Table 8-12, Central Tendency Exposure Factors for Residents and Industrial Workers	The sources of the CTE values will be presented.	Comment Noted.
14.	Tables 8-13 through 8-17	Comment will be incorporated by including the benzo(a)pyrene equivalent concentration in the cumulative risk estimates.	Comment Noted.
15.	Table 8-19	Comment will be addressed by identifying the sources of the CTE parameters for the construction/utility worker, escorted visitor, agricultural worker, and recreational visitor.	Comment Noted.
16.	Table 8-21	Comment will be addressed by presenting risk estimates based on Ca/EPA toxicity values as well as EPA's toxicity values.	Comment Noted.
Discussion and Conclusions			
a.		The responses are adequate and the RI/FS Report will be revised to address HERD's comments. There is still a possibility that the risk estimates could change after addressing HERD's comments on the data evaluation, on the RPFs for the detected PAHs, and on the rationale for eliminating chemicals from the human health risk assessment. The responses did not address HERD'S recommendation that the significant levels of methane detected in the central portion of the site be addressed.	The RI/FS Report will be revised as indicated in the Navy responses above. Based on the responses to DTSC comments, the quantification of indoor air risks will be incorporated into the Draft Final RI/FS Report. The use of the updated PAH RPFs will not have an impact on the overall risk quantification and resultant conclusions. With respect to methane, the RI concludes that it is restricted to the center of the site and is not reported in the perimeter well. The RI then recommends that response actions be evaluated for the elevated methane in the center of the site to ensure continued protection of human health and the environment. With the exception of the no-action alternative, all other response action alternatives

Document Title:

Responses to Comments on the Draft Remedial Investigation/Feasibility Study Report, Operable Unit 2C – Anomaly Area 3, Former Marine Corps Air Station El Toro, California. *Comments dated July 19, 2007.*

Reviewer: Riz A. Sarmiento, Ph.D., Staff Toxicologist, California Department of Toxic Substances Control, Human and Ecological Risk Division, Letter dated 19 August 2007.

Comment No.	Section/Page No.	Comment	Response
			incorporate some form of land gas migration control.

Appendix H
ARARs Evaluation

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ATTACHMENT

A Correspondence – State ARAR Identification

ACRONYMS AND ABBREVIATIONS

§	section
AR	Administrative Record
ARAR	applicable or relevant and appropriate requirement
CAA	Clean Air Act
Cal. Code Regs.	California Code of Regulations
Cal/EPA	California Environmental Protection Agency
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
C.F.R	Code of Federal Regulations
ch.	chapter
CZMA	Coastal Zone Management Area
DOI	Department of the Interior
DON	Department of the Navy
DTSC	(Cal/EPA) Department of Toxic Substances Control
ESA	Endangered Species Act
Fed. Reg.	Federal Register
FFA	Federal Facilities Agreement
FML	flexible membrane layer
FS	feasibility study
GCL	geosynthetic clay liner
HSWA	Hazardous and Solid Waste Amendments
IRP	Installation Restoration Program
LDR	land disposal restrictions
LRA	Local Redevelopment Authority
MCAS	Marine Corps Air Station
MCL	maximum contaminant level
mg/L	milligrams per liter
MOU	memorandum of understanding
NAAQS	National Ambient Air Quality Standards
National Register	National Register of Historic Places
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NHPA	National Historic Preservation Act
P.L.	Public Law
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
ROD	record of decision
RWQCB	(California) Regional Water Quality Control Board
SCAQMD	South Coast Air Quality Management District
SIP	State Implementation Plan
STLC	soluble threshold limit concentrations
TBC	to be considered
TCLP	toxicity characteristic leaching procedure
tit.	title
U.S.C.	United States Code
U.S. EPA	United States Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

1. INTRODUCTION

This appendix identifies and evaluates potential federal and state of California applicable or relevant and appropriate requirements (ARARs) from the universe of regulations, requirements, and guidance and sets forth the Department of the Navy (DON) determinations regarding those potential ARARs for each response action alternative retained for detailed analysis in this remedial investigation/feasibility study (RI/FS) for Anomaly Area 3 (AA 3), located at the former Marine Corps Air Station (MCAS) El Toro, California.

This evaluation includes an initial determination of whether the potential ARARs actually qualify as ARARs and a comparison for stringency between the federal and state regulations to identify the controlling ARARs. The identification of ARARs is an iterative process. The final determination of ARARs (no longer "potential" ARARs) will be made by the DON in the record of decision (ROD), after public review, as part of the response action selection process.

1.1 SUMMARY OF CERCLA AND NCP REQUIREMENTS

Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (42 *United States Code* [42 U.S.C.] Section [§] 9621[d]), as amended, states that remedial actions on CERCLA sites must attain (or the decision document must justify the waiver of) any federal or more stringent state environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate.

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address the situation at a CERCLA site. The requirement is applicable if the jurisdictional prerequisites of the standard show a direct correspondence when objectively compared to the conditions at the site. An applicable federal requirement is an ARAR. An applicable state requirement is an ARAR only if it is more stringent than federal ARARs.

If the requirement is not legally applicable, then the requirement is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable, address problems or situations similar to the circumstances of the proposed response action and are well suited to the conditions of the site (U.S. EPA 1988a). A requirement must be determined to be both relevant *and* appropriate to be considered an ARAR.

The criteria for determining relevance and appropriateness are listed in 40 Code of Federal Regulations (C.F.R.) § 300.400(g)(2) and include the following:

- the purpose of both the requirement and the CERCLA action
- the medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site
- the substances regulated by the requirement and the substances found at the CERCLA site
- the actions or activities regulated by the requirement and the response action contemplated at the CERCLA site
- any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the CERCLA site
- the type of place regulated and the type of place affected by the release or CERCLA action
- the type and size of structure or facility regulated and the type and size of structure or facility affected by the release or proposed in the CERCLA action

- any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resources at the CERCLA site

According to CERCLA ARARs guidance (U.S. EPA 1988a), a requirement may be "applicable" or "relevant and appropriate," but not both. ARARs must be identified on a site-specific basis and involve a two-part analysis: first, a determination whether a given requirement is applicable; then, if it is not applicable, a determination whether it is both relevant and appropriate. It is important to explain that some regulations may be applicable or, if not applicable, may still be relevant and appropriate. When the analysis determines that a requirement is both relevant and appropriate, such a requirement must be complied with to the same degree as if it were applicable (U.S. EPA 1988a).

Tables included in this appendix present each potential ARAR with an initial determination of ARAR status (i.e., applicable, relevant and appropriate, or not an ARAR). For the determination of relevance and appropriateness, the pertinent criteria were examined to determine whether the requirements addressed problems or situations sufficiently similar to the circumstances of the release or response action contemplated, and whether the requirement was well suited to the site. A negative determination of relevance and appropriateness indicates that the requirement did not meet the pertinent criteria. Negative determinations are documented in the tables of this appendix and are discussed in the text only for specific cases.

To qualify as a state ARAR under CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), a state requirement must be:

- a state law or regulation,
- an environmental or facility siting law or regulation,
- promulgated (of general applicability and legally enforceable),
- substantive (not procedural or administrative),
- more stringent than federal requirements,
- identified in a timely manner, and
- consistently applied.

To constitute an ARAR, a requirement must be substantive. Therefore, only the substantive provisions of requirements identified as ARARs in this analysis are considered to be ARARs. Permits are considered to be procedural or administrative requirements. Provisions of generally relevant federal and state statutes and regulations that were determined to be procedural or non-environmental, including permit requirements, are not considered to be ARARs. CERCLA Section 121(e)(1), 42 U.S.C. § 9621(e)(1), states "No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely on-site, where such remedial action is selected and carried out in compliance with this section." The term *on-site* is defined for purposes of this ARARs discussion as "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action" (40 C.F.R. § 300.5).

Non-promulgated advisories or guidance issued by federal or state governments are not legally binding and do not have the status of ARARs. Such requirements may, however, be useful, and are "to be considered" (TBC). TBC (40 C.F.R. § 300.400[g][3]) requirements complement ARARs but do not override them. They are useful for guiding decisions regarding cleanup levels or methodologies when regulatory standards are not available.

Pursuant to U.S. EPA guidance (U.S. EPA 1988a), ARARs are generally divided into three categories: chemical-, location-, and action-specific requirements. This classification was developed to aid in the identification of ARARs; some ARARs do not fall precisely into one group or another.

ARARs are identified on a site basis for remedial actions where CERCLA authority is the basis for cleanup.

As the lead federal agency, the DON has primary responsibility for identifying federal ARARs at the former MCAS El Toro. Potential federal ARARs that have been identified for AA 3 RI/FS are discussed in Section A.1.2.2. Pursuant to the definition of the term *on-site* in 40 C.F.R. § 300.5, the on-station areas that are part of this action include the 9-acre area encompassed by AA 3 near Pusan Way and adjacent to the Agua Chinon Wash. Additionally, the areas in close proximity of AA 3 including 100-foot buffer zone required to implement and maintain the selected remedy are considered to be the on-site boundary for this ARAR analysis. Groundwater and soil gas monitoring wells and lysimeters are, and any treatment conveyance systems are defined as "on-site." Elements of alternatives that include off-site disposal of waste such as the clean closure are considered to be off-site actions. Regulatory requirements that apply to off-site actions are not ARARs. Off-site actions (i.e., off-site disposal) are required to comply with applicable requirements only and are not required to comply with relevant and appropriate requirements identified as ARARs for on-site actions.

Identification of potential state ARARs was initiated through DON requests that the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) identify potential state ARARs, an action described in more detail in Section A.1.2.3. Potential state ARARs that have been identified for AA 3 are discussed below.

1.2 METHODOLOGY DESCRIPTION

The process of identifying and evaluating potential federal and state ARARs is described in this subsection.

1.2.1 General

As the lead federal agency, the DON has primary responsibility for identification of potential ARARs for AA 3. In preparing this ARARs analysis, the DON undertook the following measures, consistent with CERCLA and the NCP:

- identified federal ARARs for each response action alternative addressed in the RI/FS, taking into account site-specific information for AA 3
- reviewed potential ARARs identified by the state to determine whether they satisfy CERCLA and NCP criteria that must be met in order to constitute state ARARs
- evaluated and compared federal ARARs and their state counterparts to determine whether state ARARs are more stringent than the federal ARARs or are in addition to the federally required actions
- reached a conclusion as to which federal and state ARARs are the most stringent and/or "controlling" ARARs for each alternative

The remedial action objectives (RAOs) developed for AA 3 are:

- Prevent direct contact with the buried debris
- Control runoff and erosion
- Minimize infiltration and potential contaminant leaching to groundwater
- Prevent surface water in washes from contacting the buried debris
- Prevent the landfill gas from migrating to and beyond the established 100-foot buffer zone

Remedial action alternatives retained for detailed analysis in this RI/FS are designed to accomplish these RAOs and include the following:

- Alternative 1: No Action
- Alternative 2: Limited Grading, Monitoring and Institutional Controls
- Alternative 3: Containment, Monitoring and Institutional Controls
  - Alternative3a: Containment with Evapotranspiration Cover
  - Alternative3b: Containment with Title 27 prescriptive Cap
  - Alternative3c: Containment with Modified Title 27 prescriptive cap with Flexible Membrane Liner (FML)
  - Alternative3d: Containment with Modified Title 27 prescriptive cap with Geosynthetic Clay Liner (GCL)
- Alternative 4: Clean Closure and Groundwater Monitoring

1.2.2 Identifying and Evaluating Federal ARARs

The DON is responsible for identifying federal ARARs as the lead federal agency under CERCLA and the NCP. The final determination of federal ARARs will be made when the DON issues the ROD. The federal government implements a number of federal environmental statutes that are the source of potential federal ARARs, either in the form of the statutes or regulations promulgated thereunder. Examples include the Resource Conservation and Recovery Act (RCRA), the Clean Water Act (CWA), the Safe Drinking Water Act (SDWA), the Toxic Substances Control Act (TSCA), and their implementing regulations. See NCP preamble at 55 *Federal Register* (Fed. Reg.) 8764–8765 (1990) for a more complete listing.

The DON reviewed the proposed response action and alternatives against all potential federal ARARs, including but not limited to those set forth at 55 Fed. Reg. 8764–8765 (1990), in order to determine if they were applicable or relevant and appropriate using the CERCLA and NCP criteria and procedures for ARARs identification by lead federal agencies.

1.2.3 Identifying and Evaluating State ARARs

The process of identifying and evaluating potential state ARARs by the state and the DON is described in this subsection.

1.2.3.1 Solicitation of State ARARs Under NCP

The United States Environmental Protection Agency (U.S. EPA) guidance (U.S. EPA 1988b) recommends that the lead federal agency consult with the state when identifying state ARARs for response actions. In essence, the CERCLA/NCP requirements at 40 C.F.R. § 300.515 for response actions provide that the lead federal agency request that the state identify chemical- and location-specific state ARARs upon completion of site characterization. The requirements also provide that the lead federal agency request identification of all categories of state ARARs (chemical-, location-, and action-specific) upon completion of identification of remedial alternatives for detailed analysis. The state must respond within 30 days of receipt of the lead federal agency requests. The remainder of this subsection documents the DON's efforts to date to identify and evaluate state ARARs.

The DON followed the process set forth in 40 C.F.R. § 300.515 and Section 7.6 of the Federal Facilities Agreement (FFA) for remedial actions in seeking state assistance with identification of state ARARs.

1.2.3.2 Chronology of Efforts to Identify State ARARs

The following chronology summarizes the DON's efforts to obtain state assistance with identification of state ARARs for the response action at AA 3. Key correspondence between the DON and the state agencies relating to this effort has been included in the Administrative Record (AR) for this RI/FS.

The DON formally requested state chemical-, location-, and action-specific ARARs for AA 3 on 22 July 2005. Letters were sent to the DTSC and Santa Ana Regional Water Quality Control Board (RWQCB) soliciting ARARs based on site characterization summary and preliminary remedial alternatives provided to the agencies by the DON. Following the DON solicitation for ARARs from DTSC, DTSC requested ARARs from other state and local agencies.

The DON received letters from DTSC (dated 8 and 20 September 2005) providing list of potential ARARs from the following agencies:

- DTSC
- California Department of Fish and Game (letter dated September 8 2005)
- Air Resources Board (letter dated 14 August 2005)
- South Coast Air Quality Management District (SCAQMD) (letter dated 18 August 2005)

In addition, the DTSC included potential ARARs identified by the California Integrated Waste Management Board (CIWMB) for post closure care on landfills, IRP Sites 3 and 5 at the former MCAS El Toro. The Santa Ana RWQCB provided a list of potential state ARARs to the DON in a letter dated 28 September 2005.

The list of potential ARARs from DTSC and RWQCB included chemical-, location-, and/or action-specific ARARs and TBC state advisories, guidances, and criteria. SCAQMD and Air Resources Board identified SCAQMD rules and regulations as potential ARARs. The list for California Department of Fish and Game included location and action-specific ARARs and TBC requirements. An evaluation of all these potential ARARs including the ARARs identified by the CIWMB for IRP Sites 3 and 5 is presented in this appendix.

1.3 Other General Issues

General issues identified during the evaluation of ARARs for AA 3 are discussed in the following subsections.

1.3.1 General Approach to Requirements of the Federal Resource Conservation and Recovery Act

RCRA is a federal statute passed in 1976 to meet four goals: protection of human health and the environment, reduction of waste, conservation of energy and natural resources, and elimination of the generation of hazardous waste as expeditiously as possible. The Hazardous and Solid Waste Amendments of 1984 significantly expanded the scope of RCRA by adding new corrective action requirements, land disposal restrictions (LDRs), and technical requirements. RCRA, as amended, contains several provisions that are potential ARARs for CERCLA sites.

Substantive RCRA requirements are applicable to response actions on CERCLA sites if the waste is a RCRA hazardous waste, and either:

- the waste was initially treated, stored, or disposed after the effective date of the particular RCRA requirement; or
- the activity at the CERCLA site constitutes treatment, storage, or disposal as defined by RCRA (U.S. EPA 1988a).

The preamble to the NCP indicates that state regulations that are components of a federally authorized or delegated state program are generally considered federal requirements and potential federal ARARs for the purposes of ARARs analysis (55 Fed. Reg. 8666, 8742 [1990]). The state of California received approval for its base RCRA hazardous waste management program on 23 July 1992 (57 Fed. Reg. 32726 [1992]). The state of California "Environmental Health Standards for the Management of Hazardous Waste," set forth in Title 22 *California Code of Regulations*, Division 4.5 (Cal. Code Regs. tit. 22, div. 4.5), were approved by U.S. EPA as a component of the federally authorized state of California RCRA program. On 26 September 2001, California received final authorization of its revised State Hazardous Waste Management Program from U.S. EPA (63 Fed. Reg. 49118 [2001]).

The regulations of Cal. Code Regs. tit. 22, div. 4.5 are, therefore, a source of potential federal ARARs for CERCLA response actions. The exception is when a state regulation is "broader in scope" than the corresponding federal RCRA regulations. In that case, such regulations are not considered part of the federally authorized program or potential federal ARARs. Instead, they are purely state law requirements and potential state ARARs.

The U.S. EPA 23 July 1992 notice approving the state of California RCRA program (57 Fed. Reg. 32726 [1992]) specifically indicated that the state regulations addressed certain non-RCRA, state-regulated hazardous wastes that fell outside the scope of federal RCRA requirements. Cal. Code Regs. tit. 22, div. 4.5 requirements would be potential state ARARs for such non-RCRA, state-regulated wastes.

A key threshold question for the ARARs analysis is whether the contaminants at AA 3 constitute federal hazardous waste as defined under RCRA and the state's authorized program or qualify as non-RCRA, state-regulated hazardous waste. A discussion of waste characterization is included in Section A1.4.

1.4 WASTE CHARACTERIZATION

Selection of ARARs involves the characterization of wastes as described below.

1.4.1 RCRA Hazardous Waste Determination

Federal RCRA hazardous waste determination is necessary to determine whether a waste is subject to RCRA requirements at Cal. Code Regs. tit. 22, div. 4.5 and other state requirements at Cal. Code Regs. tit. 23, div. 3, Chapter (ch.) 15. The first step in the RCRA hazardous waste characterization process is to evaluate contaminated media at the site(s) and determine whether the contaminant constitutes a "listed" RCRA waste. The preamble to the NCP states that "... it is often necessary to know the origin of the waste to determine whether it is a listed waste and that, if such documentation is lacking, the lead agency may assume it is not a listed waste" (55 Fed. Reg. 8666, 8758 [1990]).

This approach is confirmed in U.S. EPA guidance for CERCLA compliance with other laws (U.S. EPA 1988a) as follows.

> To determine whether a waste is a listed waste under RCRA, it is often necessary to know the source. However, at many Superfund sites, no information exists on the source of wastes. The lead agency should use available site information, manifests, storage records, and vouchers in an effort to ascertain the nature of these contaminants. When this documentation is not available, the lead agency may assume that the wastes are not listed RCRA hazardous wastes, unless further analysis or information becomes available that allows the lead agency to determine that the wastes are listed RCRA hazardous wastes.

RCRA hazardous wastes that have been assigned U.S. EPA hazardous waste numbers (or codes) are listed in Cal. Code Regs. tit. 22, § 66261.30–66261.33. The lists include hazardous waste codes beginning with the letters "F," "K," "P," and "U."

Knowledge of the exact source of a waste is required for source-specific listed wastes ("K" waste codes). Some knowledge of the nature or source of the waste is required even for listed wastes from nonspecific sources, such as spent solvents ("F" waste codes) or commercial chemical products ("P" and "U" waste codes). These listed RCRA hazardous wastes are restricted to commercially pure chemicals used in particular processes such as degreasing.

P and U wastes cover only unused and unmixed commercial chemical products, particularly spilled or off-specification products (U.S. EPA 1991a). Not every waste containing a P or U chemical is a hazardous waste. To determine whether a CERCLA investigation-derived waste contains a P or U waste, there must be direct evidence of product use. In particular, all the following criteria must be met. The chemicals must be:

- discarded (as described in 40 C.F.R. § 261.2[a][2]),
- either off-specification commercial products or a commercially sold grade,
- not used (i.e., soil contaminated with spilled unused wastes is a P or U waste), and
- the sole active ingredient in a formulation.

Available historical information and investigations conducted as a part of removal site evaluation (RSE) indicate that predominantly construction-related debris with trace levels of domestic refuse are present at AA 3. No documentation of past disposal practices was found that would serve to classify the sources of soil and groundwater contamination at AA 3 with respect the RCRA waste listings. Therefore, DON has made the determination that the mere presence of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), dioxins, and metals should not classify AA 3 contaminated soil or groundwater as RCRA listed hazardous waste. By extension of this reasoning, the residuals generated during remedial action will not be classified as RCRA-listed hazardous waste either.

The second step in the RCRA hazardous waste characterization process is to evaluate potential hazardous characteristics of the waste. The evaluation of characteristic waste is described in U.S. EPA guidance as follows (U.S. EPA 1988a).

> Under certain circumstances, although no historical information exists about the waste, it may be possible to identify the waste as RCRA characteristic waste. This is important in the event that (1) remedial alternatives under consideration at the site involve on-site treatment, storage, or disposal, in which case RCRA may be triggered as discussed in this section; or (2) a remedial alternative involves off-site shipment. Since the generator (in this case, the agency or responsible party conducting the Superfund action) is responsible for determining whether the wastes exhibit any of these characteristics (defined in 40 C.F.R. § 261.21–261.24), testing may be required. The lead agency must use best professional judgment to determine, on a site-specific basis, if testing for hazardous characteristics is necessary.
>
> In determining whether to test for the toxicity characteristic using the extraction procedure (EP) toxicity test, it may be possible to assume that certain low concentrations of waste are not toxic. For example, if the total waste concentration in soil is 20 times or less the EP toxicity concentration, the waste cannot be characteristic hazardous waste. In such a case, RCRA requirements would not be applicable. In other instances, where it appears that the substances may be characteristic hazardous waste (ignitable, corrosive, reactive, or EP toxic), testing should be performed.

Hazardous waste characteristics, as defined in 40 C.F.R. § 261.21–261.24, are commonly referred to as ignitability, corrosivity, reactivity, and toxicity. California environmental health standards for the management of hazardous waste set forth in Cal. Code Regs. tit. 22, div. 4.5 were approved by U.S. EPA as a component of the federally authorized California RCRA program. Therefore, the characterization of RCRA waste is based on the state requirements.

The characteristics of ignitability, corrosivity, reactivity, and toxicity are defined in Cal. Code Regs. tit. 22, § 66261.21–66261.24. According to Cal. Code Regs. tit. 22, § 66261.24(a)(1)(A), "A waste that exhibits the characteristic of toxicity pursuant to subsection (a)(1) of this section has the EPA Hazardous Waste Number specified in Table I of this section which corresponds to the toxic contaminant causing it to be hazardous." Table I assigns hazardous waste codes beginning with the letter "D" to wastes that exhibit the characteristic of toxicity; D waste codes are limited to "characteristic" hazardous wastes.

According to Cal. Code Regs. tit. 22, § 66261.10, waste characteristics can be measured by an available standardized test method or be reasonably classified by generators of waste based on their knowledge of the waste provided that the waste has already been reliably tested or if there is documentation of chemicals used. Soil and groundwater contamination at AA 3 is not ignitable, corrosive, or reactive, as defined in Cal. Code Regs. tit. 22, § 66261.21–66261.23. This determination was based on knowledge of the nature and concentrations of constituents of potential concern (COPCs).

The requirements at Cal. Code Regs. tit. 22, § 66261.24 list the toxic contaminant concentrations that determine the characteristic of toxicity. The concentration limits are in milligrams per liter (mg/L). These units are directly comparable to total concentrations in waste groundwater and surface water. For waste soils, these concentrations apply to the extract or leachate produced by the toxicity characteristic leaching procedure (TCLP).

A waste is considered hazardous if the contaminants in the wastewater or in the soil TCLP extract equal or exceed the TCLP limits. TCLP testing is required only if total contaminant concentrations in soil equal or exceed 20 times the TCLP limits because TCLP uses a 20-to-1 dilution for the extract (U.S. EPA 1988a).

The total concentrations of COPCs in the soil samples collected from AA 3 were compared to TCLP limits at Cal. Code Regs. tit. 22 § 66261.24(a)(1). This comparison showed that concentrations of a limited number of COPCs in few soil samples exceeded 20 times their TCLP concentrations. This indicates that excavated soil from AA 3 has a potential to exceed criteria for the RCRA toxicity characteristic. Therefore, TCLP testing will be required for the contaminated soil at AA 3 to evaluate if it exhibits toxicity characteristic of RCRA hazardous waste.

A comparison of concentrations of COPCs in groundwater to TCLP limits indicated that none of the COPCs exceed their respective TCLP limits. Therefore, the groundwater at AA 3 is not expected exhibit the toxicity characteristic of the RCRA hazardous waste.

1.4.2 California-Regulated, Non-RCRA Hazardous Waste

A waste determined not to be a RCRA hazardous waste may still be considered a state-regulated non-RCRA hazardous waste. The state's RCRA program is broader in scope in its hazardous waste determination. Cal. Code Regs. tit. 22, § 66261.24(a)(2) lists the total threshold limit concentrations (TTLCs) and the soluble threshold limit concentrations (STLCs) for non-RCRA hazardous waste. The state applies its own leaching procedure, the Waste Extraction Test (WET), which uses a different acid reagent and has a different dilution factor (tenfold). There are other state requirements that may be broader in scope than federal ARARs for identifying non-RCRA wastes regulated by the state. These may be potential ARARs for wastes not covered under federal ARARs. See additional subsections of Cal. Code Regs. tit. 22, § 66261.24. A waste is considered hazardous if its total concentrations exceed the TTLCs or if the extract concentrations from the WET exceed the STLCs.

A WET is required when the total concentrations exceed the STLC but are less than the TTLCs (Cal. Code Regs. tit. 22, div. 4.5, ch. 11, Appendix [app.] II [b]).

The total concentrations of COPCs in the soil samples collected from AA 3 were compared to TTLCs and 10 times the STLCs at Cal. Code Regs. tit. 22 § 66261.24(a)(2). This comparison showed that concentrations of a limited number of COPCs in few soil samples exceeded 10 times their STLCs. This indicates that excavated soil from AA 3 has a potential to exceed toxicity characteristic of the California-regulated, non-RCRA hazardous waste. Therefore, WET will be required for the contaminated soil at AA 3 to evaluate if it exhibits toxicity characteristic of California-regulated, non-RCRA hazardous waste.

A comparison of concentrations of COPCs in groundwater to STLCs indicated that none of the COPCs exceed their respective STLCs. Therefore, the groundwater at AA 3 is not expected exhibit the characteristics of California-regulated, non-RCRA hazardous waste.

1.4.3 Other California Waste Classifications

For waste discharged after 18 July 1997, solid waste classifications at Cal. Code Regs. tit. 27, §§ 20210, 20220, and 20230 are used to determine applicability of waste management requirements. These are summarized below.

A "designated waste" under Cal. Code Regs. tit. 27, § 20210 is defined at California Water Code (Cal. Water Code) § 13173. Under Cal. Water Code § 13173, designated waste is hazardous waste that has been granted a variance from hazardous waste management requirements or nonhazardous waste that consists of or contains pollutants that, under ambient environmental conditions at a waste management unit, could be released in concentrations exceeding applicable water quality objectives (WQOs) or that could reasonably be expected to affect beneficial uses of the waters of the state.

A nonhazardous solid waste under Cal. Code Regs. tit. 27, § 20220 is all putrescible and non-putrescible solid, semisolid, and liquid wastes, including garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, manure, vegetable or animal solid and semisolid wastes, and other discarded waste (whether of solid or semisolid consistency), provided that such wastes do not contain wastes that must be managed as hazardous wastes or wastes that contain soluble pollutants in concentrations that exceed applicable WQOs or could cause degradation of waters of the state.

Under Cal. Code Regs. tit. 27, § 20230, inert waste is that subset of solid waste that does not contain hazardous waste or soluble pollutants at concentrations in excess of applicable WQOs and does not contain significant quantities of decomposable waste.

2. CHEMICAL-SPECIFIC ARARS

Chemical-specific ARARs are generally health- or risk-based numerical values or methodologies applied to site-specific conditions that result in the establishment of a cleanup level. Many potential ARARs associated with particular response alternatives (such as closure or discharge) can be characterized as action-specific but include numerical values or methodologies to establish them so they fit in both categories (chemical- and action-specific). To simplify the comparison of numerical values, most action-specific requirements that include numerical values are included in this chemical-specific section and, if repeated in the action-specific section, the discussion refers back to this section.

This section presents the ARARs determination conclusions addressing numerical values for groundwater, soil, and air and a summary of the potential ARARs followed by a more detailed discussion of the ARARs for groundwater, soil and air.

Potential federal and state chemical-specific ARARs are summarized in Tables H-1 and H-2, respectively, which are at the end of this appendix.

2.1 SUMMARY OF ARARS CONCLUSIONS BY MEDIUM

Groundwater, soil, and air are the environmental media potentially affected by the AA 3 response actions. The conclusions for ARARs pertaining to these media are presented in the following sections.

2.1.1 Groundwater ARARs Conclusions

Groundwater samples from AA 3 contained detectable low concentrations of VOCs, SVOCs, and motor oils/diesel fuel petroleum hydrocarbons. A comprehensive statistical evaluation of the groundwater concluded that historical activities at AA 3 have not resulted in a statistically significant release of constituents to groundwater at the point of compliance. Additionally, a significant portion of the risk associated with groundwater at AA 3 is attributable to ambient levels of arsenic. Therefore, groundwater is not a medium of concern. Since groundwater is not a medium of concern, no response action is planned and therefore groundwater ARARs are not triggered. However, detection monitoring requirements for groundwater at Cal. Code Regs. tit. 22 Section 66264.98 (e)(1-5), (j), (k)(1-3), 4(A), and (D), (5), (7)(C) and (D) are potential ARARs for groundwater monitoring that would be conducted as a component of response action alternatives that involve leaving the buried waste in-place in a waste management unit (except "No Action").The requirements of the detection monitoring program at AA 3 are discussed in detail in Section 4 (Action-Specific ARARs).

2.1.2 Soil ARARs Conclusions

Federal and state requirements for hazardous waste determinations are potential ARARs for any contaminated soil generated during the implementation of remedial action at AA 3.

2.1.3 Air ARARs Conclusions

Cal. Code Reg. tit. 27 § 20921 (a)(1), (2) and (3) and Cal. Code Reg. tit. § 21160(b) requirements for landfill gas monitoring would be potentially applicable for AA 3. Air chemical-specific requirements are as follows.

- The concentration of methane gas must not exceed 1.25 percent of volume in air within on-site structure.
- The concentration of methane gas migrating from the landfill must not exceed 5 percent by volume in air at the facility property boundary or at an alternative boundary.

- Trace gases must be controlled to prevent adverse acute and chronic exposure to toxic and/or carcinogenic compounds.

Excavation, earth-moving, and grading activities conducted as a part of cap construction and clean closure have the potential to create discharges of fugitive dust that must be managed to comply with the SCAQMD rules. The SCAQMD Rules 401, 403, 1150, and 1150.1 are potential ARARs for the alternatives being considered.

2.2 DETAILED DISCUSSION OF ARARS BY MEDIUM

The following subsections provide a detailed discussion of federal and state ARARs by medium.

2.2.1 Groundwater ARARs

Groundwater samples from AA 3 contained detectable low concentrations of VOCs, SVOCs, and motor oils/diesel fuel petroleum hydrocarbons. A comprehensive statistical evaluation of the groundwater concluded that historical activities at AA 3 have not resulted in a statistically significant release of constituents to groundwater at the point of compliance. Additionally, a significant portion of the risk associated with groundwater at AA 3 is attributable to ambient levels of arsenic. Therefore, groundwater is not a medium of concern. Since groundwater is not a medium of concern, no response action is planned and therefore groundwater ARARs are not triggered. However, detection monitoring requirements for groundwater at Cal. Code Regs. tit. 22 Section 66264.98 (e)(1-5), (j), (k)(1-3), 4(A), and (D), (5), (7)(C) and (D) are potential ARARs for groundwater monitoring that would be conducted as a component of response action alternatives that involve leaving the buried waste in-place in a waste management unit (except "No Action"). The requirements of the detection monitoring program at AA 3 are discussed in detail in Section 4 (Action-Specific ARARs).

2.2.1.1 FEDERAL

RCRA Hazardous Waste

The federal RCRA requirements at 40 C.F.R. pt. 261 do not apply in California because the state RCRA program is authorized. The authorized state RCRA requirements are therefore considered potential federal ARARs (see Section 1.3.1). The applicability of RCRA requirements depends on whether the waste is a RCRA hazardous waste, whether the waste was initially treated, stored, or disposed after the effective date of the particular RCRA requirement, and whether the activity at the site constitutes treatment, storage, or disposal as defined by RCRA. However, RCRA requirements may be relevant and appropriate even if they are not applicable. Examples include activities that are similar to the definition of RCRA treatment, storage, or disposal for waste that is similar to RCRA hazardous waste.

The determination of whether a waste is a RCRA hazardous waste can be made by comparing the site waste to the definition of RCRA hazardous waste. The RCRA requirements at Cal. Code Regs. tit. 22, § 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100 are potential ARARs because they define RCRA hazardous waste. A waste can meet the definition of hazardous waste if it has the toxicity characteristic of hazardous waste. This determination is made by using the toxicity characteristic leaching procedure (TCLP). The maximum concentrations allowable for the TCLP listed in § 66261.24(a)(1)(B) are potential federal ARARs for determining whether the site has hazardous waste. If the site waste has concentrations exceeding these values, it is determined to be a characteristic RCRA hazardous waste (see Section 1.4.1).

2.2.1.2 STATE

The state has identified the following ARARs for groundwater at AA 3:

- Comprehensive Water Quality Control Plan for the Santa Ana River Basin (Basin Plan) as amended by the following Regional Board Resolutions:
  - Res. 97-20 – Bacterial Objectives for Ocean Waters
  - Res. 98-100 – Newport Bay Watershed Nutrient total maximum daily load (TMDL)
  - Res. 98-101 – Newport Bay Watershed Sediment TMDL
  - Res. 99-10 – Newport Bay Fecal Coliform TMDL
  - Res. 00-27 – Incorporate Language Authorizing Compliance Schedules in NPDES, and
  - Res. R8-2004-0001 – Incorporate an Updated Total Dissolved Solids (TDS) Management Plan.
- State primary and secondary maximum contaminant levels (MCLs) at Cal. Code Regs. tit. 22, §§ 64431, 64444, and 64449.
- State Water Resources Control Board (SWRCB) Resolution (Res.) 68-16, and Res. 92-49
- Porter-Cologne Water Quality Control Act (Porter-Cologne Act), Cal. Water Code §§ 13000, 13140-13147, 13172, 13260, 13263, 13267, and 13304.

The evaluation of the ARAR status of these requirements is presented in following sections and Table H-2. As explained below and in Table H-2, since groundwater is not a medium of concern and no response action is planned for groundwater none of the above-mentioned requirements constitute ARARs for the planned response actions at AA 3

Comprehensive Water Quality Control Plan for the Santa Ana River Basin (Basin Plan)

The Basin Plan for the Santa Ana Region was prepared and implemented by the RWQCB Santa Ana Region to protect and enhance the quality of the waters in the Santa Ana Region. The Basin Plan establishes location-specific beneficial uses and WQOs for the surface water and groundwater of the region and is the basis of the RWQCB Santa Ana Region regulatory programs. The Basin Plan includes both numeric and narrative WQOs for specific groundwater subbasins. The WQOs are intended to protect the beneficial uses of the waters of the region and to prevent nuisance.

Beneficial use and reuse of water are key aspects of the Basin Plan for the Santa Ana Region. MCAS El Toro is located in the Santa Ana River basin. The Irvine Groundwater management Zone of the lower Santa Ana River Basin has the following beneficial use designations (RWQCB 24 January 1995):

- municipal and domestic supply,
- agricultural supply,
- industrial service supply, and
- industrial process supply.

The Basin Plan as amended by Resolutions 97-20 and R8-2004-0001 establish WQOs for bacteria and total dissolved solids (TDS), respectively. Resolutions 98-100, 98-101, and 99-10 establish TMDLs for nutrients, sediment, and fecal coliform, respectively, for Newport Bay Watershed. No response action is planned for groundwater and surface water at AA 3. No discharge to surface waters or groundwater is planned as a part of AA 3 remedial action. Additionally, bacteria, TDS, nutrients, sediments, and fecal coliforms are not related to site activities and are not constituents of concern for AA 3. Therefore, WQOs for bacteria and TDS, and TMDLs for nutrients, sediment, and fecal coliform are not potential ARARs for the remedial action at AA 3.

The Basin plan also contains narrative WQOs. A narrative objective for toxic substances in groundwater states: "All waters of the region shall be maintained free of substances in concentrations which are toxic, or that produce detrimental physiological responses in human, plant, animal, or aquatic life" (RWQCB 1995, p. 4-14). A comprehensive statistical evaluation of the groundwater concluded that historical activities at AA 3 have not resulted in a statistically significant release of constituents to groundwater at the point of compliance. Additionally, a significant portion of the risk associated with groundwater at AA 3 is attributable to ambient levels of arsenic. Therefore, no groundwater-specific response action is planned for AA 3. Consequently, the narrative WQO of the Basin Plan does not constitute potential ARAR for AA 3 remedial action.

Primary and Secondary State MCLs

State primary and secondary MCLs are potential relevant and appropriate requirements for an aquifer designated as potential source of drinking water. However, as discussed previously, no response/corrective action is planned for groundwater remediation at AA 3. Therefore, state primary and secondary MCLs are not potential ARARs for AA 3 remedial action.

State Water Resources Control Board Res. 92-49 and 68-16

Groundwater is not a medium of concern at AA3 and no response/corrective action is planned for groundwater. A comprehensive statistical evaluation of the groundwater concluded that historical activities at AA 3 have not resulted in a statistically significant release of constituents to groundwater at the point of compliance. Therefore, the requirements of the State Water Resources Control Board Res. 92-49 and Res. 68-16 do not constitute potential ARARs for AA 3.

Porter-Cologne Water Quality Control Act.

The Porter-Cologne Water Quality Control Act (Porter-Cologne Act) became Division 7 of the California Water Code in 1969. The Porter-Cologne Act requires each regional board to formulate and adopt Basin Plans for all areas within the region (Cal. Water Code § 13240). It also requires each regional board to establish WQOs that will protect the beneficial uses of the water basin (Cal. Water Code § 13241) and to prescribe waste discharge requirements that would implement the Basin Plan for any discharge of waste to the waters of the state (Cal. Water Code § 13263[a]).

The RWQCB identified Cal. Water Code, div. 7, §§ 13000, 13140-13147, 13172, 13260, 13263, 13267, and 13304 as potential ARARs for AA 3 remedial action. A detailed ARAR evaluation for these provisions is presented in Table H-2. This evaluation indicated that none of these provisions constitute potential ARARs for the remedial action at AA 3.

2.2.2 Soil ARARs

The key threshold question for soil ARARs is whether or not the wastes located at the AA 3 would be classified as hazardous waste. The soil may be classified as a federal hazardous waste as defined by RCRA and the state-authorized program, or as non-RCRA, state regulated hazardous waste. If the

soil is determined to be hazardous waste during the remedial action implementation, the appropriate requirements will apply.

2.2.2.1 FEDERAL

Federal requirements evaluated as potential ARARs for soil are discussed in the subsections below.

RCRA Hazardous Waste

The federal RCRA requirements at 40 C.F.R. pt. 261 do not apply in California because the state RCRA program is authorized. The authorized state RCRA requirements are therefore considered potential federal ARARs (see Section A1.3.1). The applicability of RCRA requirements depends on whether the waste is an RCRA hazardous waste, whether the waste was initially treated, stored, or disposed after the effective date of the particular RCRA requirement, and whether the activity at the site constitutes treatment, storage, or disposal as defined by RCRA. However, RCRA requirements may be relevant and appropriate even if they are not applicable. Examples include activities that are similar to the definition of RCRA treatment, storage, or disposal for waste that is similar to RCRA hazardous waste.

Determination of whether a waste is an RCRA hazardous waste can be made by comparing the site waste to the definition of RCRA hazardous waste. RCRA requirements at Cal. Code Regs. tit. 22, § 66261.21, § 66261.22(a)(1), § 66261.23, § 66261.24(a)(1), and § 66261.100 are potential ARARs because they define RCRA hazardous waste. A waste can meet the definition of hazardous waste if it has the toxicity characteristic of hazardous waste. This determination is made by using the TCLP. The maximum concentrations allowable for the TCLP listed in § 66261.24(a)(1)(B) are potential federal ARARs for determining whether the site has hazardous waste. If the site waste has concentrations exceeding these values, it is determined to be a characteristic RCRA hazardous waste (see Section A1.4.1).

RCRA land disposal restrictions (LDRs) at Cal. Code Regs. tit. 22, § 66268.1(f) are potential federal ARARs for discharging waste to land. This section prohibits the disposal of hazardous waste to land unless 1) it is treated in accordance with the treatment standards of Cal. Code Regs. tit. 22, § 66268.40 and the underlying hazardous constituents meet the Universal Treatment Standards at Cal. Code Regs. tit. 22, § 66268.48; 2) it is treated to meet the alternative soil treatment standards of Cal. Code Regs. tit. 22, § 66268.49; or 3) a treatability variance is obtained under Cal. Code Regs. tit. 22, § 66268.44. These are potentially applicable federal ARARs because they are part of the state-approved RCRA program. RCRA Treatment Standards for non-RCRA, state-regulated waste are not potentially applicable federal ARARs but they may be relevant and appropriate state ARARs.

2.2.2.2 STATE

State requirements evaluated as potential ARARs for soil are discussed in the subsections below.

RCRA Requirements

State RCRA requirements included within the U.S. EPA-authorized RCRA program for California are considered to be potential federal ARARs and are discussed in the previous section. When state regulations are broader in scope than their federal counterparts, they are considered potential state ARARs. State requirements such as the non-RCRA, state-regulated hazardous waste requirements may be potential state ARARs because they are not within the scope of the federal ARARs (57 Fed. Reg. 60848). The Cal. Code Regs. tit. 22, div. 4.5 requirements that are part of the state-approved RCRA program would be potential state ARARs for non-RCRA, state-regulated hazardous wastes.

The site waste characteristics need to be compared to the definition of non-RCRA, state-regulated hazardous waste. The non-RCRA, state-regulated waste definition requirements at Cal. Code Regs. tit. 22, § 66261.24(a)(2) are potential state ARARs for determining whether other RCRA

requirements are potential state ARARs. This section lists the TTLCs and STLCs. The site waste may be compared to these thresholds to determine whether it meets the characteristics for a non-RCRA, state-regulated hazardous waste.

2.2.3 Air ARARs

For this RI/FS, some of the alternatives evaluated include waste excavation, temporary storage, grading and earth-moving activities. There is a potential for fugitive dust and air emissions of certain COPCs at the site.

ARARs for air are discussed in greater detail under action-specific requirements.

2.2.3.1 FEDERAL

The Clean Air Act (CAA) and RCRA air emission requirements are discussed below. However, no federal air chemical-specific ARARs have been identified.

Clean Air Act

The CAA establishes the National Ambient Air Quality Standards (NAAQS) in 40 C.F.R. § 50.4–50.12. NAAQS are not enforceable in and of themselves; they are translated into source-specific emissions limitations by the state (U.S. EPA 1990). Substantive requirements of the SCAQMD rules that have been approved by U.S. EPA as part of the State Implementation Plan (SIP) under the CAA are potential federal ARARs for air emissions (CAA Section 110). The SIP includes rules for emissions restrictions for particulates, organic compounds, and hazardous air pollutants, as well as standards of performance for new sources.

SCAQMD rules that have been approved by U.S. EPA as a part of SIP and were identified as potential federal ARARs for air emissions included, Rules 201, 203, 403, 404, 405, 407, 409, 474, 1150.1, 1166, and Regulation XIII. Rule 1150.1, which contains important chemical specific requirements for landfill gas emissions is discussed in detail in this section; all the other rules are discussed in more detail in Section 4 (Action-Specific Requirements).

Rule 1150.1 establishes design and operational requirements for landfill gas collection and control systems for active and inactive municipal solid waste landfills. AA 3 is not an active or inactive municipal solid waste landfill; therefore, the requirements of SCAQMD 1150.1 are not applicable. However, substantive provisions of this rule are relevant and appropriate for landfill gas collection, control and monitoring systems at AA 3. The chemical specific provisions of this rule stipulate that a landfill gas collection system must be operated to achieve the following:

- Prevent the concentration of total organic carbon (TOC) measured as methane from exceeding 5 percent by volume in the subsurface refuse boundary sampling probes.
- Prevent the concentration of TOC measured as methane from exceeding 50 parts per million by volume (ppm_v) as determined by integrated samples taken on numbered 50,000 square foot landfill grids.
- Prevent the concentration of TOC measured as methane from exceeding 500 ppm_v above background as determined by instantaneous monitoring at any location on the landfill, except the outlet of any control device.

RCRA Air Emission Requirements

RCRA air emissions standards at Cal. Code Regs. tit. 22, § 66264.1030–66264.1034, excluding .1030(c), .1033(j), .1034(c)(2), and .1034(d)(2), and at Cal. Code Regs. tit. 22, § 66264.1050–66264.1063, excluding .1050(c) and (d), .1057(g)(2), .1060, .1063(d)(3), for vents or equipment leaks pertain to equipment that contains or contacts hazardous wastes with organic concentrations of

at least 10 percent by weight. These standards are not ARARs as organic concentrations are not expected to exceed 10 percent by weight at AA 3.

2.2.3.2 STATE

SCAQMD Rules 401, 402, 408, 431.1, 431.2, 431.3, 1150, Regulation X, and Regulation XIV were identified as potential state ARARs for the air emissions at AA 3 because they are not approved into the SIP. These rules are discussed in more detail in Section 4 (Action-Specific Requirements).

Rule 402 prohibits the discharge to the atmosphere of air contaminants that cause injury, detriment, nuisance, or annoyance to a considerable number of persons. The DON is troubled by the vague, subjective nature of the nuisance rule and the lack of objective standards, as well as the inclusion of subjective non-environmental criteria such as "annoyance, repose, and comfort," and so forth. The requirements of 40 C.F.R. § 300.5 specify that an ARAR must be an environmental or facility siting requirement or limitation. Rule 402 does not fall within the definition of those terms and is therefore not an ARAR. The nature, quantity, and location of identified contaminants at AA 3 should not be of concern. The DON has determined that Rule 402 is not an ARAR for the alternatives proposed in this RI/FS.

Cal. Code Reg. tit. 27 § 20921 (a)(1), (2) and (3) and Cal. Code Reg. tit. 27 § 21160 (b) requirements for landfill gas monitoring and controls would be a potential ARAR for landfill closure. Chemical-specific requirements are as follows:

- Concentrations of methane gas must not exceed 1.25 percent of the volume in air within on-site structures
- Concentrations of methane gas migrating from the landfill must not exceed 5 percent by volume in air at the facility property boundary or at an alternative boundary set in accordance with Section 20925. The Navy has reached an agreement with the CIWMB (see Appendix L) regarding buffer zone around AA 3. In accordance with this agreement, a 100-foot buffer zone is proposed around the final waste boundary. The compliance with limitations on concentrations of methane migrating from the landfill will be evaluated at the boundary of the proposed buffer zone.
- Trace gases must be controlled to prevent adverse acute and chronic exposure to toxic and/or carcinogenic compounds.

3. LOCATION SPECIFIC ARARS

Potential location-specific ARARs are identified and discussed in this section. The discussions are presented based on various attributes of the site location, such as whether it is within a floodplain. Additional surveys will be performed in connection with the response action design and implementation to confirm location-specific ARARs where inadequate siting information currently exists, or in the event of changes to planned facility locations.

3.1 SUMMARY OF LOCATION SPECIFIC ARARS

Floodplain management and biological resources are the resource categories relating to location specific requirements potentially affected by the AA 3 response actions. The conclusions for ARARs pertaining to these resources are presented in the following sections. None of other resource categories, such as the cultural resources, wetland protection, hydrologic resources, biological resources, coastal resources, other natural resources, and geologic characteristics relating to location-specific requirements is potentially affected by the AA 3 response actions.

3.1.1 Wetlands Protection and Floodplain Management Conclusions

Hydrologic modeling conducted using the Hydrologic Engineering Center River Analysis System (HEC-RAS) computer model indicated that the approximately linear 400 feet of the waste in the southeastern portion of AA 3 adjacent to Agua Chinon Wash has a potential to be subjected to inundation or erosion during the 100-year 24-hour rainfall event (see Appendix I). The Hazardous Waste Control Act covers hazardous waste treatment, storage, and disposal (TSD) facilities constructed within a 100-year floodplain (Cal. Code Regs. tit. 22, § 66264.18[b]). This regulation seeks to assure that the design, construction, operation, and maintenance of TSD facilities within the 100-year floodplain will prevent washouts and subsequent releases of hazardous materials. AA 3 is not a hazardous waste TSD facility; however since the constituents similar to those present in RCRA hazardous waste may be present at few locations at AA 3, these standards are potentially relevant and appropriate federal ARARs for the remedial action.

The requirements for actions taken within a floodplain at 40 C.F.R. § 6(b) and 6.302 and § 6 app. A address the potential impacts on floodplain beneficial use (flood control, water quality, and habitat) that could be affected by site remediation Therefore, the substantive provisions of 40 C.F.R. § 6.302(b) and 40 C.F.R. pt. 6 Appendix A, § 6(a)(1), (3), and (5) (at the end of § 6.1007) are potential ARARs for response action at AA 3.

3.1.2 Biological Resources ARARs Conclusions

One federally threatened animal species, the coastal California gnatcatcher, and two sensitive species, the cactus wren and the San Diego wood rat, were documented adjacent to AA 3. However, these species were not found in the area potentially affected by remedial action activities at AA 3. Therefore, the requirements of federal and state Endangered Species Act do not constitute potential ARARs for remedial action at AA 3. However, substantive requirements of the following regulations are identified as potential ARARs for AA 3 remedial action if the animal or bird species specified in the regulations are identified at the site:

- Cal. Fish and Game Code § 3005
- Cal. Fish and Game Code § 3503
- Cal. Fish and Game Code § 3503.5
- Cal. Fish and Game Code § 3800
- Cal. Fish and Game Code § 4150

Measures will be taken to avoid the take of birds or animals identified in the regulations during implementation of remedial action at AA 3.

3.2 DETAILED DISCUSSION OF ARARS

The following subsections provide a detailed discussion of federal and state ARARs by location-specific resources. Pertinent and substantive provisions of the potential ARARs listed and described below were reviewed to determine whether they are potential federal or state ARARs for the AA 3 RI/FS.

Requirements that are determined to be ARARs or TBCs are identified in Table H-3 (federal) and Table H-4 (state) at the end of this appendix. ARARs determinations are presented in the column with the heading "ARAR Determination". Determinations of status for location-specific ARARs were generally based on maps or lists included in the regulation or prepared by the administering agency. References to the document or agency consulted are provided in the "Comments" column and may be provided in footnotes to the table. Specific issues concerning some of the requirements are discussed in the following sections.

3.2.1 Cultural Resources ARARs

3.2.1.1 NATIONAL HISTORIC PRESERVATION ACT OF 1966, AS AMENDED

Pursuant to Sections 106 and 110(f) of the National Historic Preservation Act (NHPA) (16 U.S.C. § 470–470x-6, and its implementing regulations [36 C.F.R. pt. 800]), as amended, CERCLA remedial actions are required to take into account the effects of remedial activities on any historic properties included on or eligible for inclusion on the National Register of Historic Places (National Register). The National Register is a list of districts, sites, buildings, structures, and objects that are significant in American history, architecture, archaeology, engineering, and culture. Section 110(f) of the NHPA of 1966, as amended, requires that before approval of any federal undertaking that may directly and adversely affect any National Historic Landmark, the head of the responsible federal agency will, to the maximum extent possible, undertake such planning and actions as may be necessary to minimize harm to the landmark, and will afford the Advisory Council a reasonable opportunity to comment on the undertaking.

The NHPA requires federally funded projects to identify and mitigate impacts of project activities on properties included in or eligible for the National Register of Historic Places (NRHP). Based on the inventory and evaluation of the structures within former MCAS El Toro (DON 2002), the DON has determined that none of the buildings or structures at former MCAS El Toro are eligible for listing in the NRHP. Therefore, the NHPA is not a potential ARAR.

3.2.1.2 ARCHAEOLOGICAL AND HISTORIC PRESERVATION ACT

The Archaeological and Historic Preservation Act, 16 U.S.C. § 469–469c-1, provides for the preservation of historical and archaeological data that might otherwise be lost as a result of dam construction or alterations of the terrain. If activities in connection with any federal construction project or federally approved project may cause irreparable loss to significant scientific, pre-historical, or archaeological data, the act requires the agency undertaking that project to preserve the data or request the Department of the Interior (DOI) to do so. This act differs from the NHPA in that it encompasses a broader range of resources than those listed on the National Register and mandates only the preservation of the data (including analysis and publication).

The Archaeological and Historic Preservation Act requires that for federally approved projects that may cause irreparable loss to significant scientific, prehistoric, historic, or archaeological data, the data must be preserved by the agency undertaking the project or the agency undertaking the project may request DOI to do so. No prehistoric or historic sites were identified during the cultural resources investigations (including Phase I archeological survey) conducted in conjunction with base

closure for the on-Station area that could be potentially impacted by the remedial action (DON 2002). However, if archeological resources are identified during the course of remedial action, this act may be potentially applicable ARAR.

3.2.1.3 Historic Sites, Buildings, and Antiquities Act of 1935

The purpose of the Historic Sites, Buildings, and Antiquities Act (16 U.S.C. §§ 461–467) and its implementing regulations (40 C.F.R. § 6.301[c]) is to encourage the long-term preservation of nationally significant properties that illustrate or commemorate the history and prehistory of the United States, including historic landmarks (36 C.F.R. pt. 65) and natural landmarks (36 C.F.R. pt. 62). Properties designated as National Historic Landmarks in California are listed in the National Register. Natural landmarks are nationally significant examples of a full range of ecological and geological features that constitute the nation's natural heritage. In conducting an environmental review of a proposed action, the responsible official shall consider the existence and location of natural landmarks using information provided by the National Park Service pursuant to 36 C.F.R. § 62.6(d) to avoid undesirable impacts on such landmarks. These requirements are not substantive and are not potential ARARs. Since , National historic landmarks do not exist at AA 3, the requirements of Historic Sites, Buildings, and Antiquities Act (16 U.S.C. §§ 461–467) and its implementing regulations (40 C.F.R. § 6.301[c]) do not constitute potential ARARs for the remedial action at AA 3.

3.2.1.4 Archaeological Resources Protection Act of 1979

Public Law (Pub. L. No.) 96-95 (16 U.S.C. § 470aa–470mm) was enacted in 1979 and amended in 1988 and applies to all lands to which the fee title is held by the United States. The purpose of this statute is to provide for the protection of archaeological resources on federal and Indian lands. The act prohibits unauthorized excavation, removal, damage, alteration, or defacement of archaeological resources located on public lands unless such activity is pursuant to a permit issued under 16 U.S.C. § 470cc.

Based on the scope of the proposed remedial action for AA 3, and results of cultural resources investigations conducted in conjunction with base closure (DON 2002), it is not expected that any archeological resource would be impacted. However, if archeological resources are identified during the course of remedial action, this act may be potentially applicable ARAR.

3.2.2 Wetlands Protection and Floodplains Management ARARs

Hydrologic modeling was conducted using HEC-RAS computer model for the reach of Agua Chinon Wash southeast of AA 3 to evaluate if flood conditions have a potential to impact the buried debris. This modeling indicated that approximately linear 400 feet of the waste in the southeastern portion of AA 3 adjacent to Agua Chinon Wash has a potential to be subjected to inundation or erosion during the 100-year 24-hour rainfall event (see Appendix I). Based on these results, following regulations were evaluated to determine if they are potential ARARs for the remedial action at AA 3.

3.2.2.1 Federal

Federal requirements evaluated as potential ARARs for wetlands protection and floodplains management are discussed in the subsections below.

Protection of Wetlands, Executive Order No. 11990

Executive Order No. 11990 requires that federal agencies minimize the destruction, loss, or degradation of wetlands; preserve and enhance the natural and beneficial value of wetlands; and avoid support of new construction in wetlands if a practicable alternative exists.

No area within AA 3 meets all three federal criteria as a wetland. The head cut drainage way at the southeastern boundary meets the hydrology, but not the vegetation criterion. The soils criterion could not be evaluated due to the origin and texture of soils on the site.

Floodplain Management, Executive Order No. 11988

Under 40 C.F.R. § 6.302(b), federal agencies are required to evaluate the potential effects of action they may take in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain.

The southeastern portion of AA 3 adjacent to Agua Chinon Wash is within the 100-year flood plain. Therefore, the substantive provisions of 40 C.F.R. § 6.302(b) and 40 C.F.R. pt. 6 Appendix A, § 6(a)(1), (3), and (5) (at the end of § 6.1007) are potential ARARs for response action at AA 3. To control the elevation of the 100-year storm and to minimize the potential for erosion of debris, a small finger dike (approximately 350 feet in length with top elevation of 480 feet) will be placed to separate the debris and the stream flow. This finger dike will be a part of all remedial action alternatives except Alternative 1 (No Action).

Clean Water Act (33 U.S.C. § 1344)

Section 404 of the CWA of 1977 governs the discharge of dredged and fill material into waters of the United States, including adjacent wetlands. Wetlands are areas that are inundated by water frequently enough to support vegetation typically adapted for life in saturated soil conditions. Wetlands include swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, mudflats, natural ponds and similar areas. Both U.S. EPA and the U.S. Army Corps of Engineers (USACE) have jurisdiction over wetlands. U.S. EPA's Section 404 guidelines are promulgated in 40 C.F.R. pt. 230, and the USACE's guidelines are promulgated in 33 C.F.R. pt. 320.

Discharge of dredged or fill material to a wetland is not planned as part of the response action at AA 3. Therefore, the requirements of 33 U.S.C. § 1344, 40 CFR Part 230, and 33 CFR Part 320 are not ARARs for the remedial action at AA 3.

Resource Conservation and Recovery Act (42 U.S.C. §§ 6901–6991[i])

Under Cal. Code Regs. tit. 22, § 66264.18(b), any hazardous waste facility located in a 100-year floodplain or within the maximum high tide must be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood or maximum high tide, unless the owner or operator can demonstrate that procedures are in effect that will cause the waste to be removed safely, before flood or tidewater can reach the facility.

AA 3 is not a hazardous waste TSD facility; however since the constituents similar to those present in RCRA hazardous waste may be present at few locations at AA 3, the substantive requirements of Cal. Code Regs. tit. 22, § 66264.18(b) are potentially relevant and appropriate federal ARARs for all remedial action alternatives, except Alternative 1 (No Action).

3.2.2.2 STATE

The state RCRA requirements for floodplains are evaluated above as potential federal ARARs.

3.2.3 Hydrologic Resources ARARs

3.2.3.1 WILD AND SCENIC RIVERS ACT

The Wild and Scenic Rivers Act (WSRA) (16 U.S.C. §§ 1271–1287) establishes requirements applicable to water resource projects affecting wild, scenic, or recreational rivers within the National Wild and Scenic Rivers System, as well as rivers designated on the National Rivers Inventory to be studied for inclusion on the national system. In accordance with Section 7 of the act, a federal agency may not assist, through grant, loan, license, or otherwise, the construction of a water

resources project that would have a direct and adverse effect on the free-flowing, scenic, and natural values for which a river on the national system or a study river on the National Rivers Inventory was established. The act also covers indirect effects from construction of water resources projects below or above rivers or their tributaries that are in the national system or under study on the National Rivers Inventory, such as a dam on a tributary and construction or development on adjacent shorelines. Adverse impacts must be mitigated, and coordination may be required with the National Park Service and Department of Agriculture.

No wild, scenic or recreational rivers are located at or in the vicinity of AA 3. Therefore, the requirements of U.S.C. §§ 1271–1287 do not constitute ARARs for the remedial action at AA 3.

3.2.3.2 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (16 U.S.C. §§ 661–666c) was enacted to protect fish and wildlife when federal actions result in the control or structural modification of a natural stream or body of water. The statute requires federal agencies to take into consideration the effect a water-related project would have on fish and wildlife and take action to prevent loss or damage to these resources.

The remedial action at AA 3 would include limited modifications to the stream bed of the Aqua Chinon Wash in the northeastern portion of the site. Therefore substantive requirements of 16 U.S.C. §§ 661–666c are potential ARARs. However, since no significant fish and wildlife is present in the Aqua Chinon Wash in the vicinity of AA 3, the modifications to the stream are not expected to have adverse effects on fish and wildlife.

3.2.3.3 Rivers and Harbors Act of 1899

Section 10 of the Rivers and Harbors Act of 1899 prohibits the creation of any obstruction not authorized by Congress to the navigable capacity of any of the waters of the United States (33 U.S.C. §§ 401–413). It prohibits construction of wharves, piers, booms, weirs, breakwaters, bulkheads, jetties, or other structures in a port unless the construction is approved by the USACE. In addition, excavation or filling of any port, harbor, channel, lake, or any navigable water is prohibited without authorization. Section 10 permits are required for these activities. Section 10 permits cover construction, excavation, or deposition of materials in, over, or under navigable waters, or any work that would affect the course, location, condition, or capacity of those waters.

AA 3 is not located near any navigable water of the United States and therefore, this is not a potential ARAR for the sites.

3.2.4 Biological Resources ARARs

One federally threatened animal species, the coastal California gnatcatcher, and two sensitive species, the cactus wren and the San Diego wood rat, were documented adjacent to AA 3. However, these species were not found in the area potentially affected by remedial action activities at AA 3.

3.2.4.1 Federal

Federal requirements evaluated as potential ARARs for biological resources are discussed in the subsections below.

Endangered Species Act of 1973

The Endangered Species Act (ESA) of 1973 (16 U.S.C. §§ 1531–1543) provides a means for conserving various species of fish, wildlife, and plants that are threatened with extinction. The ESA defines an endangered species and provides for the designation of critical habitats. Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. Under Section 7(a) of the ESA (16 U.S.C. § 1536[a][2]), federal

agencies must carry out conservation programs for listed species. The Endangered Species Committee may grant an exemption for agency action if reasonable mitigation and enhancement measures such as propagation, transplantation, and habitat acquisition and improvement are implemented (16 U.S.C. § 1536[h][1][B]). Consultation regulations at 50 C.F.R. pt. 402 are administrative in nature and are therefore not ARARs. However, they may be TBCs to comply with the substantive provisions of the ESA.

One federally threatened animal species, the coastal California gnatcatcher, was documented adjacent to AA 3. However, this species is not found in the area potentially affected by remedial action at AA 3. Therefore, the Endangered Species Act of 1973 is not an ARAR.

Migratory Bird Treaty Act of 1972

The Migratory Bird Treaty Act (16 U.S.C. §§ 703–712) prohibits at any time, using any means or manner, the pursuit, hunting, capturing, and killing or attempting to take, capture, or kill any migratory bird. This act also prohibits the possession, sale, export, and import of any migratory bird or any part of a migratory bird, as well as nests and eggs. A list of migratory birds for which this requirement applies is found at 50 C.F.R. § 10.13. It is the DON's position that this act is not legally applicable to DON actions; however, Exec. Order No. 13186 (dated 10 January 2001) requires each federal agency taking actions that have or are likely to have a measurable effect on migratory bird populations to develop and implement measures to promote the conservation of such populations.

No migratory birds have been observed at AA 3 and, therefore, this requirement is not a potential ARAR.

Marine Mammal Protection Act

The Marine Mammal Protection Act (16 U.S.C. §§ 1361–1421h) prohibits the taking of a marine mammal on the high seas or in a harbor or other place under the jurisdiction of the United States. It prohibits the possession, transport, and sale of a mammal or marine mammal product, unless authorized under law. The prohibitions that are potentially pertinent to CERCLA actions are at 16 U.S.C. § 1372(a)(2).

The response actions at AA 3 are not expected to affect marine mammals and there is not a potential ARAR.

Magnuson-Stevens Fishery Conservation and Management Act of 1976, as Amended

The purpose of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §§ 1801–1882) is to conserve and manage the fishery resources found off the coasts of the United States, the anadromous species, and the continental shelf fishery resources of the United States. It establishes a fishery conservation zone within which the United States has exclusive fishery management prerogatives.

The response actions at AA 3 are not expected to affect the conservation and management of the fisheries.

National Wildlife Refuge System Administration Act of 1966

The National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd–668ee) and its implementing regulations at 50 C.F.R. pts 25–37 establish wildlife refuges that are maintained for the primary purpose of developing a national program of wildlife and ecological conservation and rehabilitation. These refuges are established for the restoration, preservation, development, and management of wildlife and wild land habitats; protection and preservation of endangered or threatened species and their habitats; and management of wildlife and wild lands to obtain the maximum benefit from these resources.

The National Wildlife Refuge System Administration Act contains the following substantive requirements that are potential ARARs. The act prohibits any person from disturbing, injuring, cutting, burning, removing, destroying, or possessing any property within any area of a wildlife refuge. The act also prohibits the taking or possessing of any fish, bird, mammal or other wild vertebrate or invertebrate animals, or nest or eggs within any refuge area or otherwise occupying any such area unless such activities are done with a permit or permitted by express provision of law. The act also regulates the use of audio equipment as well as motorized vehicles, aircraft, and boats in wildlife refuges. It prohibits construction activities, disposal of waste, and the introduction of plants and animals into any wildlife refuge. The prohibitions under the act are codified at 50 C.F.R. pt. 27.

AA 3 is not designated as part of the National Wildlife Refuge System and therefore, this is not a potential ARAR for the response actions at these sites.

Wilderness Act

The Wilderness Act (16 U.S.C. § 1131) and its accompanying implementing regulations (50 C.F.R. § 35.1–35.14) create the National Wilderness Preservation System. The intent of the law is to administer and manage units of this system (i.e., wilderness areas) in order to preserve their wilderness character and to leave them unimpaired for future use as wilderness.

There are no federally owned wilderness area at or within the AA 3 and therefore, this requirement is not a potential ARAR.

3.2.4.2 STATE

General requirements of the *California Fish and Game Code* (Cal. Fish & Game Code) were evaluated for potential ARARs. Requirements of some sections of the California ESA were identified as potential ARARs.

California Endangered Species Act

The California Endangered Species Act is codified in the Cal. Fish & Game Code §§ 2050–2116. It is the DON's position that the requisite federal sovereign immunity waiver does not exist to authorize applicability of the California ESA. Nevertheless, this act will be evaluated as a potentially relevant and appropriate requirement for the DON's CERCLA response actions. Cal. Fish & Game Code § 2080 prohibits the take of endangered species.

Two sensitive species, the cactus wren and the San Diego wood rat, were documented adjacent to AA 3. However, these species were not found in the area potentially affected by remedial action activities at AA 3.

Other California Fish and Game Code Regulations

The ARAR evaluations of other Cal. Fish and Game Code and Cal. Code Regs. tit. 14 regulations identified by California Department of Fish and Game are presented in Table H-4. In summary, substantive requirements of the following statutory provisions were identified as potential ARARs for AA 3 remedial action if the animal or bird species specified in the regulations are identified at the site:

- Cal. Fish and Game Code § 3005
- Cal. Fish and Game Code § 3503
- Cal. Fish and Game Code § 3503.5
- Cal. Fish and Game Code § 3800

- Cal. Fish and Game Code § 4150

Measures will be taken to avoid the take of birds or animals identified in the regulations during implementation of remedial action at AA 3.

Cal-EPA/DTSC Advisories, Guidance, and Criteria

DTSC identified the following advisories, guidance, and criteria for groundwater remedial action at AA 3:

- Drilling, Coring, Sampling and Logging at Hazardous Substance Release Sites. Guidance Manual for Groundwater Investigations (Cal-EPA, July 1995)
- Reporting Hydrogeologic Characterization Data at Hazardous Substance Release Sites. Guidance Manual for Groundwater Investigations (Cal-EPA, July 1995)
- Guidelines for Hydrogeologic Characterization of Hazardous Substance Release Sites, Volume 1 & 2 (Cal-EPA, July 1995)
- Aquifer Testing for Hydrogeologic Characterization. Guidance Manual for Groundwater Investigations (Cal-EPA, July 1995)
- Application of Borehole Geophysics at Hazardous Substance Release Sites. Guidance Manual for Groundwater Investigations (Cal-EPA, July 1995)
- Ground Water Modeling for Hydrogeologic Characterization. Guidance Manual for Groundwater Investigations (Cal-EPA, July 1995)
- Monitoring Well Design and Construction for Hydrogeologic Characterization. Guidance Manual for Groundwater Investigations (Cal-EPA, July 1995)
- Advisory – Active Soil Gas Investigation (DTSC/CRWQCB-Los Angeles Region, January 2003)
- Representative Sampling of Ground Water for Hazardous Substances (Cal/EPA, July 1995)
- Accumulating Hazardous Waste at Generator Sites (Cal/EPA, July 1995)

These guidance and advisories do not contain promulgated requirements; therefore, they do not constitute ARARs for the response action at AA 3. Additionally, as described in Table H-4, these guidance and advisories do not constitute TBC requirements for the remedial action at AA 3.

3.2.5 Coastal Resources ARARs

AA 3 is not located near the coastal area and remedial action at the site is not expected to impact coastal waters and resources. Therefore the requirements of the Coastal Zone Management Act (16 U.S.C. §§ 1451–1464) and California Coastal Act (Cal. Pub. Res. Code §§ 30000–30900 and Cal. Code Regs. tit. 14, §§ 13001–13666.4) do not constitute potential ARARs for AA 3.

3.2.6 Geologic Characteristics ARARs

3.2.6.1 FEDERAL

The state location-specific RCRA requirements for geologic characteristics are part of the federally approved program and are evaluated below as potential federal ARARs

Resource Conservation and Recovery Act (42 U.S.C. §§ 6901–6991[i])

Hazardous waste facilities must be sited in accordance with the following requirements:

- Seismic considerations (Cal. Code Regs. tit. 22, § 66264.18[a]) – portions of new facilities or facilities undergoing substantial modification where transfer, treatment, storage or disposal of hazardous waste will be conducted shall not be located within 61 meters (200 feet) of a fault that has had displacement in Holocene time.
- Salt dome formations, salt bed formations, and underground mines and caves (Cal. Code Regs. tit. 22, § 66264.18[c]) – the placement of any non-containerized or bulk liquid hazardous waste in any salt dome formation, salt bed formation, or underground mine or cave is prohibited.

AA 3 is not located within 61 meters of a Holocene fault and no discharge is proposed to a salt dome formation, salt bed formation, or underground mines or caves. Therefore, the requirements at Cal. Code Regs. tit. 22, § 66264.18(a) and § 66264.18(c) are not potential ARARs for this response action.

3.2.6.2 STATE

Other state location-specific requirements for geologic characteristics were not identified for evaluation as potential state ARARs.

4. ACTION-SPECIFIC ARARS

This RI/FS report evaluates remedial action alternatives for AA 3 at the former MCAS El Toro. This ARARs analysis is based on the four remedial alternatives for the site. Alternative 1 is no action; Alternative 2 includes institutional controls and monitoring; Alternatives 3 includes capping, institutional controls, and monitoring; Alternative 4 entails excavation and off-site transportation and disposal. None of these alternatives address groundwater cleanup since groundwater is not a medium of concern and no response action is planned for groundwater at AA 3. However, detection monitoring will be conducted for groundwater as a component of Alternatives 2, 3 and 4 that involve leaving the buried waste in-place. Detailed descriptions of the remedial alternatives are provided in the main text of this RI/FS.

Tables H-5 and H-6 at the end of this section present and evaluate federal and state potential action-specific ARARs for AA 3, respectively. A discussion of the requirements determined to be pertinent to each alternative being evaluated for AA 3 is presented in this section. A discussion of how the alternative complies with each identified ARAR is also provided.

4.1 NO ACTION

There is no need to identify ARARs for the no action alternative because ARARs apply to "any removal or remedial action conducted entirely on-site" and "no action" is not a removal or remedial action (CERCLA Section 121(e), 42 U.S.C. § 9621[e]). CERCLA Section 121 (42 U.S.C. § 9621) cleanup standards for selection of a Superfund remedy, including the requirement to meet ARARs, are not triggered by the no action alternative (U.S. EPA 1991b). Therefore, a discussion of compliance with action-specific ARARs is not appropriate for this alternative.

4.2 INSTITUTIONAL CONTROLS

Alternatives 2 and 3 for AA 3 include institutional controls to maintain the integrity of cover at AA 3 by preventing excavations or increased infiltration of surface waters, preventing land use that presents unacceptable risk to human health due to residual contamination, protecting monitoring equipment, and preserving access to the sites and associated monitoring equipment for the DON and the FFA signatories. Such institutional controls shall consist of land-use restrictions designed to protect the landfill remedy.

State statutes that have been accepted by the DON as ARARs for implementing institutional controls and entering into an Environmental Restriction Covenant and Agreement with DTSC include substantive provisions of the Cal. Civ. Code § 1471 and Cal. Health & Safety Code §§ 25202.5, 25222.1, 25232(b)(1)(A)–(E), 25233(c), 25234, and 25355.5(a)(1)(c). DTSC promulgated a regulation on 19 April 2003 regarding "Requirements for Land Use Covenants" at Cal. Code Regs. tit. 22, § 67391.1. The substantive provisions of this regulation have been determined to be "relevant and appropriate" state ARARs by the DON.

The substantive provisions of Cal. Civ. Code § 1471 are the following general narrative standard: ". . . to do or refrain from doing some act on his or her own land . . . where . . . : (c) Each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety or the environment as a result of the presence on the land of hazardous materials, as defined in Section 25260 of the Health and Safety Code." This narrative standard would be implemented through incorporation of restrictive environmental covenants in the deed at the time of transfer. These covenants would be recorded with the environmental restriction covenant and agreement and run with the land.

The substantive provisions of Cal. Health & Safety Code § 25202.5 are the general narrative standard to restrict "present and future uses of all or part of the land on which the . . . facility . . . is

located . . . ." These substantive provisions will be implemented by incorporation of restrictive environmental covenants in the Environmental Restriction Covenant and Agreement at the time of transfer for purposes of protecting present and future public health and safety.

Actual land-use restriction requirements are set forth in Cal. Health & Safety Code § 25232(b)(1)(A)–(E). These include prohibitions on construction of residences, hospitals for humans, schools for persons under 21 years of age, day care centers, or any permanently occupied human habitation on hazardous waste property. Cal. Health & Safety Code § 25233(c) sets forth substantive criteria for granting variances from the uses prohibited in Cal. Health & Safety Code § 25232(b)(1)(A)–(E) based on specified environmental and health criteria.

Cal. Health & Safety Code §§ 25222.1 and 25355.5(a)(1)(C) provide the authority for the state to enter into voluntary agreements to establish land-use covenants with the owner of property. The substantive requirements of the following Cal. Health & Safety Code § 25222.1 provisions are "relevant and appropriate": (1) the general narrative standard: "restricting specified uses of the property,..." and (2) "...the agreement is irrevocable, and shall be recorded by the owner, ...as a hazardous waste easement, covenant, restriction or servitude, or any combination thereof, as appropriate, upon the present and future uses of the land." The substantive requirements of the following Cal. Health & Safety Code § 25355.5(a)(1)(C) provisions are "relevant and appropriate": "...execution and recording of a written instrument that imposes an easement, covenant, restriction, or servitude, or combination thereof, as appropriate, upon the present and future uses of the land." The DON will comply with the substantive requirements of Cal. Health & Safety Code §§ 25222.1 and 25355.5(a)(1)(C) by incorporating the CERCLA use restrictions into the DON's deed of conveyance in the form of restrictive covenants under the authority of Cal. Civ. Code § 1471 and into the environmental restriction covenant and agreement. The substantive provisions of Cal. Health & Safety Code §§ 25222.1 and 25355.5(a)(1)(C) may be interpreted in a manner that is consistent with the substantive provisions of Cal. Civ. Code § 1471. The covenants shall be recorded with the deed and run with the land.

Cal. Health & Safety Code § 25233(c) sets forth "relevant and appropriate" substantive criteria for granting variances from prohibited uses under under Health & Safety Code § 25232(b))(1)(A)–(E) based upon specified environmental and health criteria. Cal. Health & Safety Code § 25234 sets forth the following "relevant and appropriate" substantive criteria for the removal of a land-use restriction on the grounds that "...the waste no longer creates a significant existing or potential hazard to present or future public health or safety."

In addition to being implemented through the Environmental Restriction Covenant and Agreement between the DON and DTSC, the appropriate and relevant portions of Cal. Health & Safety Code §§ 25202.5, 25222.1, 25232(b)(1)(A)–(E), 25233(c), 25234, and 25355.5(a)(1)(C) and Cal. Civ. Code § 1471 shall also be implemented through the deed between the DON and the transferee.

EPA agrees that the substantive portions of the state statutes and regulations referenced in this section are ARARs. EPA specifically considers sections (a)(1), (a)(2), (d), (e)(1), and (e)(2) of Cal. Code Regs., tit. 22 Section 67391.1, to be ARARs for this RI/FS. DTSC's position is that all of the state statutes and regulations referenced in this section are ARARs.

4.3 CAPPING

Capping or covering the debris at AA 3 is a component of Alternatives 3a, 3b, 3c, and 3d considered in this RI/FS. Alternatives 3b, 3c, and 3d include construction of a Cal. Code Regs. tit. 27 prescriptive cap at AA 3. Alternative 3a proposes construction of engineered alternative to prescriptive cap in Cal. Code Regs. tit. 27.

The following general approach was followed to identify potential ARARs for capping action for different remedial alternatives considered for AA 3:

1. In the first step, ARARs evaluation for landfill closure and post-closure was performed for different remedial alternatives consistent with their intent to construct prescriptive or non-prescriptive cap. This indicated that since Alternatives 3b, 3c, and 3d include construction of a Cal. Code Regs. tit. 27 prescriptive cap, the substantive requirements of following regulations are potential ARARs for these alternatives:

   - Cal. Code Regs. tit. 27 § 21090(a)(1) for construction of a foundation layer.
   - Cal. Code Regs. tit. 27 § 21090(a)(2) for construction of a barrier layer.
   - Cal. Code Regs. tit. 27 § 21090(a)(3) for construction of an erosion resistant (vegetative) layer.

   Alternative 3a proposes construction of an engineered alternative to prescriptive cap in Cal. Code Regs. tit. 27. Alternative 2 proposes limited grading of existing soil cover. Therefore, above requirements do not constitute potential ARARs for Alternatives 2 and 3a. However, the requirements at Cal. Code Regs. tit. 27, §§ 20080(b) and 21090 (a) under which the RWQCB can allow an alternative final cover are potential ARARs for Alternatives 2 and 3a. Under Cal. Code Regs. tit. 27, § 20080(b), engineered alternatives to the prescriptive landfill cover are allowed when the discharger can demonstrate that the construction or prescriptive standard is not feasible and there is a specific engineered alternative. Under Cal. Code Regs. tit. 27, § 21090, the RWQCB can allow any alternative final cover that it finds will continue to isolate the waste and irrigation at least as well as would a final cover built in accordance with applicable prescriptive standards. The UNSAT-H modeling results indicate that Alternatives 2 and 3a provides performance equivalent to the prescriptive standard (clay) cap (Alternative 3b) in preventing potential migration of contaminants to groundwater where they could pose a risk to human health and the environment (see Appendix K). Therefore, Alternatives 2 and 3a are expected to isolate the waste and irrigation as well as the final cover built in accordance with applicable prescriptive standards.

2. In the second step, landfill closure and postclosure requirements were identified that were potential ARARs for all remedial alternatives involving construction of a cap. Landfill closure and postclosure requirements are contained in 40 C.F.R. § 258 and Cal. Code Regs. tits. 22 and 27. AA 3 ceased to receive any debris prior to the effective date Cal. Code Regs. tit. 27 (18 July 1997), and 40 C.F.R. § 258 (09 October 1991). Therefore, Cal. Code Regs. tit. 27, and 40 C.F.R. § 258 are not "applicable" ARARs. However, their provisions were reviewed to determine whether they were potentially "relevant and appropriate" ARARs. Since AA 3 continued to receive debris after the effective date of Cal. Code Regs. tits. 22 (19 November 1980), these regulations were reviewed to determine if their provisions are potentially "applicable" ARARs. All these regulations contain overlapping requirements; therefore, this RI/FS contains a table that compares 40 C.F.R. § 258 and Cal. Code Regs. tits. 22 and 27 and identified the most stringent, or controlling, ARARs. The purpose of this table is to facilitate identification of ARARs for remedial design/remedial action. When federal and state regulations were considered to be equally stringent, federal regulations were selected as controlling ARARs. This table is presented as Table H-7 and has been updated to reflect the promulgation of Cal. Code Regs. tit. 27 and repeal of portions of Titles 14 and 23

Tables H-5 and H-6 present detailed evaluation of landfill closure and postclosure requirements for alternatives involving capping action.

4.3.1 Federal ARARs

Federal requirements that are potential ARARs for capping/cover actions are described in the following sections.

4.3.1.1 RCRA

There are no reports of hazardous waste disposal at AA 3. However, because some of the debris at AA 3 may contain hazardous constituents, landfill closure and postclosure requirements at Cal. Code Regs. tit. 22 were evaluated to determine if they constitute potential ARARs for capping action. This evaluation is presented in Tables H-5 and H-7.Grading and capping activities may involve excavating buried debris from one portion of AA 3 and consolidating it in another portion. U.S. EPA has determined that disposal occurs when waste is placed in the land-based unit. However, movement within a unit does not constitute disposal or placement, and at CERCLA sites, an area of contamination can be considered comparable to a unit. The U.S. EPA Area of Contamination Policy (U.S. EPA 1996) allows wastes to be consolidated or treated in situ within an area of contamination without triggering land-disposal restrictions or minimum technology requirements. Therefore, movement within the landfill boundary does not constitute placement and, therefore, RCRA waste generation and land disposal restrictions are not triggered.

4.3.1.2 CRITERIA FOR MUNICIPAL WASTE LANDFILLS, 40 C.F.R. § 258

Landfill closure requirements for municipal waste landfills are set forth in 40 C.F.R. § 258, subpt. F. Because AA 3 did not receive debris after the effective date of these requirements (09 October 1991), these requirements would not be applicable. However, the substantive portions of these requirements would be considered potentially relevant and appropriate because trace levels of domestic waste has been encountered at AA 3 similar or identical to wastes managed in municipal solid waste landfills.

Provisions in 40 C.F.R. § 258.60(a) and (b) require that the final cover system be designed to minimize infiltration and erosion. This section provides specific technical standards for cover design but allows for alternative cover designs if it is demonstrated that the alternative designs will achieve the same level of performance.

Section 258.61 requires postclosure maintenance for 30 years unless it can be demonstrated that a shorter or longer period of maintenance is required. If it can be demonstrated that the site poses no threat to public health and safety or to the environment, the postclosure maintenance period may be eliminated.

4.3.1.3 CLEAN AIR ACT

Grading activities associated with placement of the cap and excavation of the local soil may generate fugitive dust and require the use of heavy equipment. These activities would need to comply with substantive requirements of the SCAQMD rules identified as potential ARARs. The SCAQMD rules that have been approved by U.S. EPA as a part of SIP and were identified as potential federal ARARs for air emissions included, Rules 403, 404, 405, 407, 409, 474, 1150.1, 1166, and Regulation XIII. The ARAR evaluation of these rules indicated that substantive requirements of Rules 403, 404, 405, and 1150.1 are potentially applicable to capping at AA 3. The details of these rules and methods of compliance for each are presented in the following sections and Table H-5.

Rule 403

This rule prohibits emissions of fugitive dust such that the presence of such dust remains visible in the atmosphere beyond the property line of the emission source and shall not cause or allow PM_{10} levels to exceed 50 micrograms per cubic meter when determined, by simultaneous sampling, as the difference between upwind and downwind samples

Cap construction activities may generate fugitive dust emissions. Measures such as applying water to prevent fugitive dust emissions will be implemented.

Rule 404

This rule limits equipment from discharging particulate emissions in excess of 0.01 to 0.196 grain per cubic foot based on a given volumetric (dry standard cubic feet per minute) exhaust gas flow rate averaged over one hour or on cycle of operation. It excludes steam generators or gas turbines.

The equipment used during remedial action will comply with substantive requirements of this rule.

Rule 405

This rule limits equipment from discharging particulate emissions in excess of 0.99 to 30 pounds per hour based on a given process weight.

The equipment used during remedial action will comply with substantive requirements of this rule.

Rule 1150.1

This rule establishes design and operational requirements for landfill gas collection and control systems for active and inactive municipal solid waste landfills. It also establishes landfill gas sampling and monitoring requirements.

AA 3 is not an active or inactive municipal solid waste landfill, therefore the requirements of SCAQMD Rule 1150.1 are not applicable. However, since AA 3 is a former military landfill, the substantive provisions of SCAQMD Rule 1150.1 are relevant and appropriate for the landfill gas collection, control and monitoring systems to be installed at AA 3. The landfill gas collection and control system, and landfill gas monitoring network at AA 3 will be designed and operated based on an agreement between FFA signatories documented in the letter from DON dated 24 June 2004. The details of the design and operation of the landfill gas systems and landfill gas monitoring will be presented in remedial design work plan.

4.3.2 State ARARs

State requirements that are potential ARARs for capping/cover actions are described in the following sections.

4.3.2.1 Solid Waste (Cal. Code Regs. Tit.27, Div. 2)

The RWQCB and CIWMB identified Cal. Code Regs. tit. 27 §§ 20240; 20950 (a) and (e); 21090 (b)(1), (c), and (e)(2); 21130; 21135; 21137; 21140; 21142; 21145; 21150; 21160; 21180; 21190; 21800; 21830; and 21880 as potential ARARs for capping at IRP Sites 3 and 5, former MCAS El Toro. A detailed ARAR evaluation of these regulations is presented in Table H-6. This evaluation indicates that substantive provisions of the following requirements are potential ARARs for the construction and post-closure maintenance of landfill cap under Alternatives 3a, 3b, 3c, and 3d:

- General closure and postclosure maintenance standards (Cal. Code Regs. tit. 27 §§ 20950[a])
- Site Security (Cal. Code Regs. tit. 27 § 21135[f] and [g])
- Grading of final cover (Cal. Code Regs. tit. 27 § 21142). Grading of the final cover for Alternatives 3b, 3c, and 3d (Cal. Code Regs. tit. 27 §§ 21090[b][1]).
- Cover seismic requirements (Cal. Code Regs. tit. 27 §§ 21145[a])

- General requirements for final cover design (Cal. Code Regs. tit. 27 § 21140)
- Erosion control for final cover (Cal. Code Regs. tit. 27 § 21090[c][4] and 21150)
- Post-closure care period (Cal. Code Regs. tit. 27 § 20950[a] and 21180 [a],[b], [c], and [d])
- Post-closure land use (Cal. Code Regs. tit. 27 § 21190[a] and [b])

The cover seismic requirements at Cal. Code Regs. tit. 27 § 21145 (a) were selected as potential ARARs for construction of a landfill cap at AA 3. The equivalent federal requirements for seismic design of the landfill cover are provided at Cal. Code Regs. tit. 22 § 66264.310 (a)(5), which state that final cover shall accommodate lateral and vertical shear forces generated by the maximum credible earth quake. No stringency comparison of these federal requirements with equivalent state requirements was performed, since federal provisions at Cal. Code Regs. tit. 22 § 66264.310 (a)(5) were determined not to be relevant and appropriate ARARs for AA 3. The criteria for determining relevance and appropriateness of a requirement are listed in 40 C.F.R. § 300.400(g)(2) and are discussed in Section 1.1. In evaluating the relevance and appropriateness, comparisons should be made based on the eight criteria listed in Section 1.1 to determine whether a requirement addresses problems or situations sufficiently similar to the circumstances of the release or remedial action contemplated, and whether the requirement is well-suited to the site, and therefore is both relevant and appropriate. To constitute an ARAR for a CERCLA site a requirement must be both relevant and appropriate. Based on criteria for determining relevance and appropriateness, federal provisions at Cal. Code Regs. tit. 22 § 66264.310 (a)(5) (cover seismic requirements) were determined to be relevant but not appropriate, and therefore determined not to be ARARs for AA 3 remedial action. The federal provisions at Cal. Code Regs. tit. 22 § 66264.310 (a)(5) require that the final cover shall accommodate lateral and vertical shear forces generated by the maximum credible earthquake so that the integrity of the cover is maintained. In comparison, the requirements at Cal. Code Regs. tit. 27 § 20370 require that hazardous waste and designated waste management units shall be designed to withstand the maximum credible earthquake and nonhazardous waste management units must be designed to withstand the maximum probable earthquake. The cover seismic requirements of both Cal. Code Regs. tits. 22 and 27 are relevant to AA 3. However, since the cover seismic requirements of Cal. Code Regs. tit. 27 distinguish between the hazardous and nonhazardous waste management units and explicitly define the requirements potentially applicable to nonhazardous waste management units, these requirements are appropriate to AA 3 based on the nature of the major portion of the buried debris at the site.

4.3.2.2 SCAQMD REQUIREMENTS

Grading activities associated with placement of the cap and excavation of the local soil may generate fugitive dust and require the use of heavy equipment. These activities would need to comply with substantive requirements of the SCAQMD rules identified as potential ARARs. The SCAQMD rules that have been not been approved by U.S. EPA as a part of SIP and hence were identified as potential state ARARs for air emissions included, Rules 401, 402, 408, 431.1, 431.2, 431.3, 1150, Regulation X, and Regulation XIV. The ARAR evaluation of these rules indicated that substantive requirements of Rules 401 and 1150 are potentially applicable to capping at AA 3. The details of these rules and methods of compliance for each are presented in the following sections and Table H-6.

Rule 401

This rule prohibits the discharge of any air contaminant into the atmosphere from any single source of emission for a period or periods aggregating more than 3 minutes in a 60-minute period, which is (a) as dark or darker in shade as that designated No. 1 on the Ringelmann Chart, or (b) of such

opacity as to obscure an observer's view to a degree equal to or greater than does smoke described in (a).

Substantive requirements of this rule are potentially applicable since cap construction activities have a potential to produce visible emissions due to fugitive dust. Mitigation measures such as wetting the soil will be implemented to reduce visible emissions.

Rule 1150

SCAQMD Rule 1150 requires that an excavation management plan be developed prior to excavation of landfill materials. While the plan itself is considered administrative in nature, the DON will address substantive provisions of this regulation during the remedial design/remedial action phase.

4.4 Excavation and Temporary Storage of Debris

Alternative 4 would include excavation of debris from AA 3 and disposal at an off-site disposal facility. Following sections identify ARARs for actions including excavation and temporary storage of debris.

4.4.1 Federal ARARs

The excavated debris from AA 3 is proposed to be stored in staging piles in accordance with the requirements at 40 C.F.R § 264.554. The debris will be characterized to evaluate if it exhibits the characteristics of RCRA hazardous or California-regulated, non-RCRA hazardous waste. If the debris exhibits the characteristics of the RCRA hazardous waste, substantive provisions of 40 C.F.R. § 264.554(d)(1)(i-ii), (d)(2), (e), (f), (h), (i), (j), and (k) are potentially "applicable" ARARs for design, operation, and closure of the staging pile. However, if the debris does not meet the definition of RCRA or non-RCRA hazardous waste, the staging pile requirements would be potentially relevant and appropriate federal ARARs since COPCs in the debris are same or similar to the contaminants found in RCRA hazardous waste.

4.5 Monitoring

Alternatives 2 and 3 include groundwater and landfill gas monitoring, and Alternative 4 constitutes only groundwater monitoring. Federal and state requirements that pertain to groundwater and landfill gas monitoring are described in the following sections.

4.5.1 Groundwater Monitoring

No groundwater-specific response action is planned for AA 3. Although it is not expected that future releases to groundwater that would warrant a response action, detection monitoring will be performed to detect any release of organic constituents entering the groundwater from material present at AA 3.

4.5.1.1 Federal ARARs

Portions of the RCRA groundwater protection standards contained in Cal. Code Regs. tit. 22 are considered to be relevant and appropriate for the groundwater monitoring at AA 3 since the hazardous constituents being addressed by the remedial action are similar or identical to those found in RCRA hazardous wastes. Substantive provisions of the following requirements apply to the development and implementation of groundwater monitoring program:

- general monitoring (Cal. Code Regs. tit. 22 §§ 66264.91[a][1] and 66264.97[b][1][A], [b)[1][B], [b][4-7], [e)[6], [12)[A] and [B], [13], and [15])
- point of compliance (Cal. Code Regs. tit. 22 § 66264.95[a] and [b])

- detection monitoring (Cal. Code Regs. tit. 22 § 66264.98[e][1-5], [j], [k][1-3], 4[A], and [D), [5], [7)[C] and [D]

RCRA requirements for identification and management of solid and hazardous wastes are also potential federal action-specific ARARs identified for all remedial action alternatives except Alternative 1 (No action). Soil cuttings and water generated in the course of installing and developing monitoring wells would be subject to RCRA requirements at Cal. Code Regs. tit. 22, § 66262.10(a) and § 66262.11 to determine whether such wastes should be classified as hazardous.

The DON has determined that soil and well development water at AA 3 would not be classified as RCRA-listed hazardous wastes. However, testing would still be required to classify these materials with respect to the RCRA hazardous waste characteristics. This determination would be made at the time the waste is generated. The appropriate requirements outlined in Table H-5 for storing, manifesting, and transporting this material for final disposal would need to be followed only in the unlikely event that the soil cuttings and well development water are found to be classified as RCRA characteristic hazardous wastes.

The soil cuttings and well development water generated would also be subject to state action-specific requirements to determine if these materials are non-RCRA hazardous waste. The appropriate management requirements of Cal. Code Regs. tit. 22, § 66264 would be evaluated as potential ARARs should testing unexpectedly classify these materials as non-RCRA hazardous waste.

4.5.1.2 State ARARs

The RWQCB identified Cal. Code Regs. tit. 27 § 20385 as potential ARAR for groundwater monitoring at IRP Sites 3 and 5, former MCAS El Toro. The DON as reviewed the provisions of this regulation and has determined that they are not more stringent than equivalent federal regulations at Cal. Code Regs. tit. 22 § 66264.91. Therefore, requirements of Cal. Code Regs. tit. 27 § 20385 are not ARARs for remedial action at AA 3.

4.5.2 Landfill Gas Monitoring

4.5.2.1 Federal ARARs

No federal ARARs have been identified for landfill gas monitoring.

4.5.2.2 State ARARs

In response to the DON's ARAR solicitation of April 2005, the RWQCB and CIWMB identified Cal. Code Regs. tit. 27 §§ 20921 – 20937 and 21160 as potential ARARs for landfill gas monitoring. A detailed ARAR evaluation of these regulations is presented in Table H-6. This evaluation indicates that substantive requirements of Cal. Code Regs. tit. 27 §§ 20921(a)(1), (2), and (3), 20921(b) and (d), 20923, 20925 (a), (b), and (c), 20925(d)(1) and (3), 20932, 20933, 20937, and 21160(a) (except where the provisions refer to leachate collection and control) are potential ARARs for landfill gas monitoring.

4.6 Conclusions of Action-Specific ARARs

The actions to be undertaken during proposed AA 3 remedial action may include capping, excavation, and temporary storage. The conclusions for the ARARs pertaining to these actions are presented in the following sections.

4.6.1 Capping/Cover

The potential ARARs for cap design and construction, and post-closure maintenance are presented in Tables H-6 and H-7. The following is a list of potential ARARs for all the alternatives that include capping (Alternatives 3a, 3b, 3c, and 3d):

- Location (Cal. Code Regs. tit. 22 § 66264.309[a])
- Site Security (Cal. Code Regs. tit. 27 § 21135[f] and [g])
- General requirements for final cover design (Cal. Code Regs. tit. 27 § 21140)
- Grading of final cover (Cal. Code Regs. tit. 27 § 21142). Grading of the final cover for Alternatives 3b, 3c, and 3d (Cal. Code Regs. tit. 27 §§ 21090[b][1])
- Landfill gas control (Cal. Code Regs. tit. 27 § 21160[a] except where the provisions refer to leachate collection and control.)
- Compaction (Cal. Code Regs. tit. 22 § 66264.228[e][1])
- Cover seismic requirements (Cal. Code Regs. tit. 27 §§ 21145[a])
- Post-closure care period (Cal. Code Regs. tit. 27 §§ 20950[a] and 21180[a], [b], [c], and [d])
- Post-closure care (Cal. Code Regs. tit. 22 § 66264.310[b][1])
- Erosion control for final cover (Cal. Code Regs. tit. 27 §§ 21090[c][4] and 21150)
- Benchmark maintenance (Cal. Code Regs. tit. 22 § 66264.310[b][5])

In addition to above ARARs, the substantive provisions of Cal. Cal. Code Regs. tit. 27 § 21090 (a)(1) through (3) are ARARs for Alternatives 3b, 3c, and 3d that include construction of erosion resistant, foundation, and barrier layers in accordance with the requirements of Cal. Code Regs. tit. 27 or construction of Title 27 prescriptive cap.

Under Cal. Code Regs. tit. 27, § 20080(b), engineered alternatives to the prescriptive landfill cover are allowed when the discharger can demonstrate that the construction or prescriptive standard is not feasible and there is a specific engineered alternative. Under Cal. Code Regs. tit. 27, § 21090, the RWQCB can allow any alternative final cover that it finds will continue to isolate the waste and irrigation at least as well as would a final cover built in accordance with applicable prescriptive standards. The UNSAT-H modeling results indicate that Alternatives 2 and 3a provide performance equivalent to the prescriptive standard (clay) cap (Alternative 3b) in preventing potential migration of contaminants to groundwater where they could pose a risk to human health and the environment (see Appendix K). Therefore, the requirements of Cal. Code Regs. tit. 27, §§ 20080(b) and 21090 (a) that allow for an alternative final cover have been determined to be potential ARARs for remedial Alternatives 2 and 3a. Alternative 2 include limited grading of existing soil cover. Alternative 3a includes construction of an ET cover. Both existing and ET covers are modifications of cover prescribed under Cal. Code Regs. tit. 27. The prescriptive cover requirements at Cal. Cal. Code Regs. tit. 27 §§ 21090 (a)(1) through (3) do not constitute potential ARARs for Alternatives 2 and 3a.

4.6.2 Temporary Storage of Excavated Debris

The excavated debris from AA 3 would be stored in staging piles. The substantive requirements of 40 C.F.R. § 264.554(d)(1)(i-ii), (d)(2), (e), (f), (h), (i), (j), and (k) are potentially ARARs for design, operation, and closure of the staging pile.

4.6.3 Monitoring

Although no response action is planned for groundwater at AA 3, the detection monitoring requirements of Cal. Code Regs. tit. 22 § 66264.98(e)(1-5), (j), (k)(1-3), 4(A), and (D), (5), (7)(C) and (D) are determined to be potential federal relevant and appropriate ARARs for the remedial action. The general monitoring requirements at Cal. Code Regs. tit. 22, §§ 66264.91(a)(1), and 66264.97(b)(1)(A), (b)(1)(B), (b)(4-7), (e)(6), (12)(A) and (B), (13), and (15); and; monitoring points and points of compliance at Cal. Code Regs. tit. 22, § 66264.95(a) and (b); are supporting potential ARARs for detection monitoring program.

For landfill gas monitoring, substantive requirements of Cal. Code Regs. tit. 27 §§ 20921(a)(1), (2), and (3), 20921(b) and (d), 20923, 20925 (a), (b), and (c), 20925(d)(1) and (3), 20932, 20933, and 20937 have been identified as potential ARARs.

5. SUMMARY

Controlling ARARs have been identified for AA 3 in this appendix for each medium, location, and proposed remedial action alternative.

5.1 CHEMICAL-SPECIFIC ARARS

The chemical-specific ARARs are presented in Section 2 and Tables H-1 and H-2. Alternatives evaluated in this RI/FS include excavation, consolidation, and off-site disposal of contaminated soil, and generation of investigation-derived waste (IDW). The substantive provisions of Cal. Code Regs. tit. 22, § 66261.21, § 66261.22(a)(1), § 66261.23, § 66261.24(a)(1), and § 66261.100 are potential federal ARARs for determining whether the contaminated soil or waste is a RCRA hazardous waste. The substantive provisions of Cal. Code Regs. tit. 22, § 66261.24(a)(2) are potential state ARARs for determining whether the contaminated soil or waste exhibits the characteristics of the California-regulated, non-RCRA hazardous waste.

5.2 LOCATION-SPECIFIC ARARS

The location-specific ARARs are presented in Section 3 and Tables H-3 and H-4. The HEC-RAS modeling indicated that the southeastern portion of AA 3 adjacent to the Agua Chinon Wash is within the 100-year flood plain. Therefore, the substantive requirements of Cal. Code Regs. tit. 22, § 66264.18[b] and 40 C.F.R. § 6.302(b) and 40 C.F.R. pt. 6 Appendix A, § 6(a)(1), (3), and (5) (at the end of § 6.1007) relating to construction in a 100-year flood plain are potential ARARs for AA 3 remedial action.

5.3 ACTION-SPECIFIC ARARS

The action-specific ARARs are presented in Section 4 and Tables H-5 and H-6. Capping or covering the landfill is a component of several of the alternatives being evaluated for AA 3. Federal and state requirements for landfill closure are the primary source of ARARs for this action. Potential action-specific ARARs for the soil cover were evaluated in four nearly identical sets of regulations: 40 C.F.R. § 258 and Cal. Code Regs. tits. 22 and 27.

For Alternatives 3b, 3c, and 3d that include construction of Title 27 prescriptive cap, the substantive provisions of Cal. Cal. Code Regs. tit. 27 §§ 21090 (a)(1) through (3) are potential ARARs for construction of erosion resistant, foundation, and barrier layers. The requirements under Cal. Code Regs. tit. 27, §§ 20080 and 21090 allow engineered alternatives to prescriptive landfill cover and are potential "relevant and appropriate" ARARs for remedial alternatives 2 and 3a. Alternative 2 includes limited grading of existing soil cover at AA 3 and Alternative 3a includes construction of an ET cover. Both existing and ET covers are modifications of the cover prescribed under Cal. Code Regs. tit. 27. The UNSAT-H modeling results indicate that Alternatives 2 and 3a provide performance equivalent to the prescriptive standard (clay) cap (Alternative 3b) in preventing potential migration of contaminants to groundwater where they could pose a risk to human health and the environment (see Appendix K).

The controlling ARARs for cap design and construction, and post-closure maintenance activities including, site security, final cover design, erosion control, landfill gas control, and post-closure care are identified in Table H-7.

Alternative 4 includes temporary storage of excavated debris in staging piles; therefore, substantive requirements of 40 C.F.R. § 264.554(d)(1)(i-ii), (d)(2), (e), (f), (h), (i), (j), and (k) are potentially ARARs for design, operation, and closure of the staging pile.

Although no response action is planned for groundwater at AA 3, the detection monitoring requirements of Cal. Code Regs. tit. 22 § 66264.98(e)(1-5), (j), (k)(1-3), 4(A), and (D), (5), (7)(C) and (D) are determined to be potential federal relevant and appropriate ARARs for all alternatives

except Alternative 1 (No action). For landfill gas monitoring, substantive requirements of Cal. Code Regs. tit. 27 §§ 20921(a)(1), (2), and (3), 20921(b) and (d), 20923, 20925 (a), (b), and (c), 20925(d)(1) and (3), 20932, 20933, and 20937 have been identified as potential ARARs.

For alternatives involving capping and consolidation of contaminated soil, the substantive provisions of SCAQMD Rules 403, 404, 405, and 1150.1 are potentially applicable federal ARARs since they have been approved into the SIP. Additionally, the substantive provisions of the SCAQMD Rules 401 and 1150 are potentially applicable state ARARs at AA 3.

The substantive provisions of Cal. Civ. Code § 1471; Cal. Code Regs. tit. 22, § 67391.1; and Cal. Health & Safety Code §§ 25202.5, 25222.1, 25232(b)(1)(A)–(E), 25233(c), 25234, and 25355.5(a)(1)(C) are potential ARARs for alternatives proposing the use of ICs. The Navy will comply with the substantive requirements of Cal. Health & Safety Code §§ 25222.1 and 25355.5(a)(1)(C) by incorporating CERCLA use restrictions into the Navy's deed of conveyance in the form of restrictive covenants under the authority of Cal. Civ. Code § 1471. In addition to being implemented through the Environmental Restriction Covenant and Agreement between the DON and DTSC, the appropriate and relevant portions of Cal. Health & Safety Code §§ 25202.5, 25222.1, 25232(b)(1)(A)–(E), 25233(c), 25234, and 25355.5(a)(1)(C) and Cal. Civ. Code § 1471 shall also be implemented through the deed between the DON and the transferee. EPA agrees that the substantive portions of the state statutes and regulations referenced in this section are ARARs. EPA specifically considers sections (a)(1), (a)(2), (b), (d), and (e)(1), and (e)(2) of Cal. Code Regs., tit. 22 Section 67391.1, to be ARARs for this RI/FS. DTSC's position is that all of the state statutes and regulations referenced in this section are ARARs.

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Tables

Table H-1: Pot[illegible]ederal Chemical-Specific[a] ARARs for Remedial Action at AA 3

Requirement	Prerequisite	Citation [b]	ARAR Determination	Comments
GROUNDWATER				
Safe Drinking Water Act (42 U.S.C., ch. 6A, § 300[f]–300[j]-26)[c]				
National primary drinking water standards are health-based standards for public water systems (MCLs).	Public water system.	40 C.F.R. § 141.11–141.13, excluding § 141.11(d)(3), 141.15, 141.16, 141.61(a) and (c), and 141.62(b)	Not an ARAR	No response/corrective action is planned for groundwater at AA 3
MCLGs pertain to known or anticipated adverse health effects (also known as recommended MCLs).	Public water system.	40 C.F.R. § 141.50–141.51	Not an ARAR.	No response/corrective action is planned for groundwater at AA 3.
National secondary drinking water regulations are standards for the aesthetic qualities of public water systems (SMCLs).	Public water system.	40 C.F.R. § 143.3	Not an ARAR	No response/corrective action is planned for groundwater at AA 3. Additionally, SMCLs are federal contaminant levels intended as guidelines for the states. Because they are not enforceable, federal SMCLs are not ARARs.
Resource Conservation and Recovery Act (42 U.S.C., ch. 82, §§ 6901–6991[i])[c]				
Defines RCRA hazardous waste. A solid waste is characterized as toxic, based on the TCLP, if the waste exceeds the TCLP maximum concentrations.	Waste.	Cal. Code Regs. tit. 22, § 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Applicable	Applicable for determining whether waste is hazardous. If wastes (e.g., drill cuttings from monitoring well installation) are generated during the remedial action, generator requirements (i.e., hazardous waste determinations) will be applicable.
Groundwater protection standards: Owners/operators of RCRA treatment, storage, or disposal facilities must comply with conditions in this section that are designed to ensure that hazardous constituents entering the groundwater from a regulated unit do not exceed the concentration limits for contaminants of concern set forth under Cal. Code Regs. tit. 22, § 66264.94 in the uppermost aquifer underlying the waste management area of concern at the POC.	A regulated unit that receives or has received hazardous waste before 26 July 1982 or regulated units that ceased receiving hazardous waste prior to 26 July 1982 where constituents in or derived from the waste may pose a threat to human health or the environment.	Cal. Code Regs. tit. 22, § 66264.94, except 66264.94(a)(2) and 66264.94(b)	Not an ARAR	Groundwater is not a medium of concern at AA 3. Since groundwater is not a medium of concern, no response action is planned and therefore groundwater ARARs are not triggered. However, detection monitoring will be conducted requirements for groundwater at Cal. Code Regs. tit. 22 Section 66264.98 (e)(1-5), (j), (k)(1-3), 4(A), and (D), (5), (7)(C) and (D) are potential ARARs for groundwater monitoring that would be conducted as a component of response action alternatives that involve leaving the buried waste in-place in a waste management unit (see Table H-5 for details).

Table H-1: Potential Federal Chemical-Specific[a] ARARs for Remedial Action at AA 3

Requirement	Prerequisite	Citation [b]	ARAR Determination	Comments
The POC is a vertical surface located at the hydraulically downgradient limit of the waste management area that extends through the uppermost aquifer underlying the regulated unit	Hazardous waste treatment or disposal.	Cal. Code Regs. tit. 22, § 66264.95	Relevant and appropriate	The point of compliance is designated at the downgradient edge of AA 3. The concentration limits established for the constituents of concern for groundwater monitoring as a part of landfill closure and postclosure requirements would apply downgradient from the points of compliance (see Section 2.2.1.1 for additional discussion).
Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C., ch. 103, §§ 9601–9675)[c]				
ACLs using a point of exposure beyond the facility boundary.	Known or projected points of entry from groundwater to surface water.	CERCLA Section 121(d)(2)(B)(ii) 42 U.S.C., ch. 103, § 9621	Not an ARAR.	Not an ARAR because there are no known or projected points of entry of groundwater to surface water in the vicinity of AA 3.
Clean Water Act of 1977, as Amended (33 U.S.C., ch. 26, §§ 1251–1387)[c]				
National Ambient Water Quality Criteria.	Discharges to waters of the United States and groundwater.	33 U.S.C. § 1314(a) and 42 U.S.C. § 9621(d)(2) 64 Fed. Reg. 19,781 (22 April 1999)	Not an ARAR.	There are no current or planned discharges to ground or surface water as a result of this remedial action.
Water quality standards.	Discharges to waters of the United States.	40 C.F.R. § 131.36(b) and 131.38	Not an ARAR.	There are no current or planned discharges to ground or surface water as a result of this remedial action.
SOIL				
Resource Conservation and Recovery Act (42 U.S.C., ch. 82, §§ 6901–6991[i]) [c]				
Provides definition of "Waste."		Cal. Code Regs. tit. 22 § 66261.2 (a), (b)(1), and (c)(1) and (3)	Applicable	The soil cuttings, groundwater, and other materials generated during the remedial action at AA 3 would be classified as waste. These wastes would be properly characterized and disposed in accordance with federal and state regulations for waste characterization identified as ARARs.
Defines RCRA hazardous waste. A solid waste is characterized as toxic, based on the toxicity characteristic leaching procedure (TCLP), if the waste exceeds the TCLP maximum concentrations.	Waste	Cal. Code Regs. tit. 22 § 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Applicable	Applicable for determining whether waste is hazardous.
Groundwater Protection Standards: Requirements to ensure that hazardous constituents entering the groundwater from a regulated unit do not exceed the concentration limits for contaminants of concern in the uppermost aquifer underlying the waste management area of concern at the point of compliance.	A regulated unit that receives or has received hazardous waste before 26 July 1982 or regulated units that ceased receiving hazardous waste prior to 26 July 1982 where constituents in or derived from the waste may pose a threat to human health or the environment.	Cal. Code Regs. tit. 22 § 66264.94 (a)(1) and (3), (c), (d), and (e)	Not an ARAR	No significant vadose zone contamination was found at AA 3. In addition, no conclusive evidence exists to establish that unsaturated zone at AA 3 is impacting groundwater.

Table H-1: Pot[illegible] Federal Chemical-Specific[a] ARARs for Remedial Action at AA 3

Requirement	Prerequisite	Citation [b]	ARAR Determination	Comments
LDRs prohibit disposal of hazardous waste unless treatment standards are met.	Hazardous waste land disposal.	Cal. Code Regs. tit. 22, § 66268.1(f)	Not an ARAR	It is not anticipated that any RCRA hazardous wastes generated during the remedial action will be placed outside the area of contamination. Therefore, LDRs are not ARARs.
Treatment standards including technology requirements before hazardous waste can be disposed to land.	Hazardous waste land disposal.	Cal. Code Regs. tit. 22, § 66268.40	Not an ARAR	No disposal or placement of waste is anticipated outside the area of contamination as part of this remedial action.
Universal Treatment Standards used to comply with treatment standards.	Hazardous waste land disposal.	Cal. Code Regs. tit. 22, § 66268.48	Not an ARAR	No disposal or placement of waste is anticipated outside the area of contamination as part of this remedial action.
AIR				
Clean Air Act (42 U.S.C., ch. 85, §§ 7401–7671) [c]				
NAAQS: Primary and secondary standards for ambient air quality to protect public health and welfare (including standards for particulate matter and lead).	Contamination of air affecting public health and welfare.	40 C.F.R. § 50.4–50.12	Not an ARAR	Not enforceable and therefore not an ARAR. Also, not a TBC because air pollutants covered by NAAQS are not emitted under current conditions. Emissions that are part of the response action are evaluated under the action-specific requirements.
Provisions of SIP approved by U.S. EPA under Section 110 of CAA.	Major sources of air pollutants.	42 U.S.C. § 7401; portions of 40 C.F.R. § 52.220 applicable to SCAQMD	Not an ARAR.	Emission of air pollutants regulated by SIP is currently not occurring. Emissions that are part of the response action are evaluated under the action-specific requirements.
Resource Conservation and Recovery Act Air Emissions Requirements (42 U.S.C., ch. 82, §§ 6901–6991[i])[c]				
Air emission standards for process vents or equipment leaks.	Equipment that contains or contacts hazardous waste with organic concentrations of at least 10 percent by weight or process vents associated with specified operations that manage hazardous wastes with organic concentrations of at least 10 ppmw.	Cal. Code Regs. tit. 22, § 66264.1030–66264.1034, excluding .1030(c), .1033(j), .1034(c)(2), .1034(d)(2) Cal. Code Regs. tit. 22, § 66264.1050– 66264.1063, excluding .1050(c), (d), .1057(g)(2), .1060, .1063(d)(3)	Not an ARAR	Groundwater or soil does not contain more than 10 percent by weight VOCs.

Notes:
[a] Many potential action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables
[b] Only the substantive provisions of the requirements cited in this table are potential ARARs
[c] Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs.

Acronyms/Abbreviations:

§	section	RCRA	Resource Conservation and Recovery Act
ARAR	applicable or relevant and appropriate requirement	TCLP	toxicity characteristic leaching procedure
Cal. Code Regs.	*California Code of Regulations*	tit.	title
ch.	chapter	UMTRCA	Uranium Mill Tailings Radiation Control Act
cm	centimeter	U.S.C.	*United States Code*
DON	Department of the Navy		

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Table H-2: Pot[illegible] State Chemical-Specific[a] ARARs for Remedial Action at AA 3

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
GROUNDWATER, SURFACE WATER, SOIL, SEDIMENTS, AND AIR				
Cal/EPA Department of Toxic Substances Control[c]				
Defines "non-RCRA hazardous waste"	Waste	Cal. Code Regs. tit. 22 § 66261.22(a)(3) and (4), § 66261.24(a)(2)–(a)(8), § 66261.101, § 66261.3(a)(2)(C), and § 66261.3(a)(2) (F)	Applicable	While it is not anticipated that any hazardous waste will be generated as a result of this remedial action, in the event that wastes are generated (e.g., drill cuttings from monitoring well construction) generator requirements (i.e., hazardous waste determinations) will be applicable.
State MCL list.	Source of drinking water.	Cal. Code Regs. tit. 22, §§ 64431 and 64444	Not an ARAR	No response/corrective action is planned for groundwater remediation at AA 3.
State secondary MCL list.	Source of drinking water.	Cal. Code Regs. tit. 22, § 64449(a)	Not an ARAR	No response/corrective action is planned for groundwater remediation at AA 3.
State and Regional Water Quality Control Boards[c]				
Describes the water basins in Santa Ana Region, establishes beneficial uses of groundwater and surface water, establishes WQOs, including narrative and numerical standards, establishes implementation plans to meet WQOs and protect beneficial uses, and incorporates statewide water quality control plans and policies		Comprehensive Water Quality Control Plan for the Santa Ana (Basin Plan) (Cal. Water Code § 13240)	Not an ARAR	Groundwater is not a medium of concern and no response action is planned for groundwater.
Amends Water Quality Control Plan for the Santa Ana River Basin by incorporating language authorizing compliance schedules in NPDES permits.		Regional Water Quality Control Board Resolution No. 00-27	Not an ARAR	No discharges to surface waters are planned as a part of AA 3 remedial action. In the northeastern portion of AA 3 where surface water stream is in close proximity to the buried debris, approximately 4 feet of soil cover separates surface water from the underlying debris. The surface water sampling conducted during the RSE investigation indicated that AA 3 does not impact surface water in the Aqua Chinon Wash. In addition, as a part of the remedial action, drainage improvements are planned to further separate surface water from the buried debris, which is expected to eliminate the potential for surface water to be impacted by the release from AA 3.
Amends the Water Quality Control Plan for the Santa Ana River Basin by incorporating bacterial objectives for ocean waters.		Regional Water Quality Control Board Resolution No. 97-20	Not an ARAR	No discharges to surface water or groundwater are planned as a part of AA 3 remedial action. In addition, bacteria are not related to site activities and are not constituents of concern for remedial action at AA 3.
Amends the Water Quality Control Plan for the Santa Ana River Basin by incorporating Newport Bay Watershed Nutrient TMDL.		Regional Water Quality Control Board Resolution No. 98-100	Not an ARAR	No discharges to surface water are planned as a part of AA 3 remedial action. In addition, nutrients are not related to site activities and are not constituents of concern for remedial action at AA 3.

Table H-2: Potential State Chemical-Specific[a] ARARs for Remedial Action at AA 3

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
Amends the Water Quality Control Plan for the Santa Ana River Basin by incorporating Newport Bay Watershed Sediment TMDL.		Regional Water Quality Control Board Resolution No. 98-101	Not an ARAR	No discharges to surface water are planned as a part of AA 3 remedial action. In addition, sediments are not related to site activities and are not constituents of concern for remedial action at AA 3.
Amends the Water Quality Control Plan for the Santa Ana River Basin by incorporating Newport Bay Fecal Coliform TMDL.		Regional Water Quality Control Board Resolution No. 99-10	Not an ARAR	No discharges to surface water are planned as a part of AA 3 remedial action. In addition, fecal coliforms are not related to site activities and are not constituents of concern for remedial action at AA 3.
Amends the Water Quality Control Plan for the Santa Ana River Basin by incorporating an updated total dissolved solids (TDS) Management Plan.		Regional Water Quality Control Board Resolution No. R8-2004-0001	Not an ARAR.	No discharges to surface water are planned as a part of AA 3 remedial action. In addition, total dissolved solids are not related to site activities and are not constituents of concern for remedial action at AA 3.
Establishes the policy that high-quality waters of the state "shall be maintained to the maximum extent possible" consistent with the "maximum benefit to the people of the State." It provides that whenever the existing quality of water is better than that required by applicable water quality policies, such existing high-quality water will be maintained until it has been demonstrated to the state that any change will be consistent with maximum benefit to the people of the state, will not unreasonably affect present and anticipated beneficial use of such water, and will not result in water quality less than that prescribed in the policies. It also states that any activity that produces or may produce a waste or increased volume or concentration of waste and that discharges or proposes to discharge to existing high-quality waters will be required to meet waste-discharge requirements that will result in the best practicable treatment or control of the discharge.		Statement of Policy With Respect to Maintaining High Quality of Waters in California, SWRCB Res. 68-16	Not an ARAR	Groundwater is not a medium of concern at AA 3 and no response/corrective action is planned for groundwater remediation. A comprehensive statistical evaluation of the groundwater concluded that historical activities at AA 3 have not resulted in a statistically significant release of constituents to groundwater at the point of compliance. Therefore, the requirements of the State Water Resources Control Board Res. 68-16 do not constitute potential ARARs for AA 3.

Table H-2: Pot[illegible] State Chemical-Specific[a] ARARs for Remedial Action at AA 3

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
Describes requirements for RWQCB oversight of investigation and cleanup and abatement activities resulting from discharges of hazardous substances. RWQCB may decide on cleanup and abatement goals and objectives for the protection of water quality and beneficial uses of water within each region. Establishes criteria for "containment zones" where cleanup to established water-quality goals is not economically or technically practicable.		Policies and procedures for investigation and cleanup and abatement of discharges under Cal. Water Code § 13304, SWRCB Res. 92-49	Not an ARAR	Groundwater is not a medium of concern at AA 3 and no response/corrective action is planned for groundwater remediation. A comprehensive statistical evaluation of the groundwater concluded that historical activities at AA 3 have not resulted in a statistically significant release of constituents to groundwater at the point of compliance. Therefore, the requirements of the State Water Resources Control Board Res. 92-49 do not constitute potential ARARs for AA 3.
Describes findings and declarations regarding protection of quality of waters of the state. Includes declaration for regulation of activities and factors which may affect water quality and statewide program for the control of the quality of all the waters of the state		Cal. Water Code, div. 7, § 13000	Not an ARAR.	This statutory provision does not in itself establish or contain substantive environmental "standards, requirements, criteria, or limitations" and therefore does not meet the definition of an ARAR.
Establishes requirements as to when the state policy for water quality control and regional water quality control plans become a part of the California Water Plan.		Cal. Water Code, div. 7, § 13141	Not an ARAR.	This statutory provision sets forth procedural requirements as to when the state policy for water quality control and regional water quality control plans become a part of the California Water Plan. It does not in itself establish or contain substantive environmental "standards, requirements, criteria, or limitations" pertaining to actions of the DON at AA 3. Therefore, it does not meet the definition of an ARAR.
Establishes requirements for content of the State policy for water quality control.		Cal. Water Code, div. 7, § 13142	Not an ARAR.	This statutory provision sets forth requirements for contents of the state policy for water quality control and is procedural in nature. It does not in itself establish or contain substantive environmental "standards, requirements, criteria, or limitations" pertaining to actions of the DON at the AA 3. Therefore, it does not meet the definition of an ARAR.
Requires that state policy for water quality control be periodically reviewed and revised.		Cal. Water Code, div. 7, § 13143	Not an ARAR.	This statutory provision sets forth requirements for the state board to review and revise the state policy for water quality control and is procedural in nature. It does not in itself establish or contain substantive environmental "standards, requirements, criteria, or limitations" pertaining to actions of the DON at AA 3. Therefore, it does not meet the definition of an ARAR.
Establishes requirements for consultation of the state board with concerned federal, state,		Cal. Water Code, div. 7, § 13144	Not an ARAR.	This statutory provision sets forth requirements for the state board to consult with concerned federal, state, and local agencies during the process of formulating and revising state policy for water quality control

Table H-2: Potential State Chemical-Specific[a] ARARs for Remedial Action at AA 3

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
and local agencies during the process of formulating and revising state policy for water quality control.				and is procedural in nature. It does not in itself establish or contain substantive environmental "standards, requirements, criteria, or limitations" pertaining to actions of the DON at AA 3. Therefore, it does not meet the definition of an ARAR.
Requires state board to take into consideration the effect of its actions on the California Water Plan and any other general or coordinated governmental plan looking toward the development, utilization, or conservation of the waters of the state.		Cal. Water Code, div. 7, § 13145	Not an ARAR.	This statutory provision sets forth requirements for the state board to take into consideration the effect of its actions on the California Water Plan and is procedural in nature. It does not in itself establish or contain substantive environmental "standards, requirements, criteria, or limitations" pertaining to actions of the DON at AA 3. Therefore, it does not meet the definition of an ARAR.
Requires that state offices, departments and boards comply with state policy for water quality control in carrying out activities which affect water quality.		Cal. Water Code, div. 7, § 13146	Not an ARAR.	The regulation sets forth requirements for state offices, boards, and department to comply with state policy for water quality control. The regulation does not pertain to actions of federal agencies such as DON at the site.
Requires state board to hold public hearing before adopting state policy for water quality control.		Cal. Water Code, div. 7, § 13147	Not an ARAR.	This statutory provision sets forth requirements for the state board to hold public hearing before adopting state policy for water quality control. It does not in itself establish or contain substantive environmental "standards, requirements, criteria, or limitations" pertaining to actions of the DON at AA 3. Therefore, it does not meet the definition of an ARAR.
Defines activities that the state board should perform to ensure adequate protection of water quality and statewide uniformity in the siting, operation, and closure of waste disposal sites.		Cal. Water Code, div. 7, § 13172	Not an ARAR.	This statutory provision sets forth the activities that state board shall perform to ensure protection of water quality and statewide uniformity in the siting, operation, and closure of waste disposal sites. It does not in itself establish or contain substantive environmental "standards, requirements, criteria, or limitations" pertaining to actions of the DON at AA 3. Therefore, it does not meet the definition of an ARAR.
Establishes requirements for submission of a report and annual fee for waste discharge that could affect the quality of the waters of the state.		Cal. Water Code, div. 7, § 13260	Not an ARAR.	The requirements are procedural in nature; to constitute an ARAR a requirement must be substantive. Additionally, none of the remedial action alternatives considered for AA 3 includes discharges to surface water or groundwater.
Authorizes regional water boards to prescribe requirements for discharges to the receiving waters.		Cal. Water Code, div. 7, § 13263	Not an ARAR	None of the remedial action alternatives considered for AA 3 includes discharges to surface water or groundwater. The objective of the remedial action at AA 3 is to minimize the potential for discharge of contaminants of concern to groundwater and surface water. Any potential releases to groundwater from buried debris at AA 3 will be addressed under landfill closure and postclosure requirements contained in 40 C.F.R. § 258, and Cal. Code Regs. tits. 22, 23, and 27. The evaluation of ARAR status of these regulations is presented in Tables H-5 and H-6.

Table H-2: Pot State Chemical-Specific[a] ARARs for Remedial Action at AA 3

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
Authorizes regional boards to investigate the quality of any waters of the state in establishing or reviewing any water quality control plan or waste discharge requirements. As a part of this investigation, the regional board may require submission of technical or monitoring program reports.		Cal. Water Code, div. 7, § 13267	Not an ARAR.	The requirements including submission of technical or monitoring program reports are procedural in nature. To constitute an ARAR a requirement must be substantive.
Establishes prohibitions on discharges to cold interstate waters and maximum temperature changes to other waters to protect natural receiving water temperatures; includes site-specific temperature objectives for certain water bodies.	Discharge to surface waters, enclosed bays, and estuaries.	Cal. Water Code, div. 7 §§ 13140, 13142.5 (Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California)	Not an ARAR.	No discharges to surface waters, enclosed bays, or estuaries are planned as a part of AA 3 remedial action. In the northeastern portion of AA 3 where surface water stream is in close proximity to the buried debris, approximately 4 feet of soil cover separates surface water from the underlying debris. The surface water sampling conducted during the RSE investigation indicated that AA 3 does not impact surface water in the Aqua Chinon Wash. In addition, as a part of the remedial action, drainage improvements are planned to further separate surface water from the buried debris, which is expected to eliminate the potential for surface water to be impacted by the release from AA 3.

Notes:

[a] Many potential action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables

[b] Only the substantive provisions of the requirements cited in this table are potential ARARs

[c] Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of specific citations are considered potential ARARs.

Acronyms/Abbreviations:

§	section
ARAR	applicable or relevant and appropriate requirement
Cal. Code Regs.	*California Code of Regulations*
Cal/EPA	California Environmental Protection Agency
RCRA	Resource Conservation and Recovery Act
tit.	title

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Table H-3: Pot[illegible] Federal Location-Specific[a] ARARs for Remedial Action at AA 3

Location	Requirement	Prerequisite	Citation [b]	ARAR Determination	Comments
National Historic Preservation Act of 1966, as Amended (16 U.S.C. § 470–470x-6)[b]					
Historic project owned or controlled by federal agency	Action to preserve historic properties; planning of action to minimize harm to properties listed on or eligible for listing on the National Register of Historic Places.	Property included in or eligible for the National Register of Historic Places.	16 U.S.C. § 470–470x-6 36 C.F.R. pt. 800 40 C.F.R. § 6.301(b)	Not an ARAR	Based on the cultural resources investigations conducted in conjunction with base closure, DON has determined that no sites, buildings or structures at former MCAS El Toro are eligible for listing in the National Register for Historic Places (DON 2002).
Archaeological and Historic Preservation Act (16 U.S.C. § 469–469c-1)[b]					
Within area where action may cause irreparable harm, loss, or destruction of significant artifacts	Construction on previously undisturbed land would require an archaeological survey of the area. Data recovery and preservation would be required if significant archaeological or historical data were found on site. The responsible official or Secretary of the Interior is authorized to undertake data recovery and preservation.	Regulated alteration of terrain caused as a result of a federal construction project or federally licensed activity or program where action may cause irreparable harm, loss, or destruction of significant artifacts.	16 U.S.C. § 469–469c-1 40 C.F.R. § 6.301(c)	Applicable.	No prehistoric or historic sites were identified during the cultural resources investigations (including Phase I archeological survey) conducted in conjunction with base closure for the on-Station area that could be potentially impacted by the remedial action (DON 2002). However, if archeological resources are identified during the course of remedial action, this act may be potentially applicable.
Historic Sites, Buildings, and Antiquities Act of 1935 (16 U.S.C. §§ 461–467)[b]					
Historic sites	Avoid undesirable impacts on landmarks.	Areas designated as historic sites.	16 U.S.C. §§ 461–467 40 C.F.R. § 6.301(a)	Not an ARAR	Since , National historic landmarks do not exist at AA 3, the requirements of Historic Sites, Buildings, and Antiquities Act (16 U.S.C. §§ 461–467) and its implementing regulations (40 C.F.R. § 6.301[c]) do not constitute potential ARARs for the remedial action at AA 3.
Archaeological Resources Protection Act of 1979, as Amended (16 U.S.C. § 470aa–470mm)[b]					
Archaeological resources on federal land	Prohibits unauthorized excavation, removal, damage, alteration, or defacement of archaeological resources located on public lands unless such action is conducted pursuant to a permit.	Archaeological resources on federal land.	Pub. L. No. 96-95 16 U.S.C. § 470aa–470mm	Applicable.	Based on the scope of the proposed remedial action at AA 3 and results of cultural resources investigations conducted in conjunction with base closure (DON 2002), it is not expected that any archeological resources would be impacted. However, if archeological resources are identified during the course of remedial action, this act may be potentially applicable.

Table H-3: Potential Federal Location-Specific[a] ARARs for Remedial Action at AA 3

Location	Requirement	Prerequisite	Citation [b]	ARAR Determination	Comments
Exec. Order No. 11990, Protection of Wetlands[b]					
Wetland	Avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and avoid support of new construction in wetlands if practicable alternatives exist.	Wetland meeting definition of Section 7.	40 C.F.R. § 6.302(a) and 40 C.F.R. pt. 6, app. A, § 6(a)(1), (3), and (5) (at the end of § 6.1007)	Not an ARAR.	No area within AA 3 meets all three federal criteria as a wetland. The head cut drainage way at the southeastern boundary meets the hydrology, but not the vegetation criterion. The soils criterion could not be evaluated due to the origin and texture of soils on the site.
Exec. Order No. 11988, Floodplain Management[b]					
Within floodplain	Evaluate potential effects of actions in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain.	Action that will occur in a floodplain (i.e., lowlands) and relatively flat areas adjoining inland and coastal waters and other flood-prone areas.	40 C.F.R. § 6.302(b) and 40 C.F.R. pt. 6, app. A, § 6(a)(1), (3), and (5) (at the end of § 6.1007)	Applicable.	The HEC-RAS modeling indicated that the southeastern portion of AA 3 adjacent to the Agua Chinon Wash is within the 100-year flood plain. Therefore the substantive requirements of the cited regulations are potentially applicable federal ARARs.
Clean Water Act of 1977, as Amended, Section 404 (33 U.S.C. § 1344)[b]					
Wetland	Action to prohibit discharge of dredged or fill material into wetland without permit.	Wetland as defined by Exec. Order No. 11990 Section 7.	33 U.S.C. § 1344; 40 CFR Part 230; and 33 CFR Part 320	Not an ARAR.	Discharge of dredged or fill material to a wetland is not planned as part of the response action.
Resource Conservation and Recovery Act (42 U.S.C. §§ 6901–6991[i])[b]					
Within 100-year floodplain	Facility must be designed, constructed, operated, and maintained to avoid washout.	RCRA hazardous waste; treatment, storage, or disposal of hazardous waste.	Cal. Code Regs. tit. 22, § 66264.18(b)	Relevant and appropriate.	The HEC-RAS modeling indicated that the southeastern portion of AA 3 adjacent to the Agua Chinon Wash is within the 100-year flood plain. AA 3 is not a hazardous waste TSD facility; however since the constituents similar to those present in RCRA hazardous waste may be present at few locations at AA 3, the substantive requirements of Cal. Code Regs. tit. 22, § 66264.18(b) are potentially relevant and appropriate federal ARARs for the remedial action.
Wild and Scenic Rivers Act (16 U.S.C. §§ 1271–1287)[b]					
Within area affecting national wild, scenic, or recreational river	Avoid taking or assisting in action that will have direct adverse effect on scenic river.	Activities that affect or may affect any of the rivers specified in 16 U.S.C. §1276(a).	16 U.S.C. §§ 1271–1287	Not an ARAR.	No wild, scenic, or recreational rivers are located at or in the vicinity of former MCAS El Toro.
Fish and Wildlife Coordination Act (16 U.S.C. §§ 661–666c)[b]					
Area affecting stream or other water body	Action taken should protect fish or wildlife.	Diversion, channeling, or other activity that modifies a stream or other water body and affects fish or wildlife.	16 U.S.C. § 662	Applicable	The remedial action at AA 3 would include limited modifications to the stream bed of the Aqua Chinon Wash in the northeastern portion of the site. Therefore substantive requirements of 16 U.S.C. §§

Table H-3: Pot[illegible] Federal Location-Specific[a] ARARs for Remedial Action at AA 3

Location	Requirement	Prerequisite	Citation [b]	ARAR Determination	Comments
					661–666c are potential ARARs. However, since no significant fish and wildlife is present in the Aqua Chinon Wash in the vicinity of AA 3, the modifications to the stream are not expected to have adverse effects on fish and wildlife.
Rivers and Harbors Act of 1899 (33 U.S.C. §§ 401–413)[b]					
Navigable waters	Permits required for structures or work in or affecting navigable waters.	Activities affecting navigable waters.	33 U.S.C. § 403 33 C.F.R. § 322	Not an ARAR.	Former MCAS El Toro (AA 3) is not located near navigable water.
Endangered Species Act of 1973 (16 U.S.C. §§ 1531–1543)[b]					
Habitat upon which endangered species or threatened species depend	Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. The Endangered Species Committee may grant an exemption for agency action if reasonable mitigation and enhancement measures such as propagation, transplantation, and habitat acquisition and improvement are implemented.	Determination of effect upon endangered or threatened species or its habitat. Critical habitat upon which endangered species or threatened species depend.	16 U.S.C. § 1536(a), (h)(1)(B)	Not an ARAR.	The landfill is not located in an area that supports special status species or habitat.
Migratory Bird Treaty Act of 1972 (16 U.S.C. §§ 703–712)[b]					
Migratory bird area	Protects almost all species of native migratory birds in the U.S. from unregulated "take," which can include poisoning at hazardous waste sites.	Presence of migratory birds.	16 U.S.C. § 703	Not an ARAR.	Migratory birds have not been observed at or in the vicinity of the AA 3.
Marine Mammal Protection Act (16 U.S.C. §§ 1361–1421h)[b]					
Marine mammal area	Protects any marine mammal in the U.S. except as provided by international treaties from unregulated "take."	Presence of marine mammals.	16 U.S.C. § 1372(a)(2)	Not an ARAR.	No marine mammals have been documented at AA 3.
Magnuson-Stevens Fishery Conservation and Management Act of 1976, as Amended (16 U.S.C. §§ 1801–1882)[b]					
Fishery under management	Provides for conservation and management of specified fisheries within specified fishery conservation zones.	Presence of managed fisheries.	16 U.S.C. §§ 1801–1882	Not an ARAR.	Former MCAS El Toro (AA 3) is not located in an area designated as part of the Fishery Management Areas.

Table H-3: Potential Federal Location-Specific[a] ARARs for Remedial Action at AA 3

Location	Requirement	Prerequisite	Citation [b]	ARAR Determination	Comments
National Wildlife Refuge System Administration Act of 1996 (16 U.S.C. § 668dd–668ee)[b]					
Wildlife refuge	No person shall take any animal or plant on any national wildlife refuge, except as authorized under 50 C.F.R. § 27.51. The disposing or dumping of wastes is prohibited.	Area designated as part of National Wildlife Refuge System.	16 U.S.C § 668dd–668ee Substantive provisions of 50 C.F.R. § 27.11–27.97	Not an ARAR.	Former MCAS El Toro (AA 3) is not located in an area designated as part of the National Wildlife Refuge System.
Wilderness Act (16 U.S.C. §§ 1131–1136)[b]					
Wilderness area	Area must be administered in such a manner as will leave it unimpaired as wilderness and preserve its wilderness character.	Federally owned area designated as wilderness area.	16 U.S.C. §§ 1131–1136 50 C.F.R. § 35.1–35.14	Not an ARAR.	Former MCAS El Toro (AA 3) are not located in an area designated as Wilderness Area.
Coastal Zone Management Act (16 U.S.C. §§ 1451–1464)[b]					
Within coastal zone	Conduct activities in a manner consistent with approved state management programs.	Activities affecting the coastal zone including lands thereunder and adjacent shore land.	16 U.S.C. § 1456(c) 15 C.F.R. § 930	Not an ARAR.	Former MCAS El Toro (AA 3) is not located near a coastal area (California Coastal Commission).
Resource Conservation and Recovery Act (42 U.S.C. §§ 6901–6991[i])[b]					
Within 61 meters (200 feet) of a fault displaced in Holocene time	New treatment, storage, or disposal of hazardous waste prohibited.	RCRA hazardous waste; treatment, storage, or disposal of hazardous waste.	Cal. Code Regs. tit. 22, § 66264.18(a)	Not an ARAR.	The nearest fault that is considered active with Holocene movement is the Newport-Inglewood Fault located approximately 10 miles southwest of former MCAS El Toro.
Within salt dome formation, underground mine, or cave	Placement of noncontainerized or bulk liquid hazardous waste prohibited.	RCRA hazardous waste; placement.	Cal. Code Regs. tit. 22, § 66264.18(c)	Not an ARAR.	Based on geologic information, salt domes, mines, or caves do not exist at or in the vicinity of former MCAS El Toro.

Notes:
[a] Many potential action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables
[b] Only the substantive provisions of the requirements cited in this table are potential ARARs
[c] Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs.

Acronyms/Abbreviations:
ARAR – applicable or relevant and appropriate requirement
Cal. Fish & Game Code – *California Fish and Game Code*
CCC – California Coastal Commission
§ – section
Cal. Code Regs. – *California Code of Regulations*
Cal. Pub. Res. Code – *California Public Resources Code*
DON – Department of the Navy

Table H-4: Pot[illegible] State Location-Specific[a] ARARs for Remedial Action at AA 3

Location	Requirement	Prerequisite	Citation [b]	ARAR Determination	Comments
California Endangered Species Act (Cal. Fish & Game Code §§ 2050–2116)[b]					
Rare native plants	No person shall import, or take, possess, or sell, except as incident to the possession or sale of the real property on which the plant is growing, any native plant, or any part or product thereof, that is determined to the endangered native plant or rare native plant, except as otherwise provided in this Chapter 10 of the California Fish and Game Code.		Cal. Fish & Game Code § 1908	Not an ARAR	Rare native plants are not present onsite.
Endangered species habitat	No person shall import, export, take, possess, or sell any endangered or threatened species or part or product thereof.	Threatened or endangered species determination on or before 01 January 1985 or a candidate species with proper notification.	Cal. Fish & Game Code § 2080	Not an ARAR	California listed threatened or endangered species are not present onsite.
Fur-bearing, game, nongame, and protected mammals	Prohibits the use of steel-jawed leghold trap and provides that it is unlawful for any person, including an employee of the federal government, to use or authorize the use of such device to capture any game mammal, fur bearing mammal, nongame mammal, protected mammal, or any dog or cat. This prohibition does not apply in the extraordinary case where the use of such devise is the only method available to protect human health and safety.	Use of body gripping trap	Cal. Fish & Game Code § 3003.1	Not an ARAR.	The use of steel-jawed leghold trap for the capture of game, fur-bearing, nongame, and protected mammal, or any dog or cat is not planned as a part of remedial action at AA 3.
Birds or mammals	Prohibits the taking of birds and mammals, including the taking by poison.		Cal. Fish & Game Code §§ 3005	Relevant and appropriate	Proceduaral aspects are not ARARs. Certain substantive requirements pertaining to take of birds and mammals with poisonous substance are relevant and appropriate. The remedial action at AA 3 will prevent "take" of birds and mammals by containing contaminants of concern and severing the pathway of exposure to contaminated soil. .
Birds	Actions must be taken to avoid the take or destruction of the nest or eggs of any bird.		Cal. Fish and Game Code § 3503	Relevant and appropriate	Substantive requirements are potential ARARs if birds are identified at AA 3 during remedial action. Measures will be taken to avoid the take of birds or needless destruction of the nest or eggs during remedial action implementation.

Table H-4: Potential State Location-Specific[a] ARARs for Remedial Action at AA 3

Location	Requirement	Prerequisite	Citation [b]	ARAR Determination	Comments
Birds of prey	Actions must be taken to prevent take, possession, or destruction of any birds-of-prey or their eggs.		Cal. Fish and Game Code § 3503.5	Relevant and appropriate	Substantive requirements are potential ARARs if birds in the orders Falconiformes or Strigiformes (birds-of-prey) or their nest or egss are identified at AA 3 during remedial action. Measures will be taken to avoid the take of these birds during remedial action implementation.
Fully protected birds.	Actions must of be taken to prevent the taking of the following fully protected binds: 1) American peregrine falcon (2) Brown pelican (3) California black rail (4) California clapper rail (5) California condor (6) California least tern (7) Golden eagle (8) Greater sandhill crane (9) Light-footed clapper rail (10) Southern bald eagle (11) Trumpeter swan (12) White-tailed kite (13) Yuma clapper rail.		Cal. Fish & Game Code § 3511	Not an ARAR	The listed fully protected birds have not been identified on or adjacent to AA 3.
Nongame birds	Prohibits the take of nongame birds, except in accordance with regulations of the commission, or when related to mining operations with a mitigation plan approved by the California Department of Fish and Game.		Cal. Fish & Game Code § 3800	Relevant and appropriate	Substantive requirements are potential ARARs if nongame birds are identified at AA 3 during remedial action. Measures will be taken to avoid the take of nongame birds during remedial action implementation.
Fur-bearing mammals	Provides manners under which fur-bearing mammals may be taken.		Cal. Fish & Game Code § 4000 et seq.	Not an ARAR.	The scope of remedial action at AA 3 does not include take of fur-bearing mammals.
Nongame mammals	Actions must be taken to avoid the take or possession of nongame mammals.		Cal. Fish & Game Code § 4150	Relevant and appropriate	Substantive requirements are potential ARARs if nongame mammals are identified at AA 3 during remedial action. Measures will be taken to avoid the take of nongame birds during remedial action implementation.
Fully protected mammals	Actions must be taken to assure that the following fully protected mammals are not taken or possessed at any time: (1) Morro Bay kangaroo rat (2) Bighorn sheep except Nelson bighorn sheep (3) Northern elephant seal (4) Guadalupe fur seal (5) Ring-tailed cat (6) Pacific right whale (7) Salt-marsh harvest mouse (8) Southern sea otter (9) Wolverine.		Cal Fish & Game Code § 4700	Relevant and appropriate	Substantive requirements are potential ARARs if fully protected mammals are identified at AA 3 during remedial action. Measures will be taken to avoid the take of these mammals during remedial action implementation.

Table H-4: Pot State Location-Specific[a] ARARs for Remedial Action at AA 3

Location	Requirement	Prerequisite	Citation [b]	ARAR Determination	Comments
Bear	Prohibits take of any bear with firearm, trap, or bow and arrow without first procuring a license tag authorizing the taking of such bear. This section further provides that no iron or steel-jawed or any type of metal-jawed trap shall be used to take any bear.		Cal. Fish & Game Code § 4750	Not an ARAR.	Bear have not been identified on or adjacent to AA 3.
Secially-protected Mountain Lion	It is unlawful to take, injure, possess, transport, import, or sell any mountain lion or any part or product thereof.		Cal. Fish & Game Code §§ 4800	Not an ARAR.	Mountain lions have not been identified on or adjacent to AA 3.
Fully protected reptiles and amphibians	Actions must be taken to prevent the take or possession of the following fully protected reptiles and amphibians or parts thereof: Blunt-nosed leopard lizard (2) San Francisco garter snake (3) Santa Cruz long-toed salamander (4) Limestone salamander (5) Black toad.		Cal. Fish & Game Code §§ 5050	Not an ARAR	The listed reptiles and amphibians have not been identified at AA 3.
Aquatic habitat/species	Prohibits the passage of enumerated substances or materials into waters of the state deleterious to fish, plant life, or birds.		Cal. Fish & Game Code § 5650(a)	Relevant and Appropriate	The substantive requirements of the Cal. Fish and Game Code § 5650(a) are potential ARARs for remedial action at AA3.
Aquatic habitat/species	Discuss the conditions under which the requirements of Cal. Fish & Game Code § 5650 and affirmative defense to violation of the section do not apply.		Cal. Fish & Game Code §§ 5650 (b) and (f)	Not an ARAR	The requirements of the Cal. Fish & Game Code §§ 5650 (b) and (f) do not establish or contain substantive environmental "standards, requirements, criteria, or limitations" pertaining to actions of the DON at AA 3. Therefore, it does not meet the definition of an ARAR.
Native reptiles and amphibians	It is unlawful to capture, collect, intentionally kill or injure, possess, purchase, propagate, sell, transport, import, or export any native reptile or amphibian, or parts thereof unless under special permit from the department issued pursuant to Cal. Code Regs. tit. 14, §§ 650, 670.7, or 783 or as otherwise provided in the Fish and Game Code or these regulations.		Cal. Code Regs. tit. 14, § 40	Not an ARAR.	The scope of the remedial action at AA 3 does not include capture, collection, intentional killing or injury, possession, purchase, propagation, selling, transport, import, or export of any native reptile or amphibian.

Table H-4: Potential State Location-Specific[a] ARARs for Remedial Action at AA 3

Location	Requirement	Prerequisite	Citation [b]	ARAR Determination	Comments
Furbearing mammals	Fisher, marten, river otter, desert kit fox and red fox may not be taken at any time.	Furbearing mammals	Cal. Code Regs. tit. 14, § 460	Not an ARAR	The animals specified in the regulations have not been identified on or adjacent to AA 3.
Wetlands	Actions must be taken to assure that there is "no net loss" of wetlands acreage or habitat value. Action must be taken to preserve, protect, restore, and enhance California's wetland acreage and habitat values.		Fish and Game Commission Wetland Policy (adopted 1987) included in Fish and Game Code Addenda	Not an ARAR	In order for a state requirement to qualify as an ARAR under CERCLA, the requirement must be a state law or regulation and must be promulgated (of general applicability and legally enforceable). The Fish and Game Commission Wetland Policy is not a promulgated regulatory requirement; therefore, it does not constitute a potential ARAR for the remedial action at AA 3. The DON as further determined that Fish and Game Commission Wetland Policy is not a TBC requirement for AA 3 remedial action. Although CFGC Wetland Policy does not constitute potential ARAR or TBC for the remedial action at AA 3, measures will be taken to protect sensitive areas during potential response actions. In this context, it should be noted that no area within AA 3 meets all three federal criteria as a wetland. The head cut drainage way at the southeastern boundary meets the hydrology, but not the vegetation criterion. The soils criterion could not be evaluated due to the origin and texture of soils on the site.
California Coastal Act of 1976[b]					
Coast	Regulates activities associated with development to control direct significant impacts on coastal waters and to protect state and national interests in California coastal resources.	Any activity which could impact coastal waters and resources.	Cal. Pub. Res. Code §§ 30000–30900; Cal. Code Regs. tit. 14, §§ 13001–13666.4	Not an ARAR	The project sites are not in an area governed by this statute.
Cal-EPA/DTSC Advisories, Guidance, and Criteria[b]					
Hazardous substance release sites		Drilling, coring, sampling and logging at hazardous substance release sites.	Drilling, Coring, Sampling and Logging at Hazardous Substance Release Sites. Guidance Manual for Groundwater Investigations (Cal-EPA, July 1995)	Not an ARAR or to be considered (TBC) requirement	The guidance does not contain promulgated requirements; therefore, does not constitute an ARAR. The DON has determined that the cited document does not constitute a TBC guidance for AA 3 remedial action.

Table H-4: Pot State Location-Specific[a] ARARs for Remedial Action at AA 3

Location	Requirement	Prerequisite	Citation [b]	ARAR Determination	Comments
Hazardous substance release sites		Reporting hydrogeologic characterization data	Reporting Hydrogeologic Characterization Data at Hazardous Substance Release Sites. Guidance Manual for Groundwater Investigations (Cal-EPA, July 1995)	Not an ARAR or TBC requirement	The guidance does not contain promulgated requirements; therefore, does not constitute an ARAR. The DON has determined that the cited document does not constitute a TBC guidance for AA 3 remedial action.
Hazardous substance release sites		Conducting hydrogeologic characterization	Guidelines for Hydrogeologic Characterization of Hazardous Substance Release Sites, Volume 1 & 2 (Cal-EPA, July 1995)	Not an ARAR or TBC requirement	The guidance does not contain promulgated requirements; therefore, does not constitute an ARAR. The DON has determined that the cited document does not constitute a TBC guidance for AA 3 remedial action.
Hazardous waste sites		Conducting aquifer test	Aquifer Testing for Hydrogeologic Characterization. Guidance Manual for Groundwater Investigations (Cal-EPA, July 1995)	Not an ARAR or TBC requirement	The guidance does not contain promulgated requirements; therefore, does not constitute an ARAR. Additionally, aquifer test is not planned as a part of AA 3 remedial action.
Hazardous substance release sites		Conducting borehole geophysics	Application of Borehole Geophysics at Hazardous Substance Release Sites. Guidance Manual for Groundwater Investigations (Cal-EPA, July 1995)	Not an ARAR or TBC requirement	The guidance does not contain promulgated requirements; therefore, does not constitute an ARAR. The DON has determined that the cited document does not constitute a TBC guidance for AA 3 remedial action.
Hazardous substance release sites		Conducting groundwater modeling	Ground Water Modeling for Hydrogeologic Characterization. Guidance Manual for Groundwater Investigations (Cal-EPA, July 1995)	Not an ARAR or TBC requirement	The guidance does not contain promulgated requirements; therefore, does not constitute an ARAR. The DON has determined that the cited document does not constitute a TBC guidance for AA 3 remedial action.
Hazardous waste sites		Construction of monitoring wells	Monitoring Well Design and Construction for Hydrogeologic Characterization. Guidance Manual for Groundwater Investigations (Cal-EPA, July 1995)	Not an ARAR or TBC requirement	The guidance does not contain promulgated requirements; therefore, does not constitute an ARAR. The DON has determined that the cited document does not constitute a TBC guidance for AA 3 remedial action.

Table H-4: Potential State Location-Specific[a] ARARs for Remedial Action at AA 3

Location	Requirement	Prerequisite	Citation [b]	ARAR Determination	Comments
Sites potentially affected by VOCs		Conducting soil gas investigations	Advisory – Active Soil Gas Investigation (DTSC/CRWQCB-Los Angeles Region, January 2003)	Not an ARAR or TBC requirement	The guidance does not contain promulgated requirements; therefore, does not constitute an ARAR. The DON has determined that the cited document does not constitute a TBC guidance for AA 3 remedial action.
Hazardous waste sites		Groundwater monitoring	Representative Sampling of Ground Water for Hazardous Substances (Cal/EPA, July 1995)	Not an ARAR or TBC requirement	The guidance does not contain promulgated requirements; therefore, does not constitute an ARAR. The DON has determined that the cited document does not constitute a TBC guidance for AA 3 remedial action.
Hazardous waste sites accumulating hazardous wastes		Accumulation of hazardous waste	Accumulating Hazardous Waste at Generator Sites (Cal/EPA, July 1995)	Not an ARAR or TBC requirement	The guidance does not contain promulgated requirements; therefore, does not constitute an ARAR. If the hazardous wastes are generated during the remedial action, they will be accumulated in accordance with the regulations identified as potential ARARs in Table H-5

Notes:
[a] Many potential action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables
[b] Only the substantive provisions of the requirements cited in this table are potential ARARs
[c] Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs.

Acronyms/Abbreviations:
ARAR – applicable or relevant and appropriate requirement
Cal. Fish & Game Code – *California Fish and Game Code*
CCC – California Coastal Commission
§ – section
Cal. Code Regs. – *California Code of Regulations*
Cal. Pub. Res. Code – *California Public Resources Code*
DON – Department of the Navy

Table H-5: Federal Action-Specific ARARs for Remedial Action at AA 3

Alternative 1: No Action; Alternative 2: Limited Grading, Monitoring and Institutional Controls; Alternative 3: Containment, Monitoring and Institutional Controls; Four options for Alternative 3 include: Alternative 3a: Containment with Evapotranspiration Cover, Alternative 3b: Containment with Title 27 prescriptive Cap, Alternative 3c: Containment with Modified Title 27 prescriptive cap with Flexible Membrane Liner (FML), Alternative 3d: Containment with Modified Title 27 prescriptive cap with Geosynthetic Clay Liner (GCL); Alternative 4: Clean Closure and Groundwater Monitoring

Action/ Requirement	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
Resource Conservation and Recovery Act (42 U.S.C. §§ 6901–6991[i])*							
Onsite waste generation	Person who generates waste shall determine if that waste is a hazardous waste.	Generator of waste	Cal. Code Regs. tit. 22 § 66262.10(a), 66262.11	2, 3, 4			Applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities (e.g., soil cuttings from well installations) are hazardous will be made at the time the wastes are generated.
	Requirements for analyzing waste for determining whether waste is hazardous.	Generator of waste.	Cal. Code Regs. tit. 22, § 66264.13(a) and (b)	2, 3, 4			Applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities (e.g., soil cuttings from well installations) are hazardous will be made at the time the wastes are generated.
Identification number for the generator	A generator shall not treat, store, dispose of, transport, or offer for transportation, hazardous waste without having received an identification number.	Generator of waste.	Cal. Code Regs. tit. 22, § 66264.12				Not an ARAR. The requirement is procedural in nature; to constitute an ARAR a requirement must be substantive.
Use of a manifest	A generator of hazardous waste who transports or offers hazardous waste for transportation shall prepare a manifest.	Transportation of hazardous waste	Cal. Code Regs. tit. 22, §§ 66262.20, 66262.22				Not an ARAR. The requirements pertain to offsite actions and ARARs need to be identified only for onsite response actions. Offsite actions will need to comply with all applicable regulations.
Packaging, labeling, marking, placarding	Before transporting hazardous waste or offering hazardous waste for transportation off-site, the generator must do the following: package the waste, label and mark each package of hazardous waste, and ensure that the transport vehicle is correctly placarded.	Transporting hazardous waste	Cal. Code Regs. tit. 22, §§ 66262.30, 66262.31, 66262.32, 66262.33				Not an ARAR. The requirements pertain to offsite actions and ARARs need to be identified only for onsite response actions. Off site actions will need to comply with all the applicable regulations.
Hazardous waste accumulation	Onsite hazardous waste accumulation is allowed for up to 90 days as long as the waste is stored in containers in accordance with § 66262.171–178 or in tanks, on drip pads, inside buildings, and is labeled and dated, etc.	Accumulate hazardous waste	Cal. Code Regs. tit. 22 § 66262.34	2, 3, 4			Substantive requirements are potentially applicable for accumulation of waste for less than 90 days if the waste is hazardous waste and is stored on site. Wastes will not be stored on site for greater than 90 days.
Record-keeping and reporting	Establish requirements for recordkeeping of manifest, test results, waste analysis, and biennial report.	Generator of hazardous waste	Cal. Code Regs. tit. 22, §§ 66262.40, 66262.41				Not an ARAR. The requirements are procedural in nature; to constitute an ARAR a requirement must be substantive.

Table H-5: Federal Action-Specific ARARs for Remedial Action at AA 3

Alternative 1: No Action; Alternative 2: Limited Grading, Monitoring and Institutional Controls; Alternative 3: Containment, Monitoring and Institutional Controls; Four options for Alternative 3 include: Alternative 3a: Containment with Evapotranspiration Cover, Alternative 3b: Containment with Title 27 prescriptive Cap, Alternative 3c: Containment with Modified Title 27 prescriptive cap with Flexible Membrane Liner (FML), Alternative 3d: Containment with Modified Title 27 prescriptive cap with Geosynthetic Clay Liner (GCL); Alternative 4: Clean Closure and Groundwater Monitoring

Action/ Requirement	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
Management of hazardous waste at transfer and TSD facilities	Establish requirements for a hazardous waste treatment facility to have a plan for waste analysis, develop a security system, conduct regular inspections, provide training to facility personnel, and use a quality assurance program during construction.	Hazardous waste facilities	Cal. Code Regs. tit. 22, Div. 4.5, Ch. 14, Article 2				Only the selected regulations at Cal. Code Regs. tit. 22, Div. 4.5. Ch.14, Article 2 constitute potential ARARs for AA 3 remedial action. The specific provisions of Cal. Code Regs. tit. 22, Div. 4.5. Ch.14, Article 2 are evaluated as potential federal ARARs (in accordance with the rationale presented in Section 1.3.1) in this table and Section 4.
	Establish requirements for a facility to plan for emergency conditions. In addition, the design and operation of the facility must be done to prevent releases. Other requirements include testing and maintenance of equipment and incorporation of communication and alarm systems and contingency plan.	Hazardous waste facilities	Cal. Code Regs. tit. 22, Div. 4.5, Ch. 14, Articles 3 and 4				Not an ARAR. AA 3 does not constitute a hazardous waste facility. Based on the available information on the nature of the waste, large-scale hazardous waste operations are not expected as a part of AA 3 remedial action. Therefore, the requirements of Cal. Code Regs. tit. 22, Div. 4.5, Ch. 14, Articles 3 and 4 are not appropriate for remedial action at AA 3.
Use of tank systems	Establishes requirements for the use of tank systems for transferring, storing or treating hazardous waste.	Tank systems for transferring, storing, or treating hazardous waste.	Cal. Code Regs. tit. 22, Div. 4.5, Ch. 14, Article 10				Not an ARAR. Use of tank systems for treatment or storage of hazardous waste is not planned as a part of AA 3 remedial action. Any wastes requiring temporary storage would be stored in U.S. EPA-designated staging piles in compliance with the requirements of 40 C.F.R. § 264.554(d)(1)(i–ii) and (d)(2), (e), (f), (h), (i), (j), and (k).
Waste pile	Establishes requirements for storage or treatment of RCRA hazardous waste in a waste pile.	RCRA hazardous waste, noncontainerized accumulation of solid, nonflammable hazardous waste that is used for treatment or storage.	Cal. Code Regs. tit. 22, Div. 4.5, Ch. 14, Article 12				Not an ARAR. Any wastes requiring temporary storage during AA 3 remedial action would be stored in U.S. EPA-designated staging piles in compliance with the requirements of 40 C.F.R. § 264.554(d)(1)(i–ii) and (d)(2), (e), (f), (h), (i), (j), and (k).

Table H-5: Federal Action-Specific ARARs for Remedial Action at AA 3

Alternative 1: No Action; Alternative 2: Limited Grading, Monitoring and Institutional Controls; Alternative 3: Containment, Monitoring and Institutional Controls; Four options for Alternative 3 include: Alternative 3a: Containment with Evapotranspiration Cover, Alternative 3b: Containment with Title 27 prescriptive Cap, Alternative 3c: Containment with Modified Title 27 prescriptive cap with Flexible Membrane Liner (FML), Alternative 3d: Containment with Modified Title 27 prescriptive cap with Geosynthetic Clay Liner (GCL); Alternative 4: Clean Closure and Groundwater Monitoring

Action/ Requirement	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
Hazardous waste disposal	Establish design, operation, closure, and post-closure requirements for disposal of hazardous wastes in landfills.	Hazardous waste disposal in landfills.	Cal. Code Regs. tit. 22, Div. 4.5, Ch. 14, Article 14				Only the selected regulations at Cal. Code Regs. tit. 22, Div. 4.5. Ch.14, Article14 constitute potential ARARs for AA 3 remedial action. The specific landfill closure and post-closure requirements of Cal. Code Regs. tit. 22, Div. 4.5. Ch.14, Article 14 are evaluated as potential federal ARARs for capping action in accordance with the rationale presented in Section 1.3.1. The details of this evaluation are presented in Section 4.3.
Treatment in a miscellaneous unit	Establish requirements for design, operation, maintenance, and closure of units in which hazardous waste is treated.	Treatment of hazardous waste in a unit.	Cal. Code Regs. tit. 22, Div. 4.5, Ch. 14, Article 16				Not an ARAR. Miscellaneous units are not planned for treatment of hazardous waste as a part of AA 3 remedial action.
Land disposal restrictions for RCRA wastes and non-RCRA wastes	Movement of hazardous waste to new locations and placed in or on land will trigger LDR. General applicability, dilution prohibited, waste analysis and recordkeeping, and special rules apply for wastes that exhibit a characteristic waste.	Land disposal of hazardous wastes	Cal. Code Regs. tit. 22, Div. 4.5, Ch. 18, Articles 1, 3, 4, 10, 11				Only the selected regulations at Cal. Code Regs. tit. 22, Div. 4.5. Ch.18, Articles 1, 3, 4, 10, and 11 constitute potential ARARs for AA 3 remedial action. The specific provisions of Cal. Code Regs. tit. 22, Div. 4.5. Ch.18, Articles 1, 3, 4, 10, and 11 are evaluated as potential federal ARARs (in accordance with the rationale presented in Section 1.3.1) in this table and Section 4.
Site closure	Minimize the need for further maintenance controls and minimize or eliminate, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated rainfall or runoff, or waste decomposition products to groundwater or surface water or to the atmosphere.	Hazardous waste management facility	Cal. Code Regs. tit. 22 § 66264.111(a) and (b)		2, 3		Substantive requirements are potentially relevant and appropriate for closure determination for AA 3.
Clean Closure	During the partial and final closure periods, all contaminated equipment, structures and soils shall be properly disposed or decontaminated by removing all hazardous waste and residues.	Hazardous waste management facility	Cal. Code Regs. tit. 22, § 66264.114		4		Substantive requirements are potentially relevant and appropriate for alternative including clean closure.

Table H-5: Federal Action-Specific ARARs for Remedial Action at AA 3

Alternative 1: No Action; Alternative 2: Limited Grading, Monitoring and Institutional Controls; Alternative 3: Containment, Monitoring and Institutional Controls; Four options for Alternative 3 include: Alternative 3a: Containment with Evapotranspiration Cover, Alternative 3b: Containment with Title 27 prescriptive Cap, Alternative 3c: Containment with Modified Title 27 prescriptive cap with Flexible Membrane Liner (FML), Alternative 3d: Containment with Modified Title 27 prescriptive cap with Geosynthetic Clay Liner (GCL); Alternative 4: Clean Closure and Groundwater Monitoring

Action/ Requirement	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
Container storage	Containers of RCRA hazardous waste must be - maintained in good condition, - compatible with hazardous waste to be stored, and - closed during storage except to add or remove waste.	Storage of RCRA hazardous waste not meeting small-quantity generator criteria before treatment, disposal, or storage elsewhere, in a container.	Cal. Code Regs. tit. 22 § 66264.171, .172, .173		2, 3, 4		Substantive requirements are potentially relevant and appropriate for accumulation of waste for less than 90 days if the waste is hazardous waste and is stored on site. Wastes will not be stored on site for greater than 90 days.
	Inspect container storage areas weekly for deterioration.		Cal. Code Regs. tit. 22 § 66264.174		2, 3, 4		Substantive requirements for inspection of container storage areas are potentially relevant and appropriate if the wastes are determined to be hazardous and are stored on site for less than 90 days.
	Place containers on a sloped, crack-free base, and protect from contact with accumulated liquid. Provide containment system with a capacity of 10 percent of the volume of containers of free liquids. Remove spilled or leaked waste in a timely manner to prevent overflow of the containment system.	Storage in a container of RCRA hazardous waste not meeting small-quantity generator criteria before treatment, disposal, or storage elsewhere.	Cal. Code Regs. tit. 22 § 66264.175(a) and (b)		2, 3, 4		Substantive requirements are potentially relevant and appropriate for accumulation of waste for less than 90 days if the waste is hazardous waste and is stored on site. Wastes will not be stored on site for greater than 90 days.
	At closure, remove all hazardous waste and residues from the containment system, and decontaminate or remove all containers and liners.		Cal. Code Regs. tit. 22 § 66264.178		2, 3, 4		Substantive requirements are potentially relevant and appropriate for accumulation of waste for less than 90 days if the waste is hazardous waste and is stored on site. Wastes will not be stored on site for greater than 90 days.
Placement of waste in land disposal units	Movement of excavated materials to new location and placement in or on land will trigger land disposal restrictions for the excavated waste or closure requirements for the unit in which the waste is being placed.	Materials containing RCRA hazardous wastes subject to land disposal restrictions are placed in another unit.	Cal. Code Regs. tit. 22, § 66268.40				Not an ARAR. While solid wastes may be excavated for consolidation purposes, no "placement" of waste to new location outside the area of contamination will occur.
	Treatment of waste subject to ban on land disposal must attain levels achievable by BDAT for each hazardous constituent in each listed waste, if residual is to be land disposed.	Placement of RCRA hazardous waste in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, or underground mine or cave.	Cal. Code Regs. tit. 22, § 66268.42				Not an ARAR. While solid wastes may be excavated for consolidation purposes, no "placement" of waste to new location outside the area of contamination will occur.

Table H-5: Federal Action-Specific ARARs for Remedial Action at AA 3

Alternative 1: No Action; Alternative 2: Limited Grading, Monitoring and Institutional Controls; Alternative 3: Containment, Monitoring and Institutional Controls; Four options for Alternative 3 include: Alternative 3a: Containment with Evapotranspiration Cover, Alternative 3b: Containment with Title 27 prescriptive Cap, Alternative 3c: Containment with Modified Title 27 prescriptive cap with Flexible Membrane Liner (FML), Alternative 3d: Containment with Modified Title 27 prescriptive cap with Geosynthetic Clay Liner (GCL); Alternative 4: Clean Closure and Groundwater Monitoring

Action/ Requirement	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
Clean Closure	Remove or decontaminate all waste residues, contaminated containment system components (liners, etc.), contaminated sub-soils, and structures and equipment contaminated with waste and leachate, and manage them as hazardous waste. If waste is left on site, closure and postclosure care requirements are necessary.	Surface impoundments, container or tank liners, and hazardous waste residues or contaminated soil (including soil from dredging or soil disturbed in the course of drilling or excavation) returned to land. Not applicable to material treated, stored, or disposed only before the effective date of the requirements, or if treated *in situ* or consolidated within the area of contamination.	Cal. Code Regs. tit. 22, § 66264.228(a), (b), (e)–(k), (m), and (o)–(q) except as it cross-references procedural requirements such as closure plans and annual reports.				Not an ARAR. No land-based disposal units are planned for waste management.
Waste pile	Use a single liner and leachate collection system. Waste put into waste pile is subject to land ban regulations.	RCRA hazardous waste, non-containerized accumulation of solid, nonflammable hazardous waste that is used for treatment or storage.	Cal. Code Regs. tit. 22, § 66264.251 (except 251[j], 251[e][11])				Not an ARAR. Wastes are not planned to be managed in waste piles as part of this remedial action
	Alternative requirements that are protective of human health or the environment may replace design, operating, or closure standards for temporary tanks and container storage areas.		Cal. Code Regs. tit. 22, § 66264.553(b), (d), (e), and (f)				Not an ARAR. Wastes are not planned to be managed in waste piles as part of this remedial action
	Allows generators to accumulate solid remediation waste in a U.S. EPA-designated pile for storage only, up to 2 years, during remedial operations without triggering LDRs.	Hazardous remediation waste temporarily stored in piles.	40 C.F.R. § 264.554(d)(1)(i–ii) and (d)(2), (e), (f), (h), (i), (j), and (k)	4			Substantive provisions are potentially applicable for temporary storage of excavated debris, if the debris exhibits the characteristics of the RCRA hazardous waste.

Table H-5: Federal Action-Specific ARARs for Remedial Action at AA 3

Alternative 1: No Action; Alternative 2: Limited Grading, Monitoring and Institutional Controls; Alternative 3: Containment, Monitoring and Institutional Controls; Four options for Alternative 3 include: Alternative 3a: Containment with Evapotranspiration Cover, Alternative 3b: Containment with Title 27 prescriptive Cap, Alternative 3c: Containment with Modified Title 27 prescriptive cap with Flexible Membrane Liner (FML), Alternative 3d: Containment with Modified Title 27 prescriptive cap with Geosynthetic Clay Liner (GCL); Alternative 4: Clean Closure and Groundwater Monitoring

Action/ Requirement	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
Waste pile (continued)	Prevent run-on and control and collect runoff from a 24-hour 25-year storm (waste piles, land treatment facilities, landfills). Prevent overtopping of surface impoundments.	RCRA hazardous waste treated, stored, or disposed after the effective date of the requirements.	Cal. Code Regs. tit. 22, § 66264.221(c), (e), (h); § 66264.251(c), (d), (f), (g), (h), (k); § 66264.273(c), (d), (j)(1); § 66264.301(c), (d), (f), (g)				Not an ARAR. Wastes are not planned to be managed in waste piles as part of this remedial action
Closure of waste pile	At closure, owner shall remove or decontaminate all waste residues, contaminated containment system components, contaminated subsoils, and structures and equipment contaminated with waste and leachate, and manage them as hazardous waste. If waste is left on-site, perform postclosure care in accordance with the closure and postclosure care requirements that apply to landfills.	Waste pile used to store hazardous waste.	Cal. Code Regs. tit. 22, § 66264.258(a) and (b) except references to procedural requirements				Not an ARAR. Wastes are not planned to be managed in waste piles as part of this remedial action
Location of the landfill	A map must be prepared showing the exact location and dimensions, including depth, of each cell with respect to permanently surveyed benchmarks with horizontal and vertical controls.	Disposal of hazardous waste in landfills except as provided in Cal. Code Regs. tit. 22, § 66264.1	Cal. Code Regs. tit. 22, § 66264.309(a)		2, 3		The substantive requirements are potential ARARs for surveying of the closed landfills to show topography.

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Action/ Requirement	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
Postclosure care pertaining to infiltration of water	The final cover shall be designed to prevent the downward entry of water into the closed landfill throughout a period of at least 100 years.	Disposal of hazardous waste in landfills except as provided in Cal. Code Regs. tit. 22, § 66264.1	Cal. Code Regs. tit. 22, § 66264.310(a)(1)				Not an ARAR. A requirement must be both relevant and appropriate to constitute an ARAR for a CERCLA site. If the requirement is relevant but not appropriate, such a requirement need not be complied with. The federal provisions at Cal. Code Regs. tit. 22 § 66264.310 (a)(1) were determined to be relevant but not appropriate, and therefore determined not to be ARARs for AA 3 remedial action. The cited requirements are not appropriate since the primarily construction debris is buried at AA 3 and the analysis of soil samples indicated absence of significant contamination. Therefore, very low risk of mobility of the contaminants due to infiltration of water exists at AA 3.
Postclosure care	Maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events throughout the postclosure period.	Disposal of hazardous waste in landfills except as provided in Cal. Code Regs. tit. 22, § 66264.1	Cal. Code Regs. tit. 22, § 66264.310(b)(1)		2, 3		Substantive requirements are potentially relevant and appropriate for postclosure care of landfill covers.
Erosion control	Prevent run-on and runoff from eroding or otherwise damaging the final cover throughout the postclosure period.	Disposal of hazardous waste in landfills except as provided in Cal. Code Regs. tit. 22, § 66264.1	Cal. Code Regs. tit. 22, § 66264.310(b)(4)				Not an ARAR. The equivalent state requirements at Cal. Code Regs. tit. 27 § 21090 (c) (4) are more stringent (see Table H-7)
Benchmark maintenance	Protect and maintain surveyed benchmarks throughout the postclosure period.	Disposal of hazardous waste in landfills except as provided in Cal. Code Regs. tit. 22, § 66264.1	Cal. Code Regs. tit. 22, § 66264.310(b)(5)		2, 3		Substantive requirements are potentially relevant and appropriate for surveying the final cover.
Seismic requirements for landfill cover	The final cover shall accommodate lateral and vertical shear forces generated by the maximum credible earthquake so that the integrity of the cover is maintained.	Disposal of hazardous waste in landfills except as provided in Cal. Code Regs. tit. 22, § 66264.1	Cal. Code Regs. tit. 22, § 66264.310(a)(5)				Not an ARAR. The requirements are relevant but not appropriate (see Section 4.3.2.1 for details).
Vegetation layer of landfill cap	A layer of topsoil shall be provided thick enough to support vegetation for erosion control and deep enough to prevent root penetration into the filter layer.	Surface impoundments to treat, store, or dispose of hazardous waste except as provided in Cal. Code Regs. tit. 22, § 66264.1	Cal. Code Regs. tit. 22, § 66264.228 (e)(12)				Not an ARAR. The equivalent state requirements at Cal. Code Regs. tit. 27 § 21090 (a) (3) are more stringent (see Table H-7).

Table H-5: Federal Action-Specific ARARs for Remedial Action at AA 3

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Action/ Requirement	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
	The owner or operator shall provide a water drainage layer, blanket or channel above the compacted barrier layer of the final cover to provide a path for water to exit rapidly. The owner or operator shall provide a filter layer above the water drainage layer to prevent soils from clogging the drainage layer.	Surface impoundments to treat, store, or dispose of hazardous waste except as provided in Cal. Code Regs. tit. 22, § 66264.1	Cal. Code Regs. tit. 22, § 66264.228 (e)(10) and (e)(11)				Not an ARAR. The equivalent state requirements at Cal. Code Regs. tit. 27 § 21090 (a) (3) are more stringent (see Table H-7).
Foundation layer of landfill cap	A foundation layer shall be provided for the compacted barrier layer of the final cover. If needed, the foundation layer shall contain herbicide sufficient to prevent vegetative growth, and shall be free of decomposable organic matter. The layer shall be compacted at a moisture content sufficient to achieve the density required to provide adequate support for the nonearthen membrane.	Surface impoundments to treat, store, or dispose of hazardous waste except as provided in Cal. Code Regs. tit. 22, § 66264.1	Cal. Code Regs. tit. 22, § 66264.228(e)(4)				Not an ARAR. The equivalent state requirements at Cal. Code Regs. tit. 27 § 21090 (a) (1) are more stringent (see Table H-7).
Barrier Layer of landfill cap	A compacted barrier layer of clean earth shall be provided above the foundation layer, and shall be provided around the unit to a depth as low as the level at which the owner or operator has deposited waste, to prevent lateral migration of waste and gas and vapor from the waste. The layer of earth shall be wholly below the average depth of frost penetration, and shall be compacted at a moisture content sufficient to achieve a percent compaction that has been demonstrated, with the specific cover material to be used, to prevent the downward entry of water into the foundation layer for a period of at least 100 years. The owner or operator may use nonearthen materials for the barrier layer provided it is demonstrated to the satisfaction of the department that a barrier layer of alternative composition will equally impede movement of fluid and be as durable as a compacted earthen barrier.	Surface impoundments to treat, store, or dispose of hazardous waste except as provided in Cal. Code Regs. tit. 22, § 66264.1	Cal. Code Regs. tit. 22, § 66264.228 (e)(5) and (e) (7)				Not an ARAR. The equivalent state requirements at Cal. Code Regs. tit. 27 § 21090 (a) (2) are more stringent (see Table H-7).
Permeability requirements	Before installing the compacted layer of the final cover, the owner or operator shall accurately establish the correlation between the desired permeability and the density at which that permeability is achieved.	Surface impoundments to treat, store, or dispose of hazardous waste except as provided in Cal. Code Regs. tit. 22, § 66264.1	Cal. Code Regs. tit. 22, § 66264.228(f)		3b		The substantive requirements are potentially applicable for the alternative involving construction of a clay barrier layer.

Table H-5: Federal Action-Specific ARARs for Remedial Action at AA 3

Alternative 1: No Action; Alternative 2: Limited Grading, Monitoring and Institutional Controls; Alternative 3: Containment, Monitoring and Institutional Controls; Four options for Alternative 3 include: Alternative 3a: Containment with Evapotranspiration Cover, Alternative 3b: Containment with Title 27 prescriptive Cap, Alternative 3c: Containment with Modified Title 27 prescriptive cap with Flexible Membrane Liner (FML), Alternative 3d: Containment with Modified Title 27 prescriptive cap with Geosynthetic Clay Liner (GCL); Alternative 4: Clean Closure and Groundwater Monitoring

Action/ Requirement	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
Use of equipment that contacts hazardous waste with organic concentrations greater than 10 percent by weight	Air emission standards for process vents or equipment leaks.	Equipment that contains or contacts hazardous waste with organic concentrations of at least 10 percent by weight or process vents associated with specified operations that manage hazardous wastes with organic concentrations of at least 10 ppm_w.	Cal. Code Regs. tit. 22, § 66264.1030–1034 (excluding 1030[c], 1033[j], 1034[c][2], 1034[d][2]); 66264.1050–1063 (excluding 1050[c], 1050[d], 1057[g][2], 1061[d], 1063[d][3])				Not an ARAR Organic contaminant concentrations in groundwater are less than 10 percent by weight.
Monitoring	Owners/operators of RCRA surface impoundment, waste pile, land treatment unit, or landfill shall conduct a monitoring and response program for each regulated unit.	Surface impoundment, waste pile, land treatment unit, or landfill for which constituents in or derived from waste in the unit may pose a threat to human health or the environment.	Cal. Code Regs. tit. 22, § 66264.91(a)(1), except as it cross-references permit requirements		2, 3, 4		Substantive requirements for detection monitoring program at Cal. Code Regs. tit. 22, § 66264.91(a)(1) are relevant and appropriate.
Point of compliance	The POC is a vertical surface, located at the hydraulically downgradient limit of the waste management area that extends through the uppermost aquifer underlying the regulated unit	Hazardous waste treatment, storage, or disposal facility.	Cal. Code Regs. tit. 22, § 66264.95(a) and (b)		2, 3, 4		Substantive requirements are potentially relevant and appropriate for all alternatives including groundwater monitoring.
Monitoring	Requirements for monitoring groundwater.	Hazardous waste treatment, storage, or disposal facility.	Cal. Code Regs. tit. 22, § 66264.97 (b)(1)(A), (b)(1)(B), (b)(4-7), (e)(6), (12)(A) and (B), (13), and (15)		2, 3, 4		Substantive requirements are potentially relevant and appropriate for detection monitoring program.

Table H-5: Federal Action-Specific ARARs for Remedial Action at AA 3

Alternative 1: No Action; Alternative 2: Limited Grading, Monitoring and Institutional Controls; Alternative 3: Containment, Monitoring and Institutional Controls; Four options for Alternative 3 include: Alternative 3a: Containment with Evapotranspiration Cover, Alternative 3b: Containment with Title 27 prescriptive Cap, Alternative 3c: Containment with Modified Title 27 prescriptive cap with Flexible Membrane Liner (FML), Alternative 3d: Containment with Modified Title 27 prescriptive cap with Geosynthetic Clay Liner (GCL); Alternative 4: Clean Closure and Groundwater Monitoring

Action/ Requirement	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
Monitoring (continued)	Requirements for monitoring surface water.	Hazardous waste treatment, storage, or disposal facility.	Cal. Code Regs. tit. 22, § 66264.97 (c),				Not an ARAR. In the northeastern portion of AA 3 where surface water stream is in close proximity to the buried debris, approximately 4 feet of soil cover separates surface water from the underlying debris. The surface water sampling conducted during the RSE investigation indicated that AA 3 does not impact surface water in the Aqua Chinon Wash. In addition, as a part of the design, drainage improvements are planned to further separate surface water from the buried debris, which is expected to eliminate the potential for surface water to be impacted by the release from AA 3.
	Requirements for monitoring vadose zone.	Hazardous waste treatment, storage, or disposal facility.	Cal. Code Regs. tit. 22, § 66264.97 (d)				Not an ARAR. The instruments such as lysimeters generally used for unsaturated zone monitoring cannot be used at AA 3 based on the practical considerations such as thickness and depth the buried debris and its close proximity to the water table.
	General monitoring requirements including requirement for certification of monitoring system by registered geologist, preparation of boring logs, and content of a water quality monitoring program.	Hazardous waste treatment, storage, or disposal facility.	Cal. Code Regs. tit. 22, § 66264.97 (e)(1) through e(5)				Not an ARAR. The requirements are procedural in nature; to constitute an ARAR a requirement must be substantive.
	Requirements for a detection monitoring program.	Hazardous waste treatment, storage, or disposal facility.	Cal. Code Regs. tit. 22, § 66264.98(e)(1-5), (i), (j), (k)(1-3), (4)(A) and (D),(5), (7)(C) and (D)		2, 3, 4		Substantive requirements are potentially relevant and appropriate for detection monitoring program.
	Requirements for an evaluation monitoring program.	Hazardous waste treatment, storage, or disposal facility.	Cal. Code Regs. tit. 22, § 66264.99(b), (e)(1)–(6), (f)(3), and (g)				Not an ARAR. No conclusive evidence of release to groundwater exists at the point of compliance established for AA 3. Therefore, no evaluation monitoring is planned for groundwater remediation at AA 3 (see Section 2.1.1).

Table H-5: Federal Action-Specific ARARs for Remedial Action at AA 3

Alternative 1: No Action; Alternative 2: Limited Grading, Monitoring and Institutional Controls; Alternative 3: Containment, Monitoring and Institutional Controls; Four options for Alternative 3 include: Alternative 3a: Containment with Evapotranspiration Cover, Alternative 3b: Containment with Title 27 prescriptive Cap, Alternative 3c: Containment with Modified Title 27 prescriptive cap with Flexible Membrane Liner (FML), Alternative 3d: Containment with Modified Title 27 prescriptive cap with Geosynthetic Clay Liner (GCL); Alternative 4: Clean Closure and Groundwater Monitoring

Action/ Requirement	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
Corrective action	An owner or operator required pursuant to section 66264.91 to establish a corrective action program for a regulated unit shall, at a minimum, comply with the requirements of this section for that unit.	Hazardous waste treatment, storage, or disposal facility.	Cal. Code Regs. tit. 22, § 66264.100(a)				Not an ARAR. No conclusive evidence of release to groundwater exists at the point of compliance established for AA 3. Therefore, no corrective action is planned for groundwater remediation at AA 3 (see Section 2.1.1). However, groundwater monitoring will be conducted at AA 3 pursuant to the requirements of detection monitoring program identified in Section 4.5.1.1.
	The owner or operator required to take corrective action under Cal. Code Regs. tit. 22, § 66264.91 shall take corrective action to remediate releases from the regulated unit and to ensure that the regulated unit achieves compliance with the water quality protection standard.	Hazardous waste treatment, storage, or disposal facility.	Cal. Code Regs. tit. 22, § 66264.100(b)				Not an ARAR. No conclusive evidence of release to groundwater exists at the point of compliance established for AA 3. Therefore, no corrective action is planned for groundwater remediation at AA 3 (see Section 2.1.1). However, groundwater monitoring will be conducted at AA 3 pursuant to the requirements of detection monitoring program identified in Section 4.5.1.1.
	The owner or operator shall implement corrective action measures that ensure that constituents of concern achieve their respective concentration limits at all monitoring points and throughout the zone affected by the release, including any portions of the affected zone that extend beyond the facility boundary, by removing the waste constituents or treating them in place. The owner or operator shall take other action to prevent noncompliance due to a continued or subsequent release including, but not limited to, source control.	Hazardous waste treatment, storage, or disposal facility.	Cal. Code Regs. tit. 22, § 66264.100(c)				Not an ARAR. No conclusive evidence of release to groundwater exists at the point of compliance established for AA 3. Therefore, no corrective action is planned for groundwater remediation at AA 3 (see Section 2.1.1). However, groundwater monitoring will be conducted at AA 3 pursuant to the requirements of detection monitoring program identified in Section 4.5.1.1.
	The owner or operator shall establish and implement, in conjunction with the corrective action measures, a water quality monitoring program that will demonstrate the effectiveness of the corrective action program and be effective in determining compliance with the water quality protection standard and in determining the success of the corrective action measures under subsection (c) of this section.	Hazardous waste treatment, storage, or disposal facility.	Cal. Code Regs. tit. 22, § 66264.100(d)				Not an ARAR. No conclusive evidence of release to groundwater exists at the point of compliance established for AA 3. Therefore, no corrective action is planned for groundwater remediation at AA 3 (see Section 2.1.1). However, groundwater monitoring will be conducted at AA 3 pursuant to the requirements of detection monitoring program identified in Section 4.5.1.1.

Table H-5: Federal Action-Specific ARARs for Remedial Action at AA 3

Alternative 1: No Action; Alternative 2: Limited Grading, Monitoring and Institutional Controls; Alternative 3: Containment, Monitoring and Institutional Controls; Four options for Alternative 3 include: Alternative 3a: Containment with Evapotranspiration Cover, Alternative 3b: Containment with Title 27 prescriptive Cap, Alternative 3c: Containment with Modified Title 27 prescriptive cap with Flexible Membrane Liner (FML), Alternative 3d: Containment with Modified Title 27 prescriptive cap with Geosynthetic Clay Liner (GCL); Alternative 4: Clean Closure and Groundwater Monitoring

Action/ Requirement	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
Completion of response action	The corrective action program is complete when compliance with the water quality standard is demonstrated based on the results of sampling and analysis for all constituents of concern for a period of 1 year.	Hazardous waste treatment, storage, or disposal facility.	Cal. Code Regs. tit. 22, § 66264.100(g)(1)				Not an ARAR. No conclusive evidence of release to groundwater exists at the point of compliance established for AA 3. Therefore, no corrective action is planned for groundwater remediation at AA 3 (see Section 2.1.1). However, groundwater monitoring will be conducted at AA 3 pursuant to the requirements of detection monitoring program identified in Section 4.5.1.1.
	Establishes requirements for reporting the effectiveness of the corrective action program.	Hazardous waste treatment, storage, or disposal facility.	Cal. Code Regs. tit. 22, § 66264.100(h)				Not an ARAR. The requirements are procedural in nature; to constitute an ARAR a requirement must be substantive.
Solid Waste Management Unit/Permitted Hazardous Waste Management Unit	Media impacted by RCRA hazardous waste must be considered for corrective action regardless of the date of original impact.	Hazardous waste transfer, treatment, storage, or disposal facility.	Cal. Code Regs. tit. 22, § 66264.101(a)				Not an ARAR. No onsite waste management unit for transfer, treatment, storage, or disposal of hazardous waste is planned as a part of AA 3 remedial action.
	Establishes requirements for specifying the corrective action in a permit or order containing schedules of compliance for corrective action and assurances of financial responsibility for completing such corrective action.	Consolidated hazardous waste.	Cal. Code Regs. tit. 22, § 66264.101(b)				Not an ARAR. The requirements are procedural in nature; to constitute an ARAR a requirement must be substantive.
	Corrective action, where appropriate, must be performed not only at the facility, but also beyond the facility boundary.	Consolidated hazardous waste.	Cal. Code Regs. tit. 22, § 66264.101(c)				Not an ARAR. No onsite waste management unit for transfer, treatment, storage, or disposal of hazardous waste is planned as a part of AA 3 remedial action.
Corrective Action Management Unit	Establishes requirements including maintenance of a written closure plan and content of the plan for a hazardous waste management facility	Hazardous waste management facility.	Cal. Code Regs. tit. 22, § 66264.112				Not an ARAR. The requirements are procedural in nature; to constitute an ARAR a requirement must be substantive.
	Establishes requirements for submission of a certification that the hazardous waste management unit or facility, has been closed in accordance with the specifications in the approved closure plan.	Hazardous waste management facility	Cal. Code Regs. tit. 22, § 66264.115				Not an ARAR. The requirements are procedural in nature; to constitute an ARAR a requirement must be substantive.

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Action/ Requirement	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
Corrective Action Management Unit (continued)	Establishes requirements for submission of a survey plat indicating the location and dimensions of landfill cells or other hazardous waste disposal units with respect to permanently surveyed vertical and horizontal benchmarks.	Hazardous waste management facility	Cal. Code Regs. tit. 22, § 66264.116		2, 3, 4		The requirements for submission of a survey plat are procedural in nature and do not constitute ARARs. Substantive requirements pertaining for preparation of a survey plat indicating location and dimensions of landfill cells are relevant and appropriate.
Postclosure care and use of the property	Postclosure care shall be begin after completion of closure and continue for approximately 30 years, based on protectiveness to human health and the environment.	Hazardous waste management facility where hazardous wastes, waste residues, contaminated materials and contaminated soils will not be removed during closure.	Cal. Code Regs. tit. 22, § 66264.117(b)(1) and (2)				Not an ARAR. The equivalent state requirements at Cal. Code Regs. tit. 27 §§ 20950(a) and 21180(a) are more stringent (see Table H-7).
	Continue security requirements specified in §66264.14, which require 24-hour surveillance, a barrier surrounding entire facility, entry control, and placarding if hazardous waste remains exposed after final closure or if access by public or livestock may pose a threat to human health.	Hazardous waste management facility where hazardous wastes, waste residues, contaminated materials and contaminated soils will not be removed during closure.	Cal. Code Regs. tit. 22, § 66264.117(c)				Not an ARAR. The equivalent state requirements at Cal. Code Regs. tit. 27 §§ 21135 (f) and (g) are more stringent (see Table H-7).
	Postclosure use of the property shall never be allowed to disturb the integrity of the final cover and any other components of the containment system unless such disturbance will not increase the potential hazard or is necessary to reduce threat to human health or the environment.	Hazardous waste management facility where hazardous wastes, waste residues, contaminated materials and contaminated soils will not be removed during closure.	Cal. Code Regs. tit. 22, § 66264.117(d)		2, 3, 4		Institutional controls would be implemented for the alternatives in which the waste will be left in place to maintain the integrity of the cover at AA 3.
	Postclosure care activities shall be in accordance with the provisions of an approved postclosure plan as specified in § 66264.118. Construction, filling, grading, excavating, or mining shall require issuance of a variance by the Department.	Hazardous waste management facility where hazardous wastes, waste residues, contaminated materials and contaminated soils will not be removed during closure.	Cal. Code Regs. tit. 22, § 66264.117(e) and (f)				Not an ARAR. The requirements are procedural in nature; to constitute an ARAR a requirement must be substantive.
	Establishes requirements including having a postclosure plan and content for the plan for a hazardous waste disposal unit.	Hazardous waste disposal unit	Cal. Code Regs. tit. 22, § 66264.118				Not an ARAR. The requirements are procedural in nature; to constitute an ARAR a requirement must be substantive.
	Establishes requirements for submission of a record of the type, location, and quantity of hazardous wastes disposed of within each cell or area of the facility following certification of closure.	Hazardous waste disposal unit	Cal. Code Regs. tit. 22, § 66264.119				Not an ARAR. The requirements are procedural in nature; to constitute an ARAR a requirement must be substantive.

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Action/ Requirement	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
Postclosure care and use of the property (continued)	Establishes requirements for submission of a certification that the post-closure care period for the hazardous waste disposal unit was performed in accordance with the specifications in the approved post-closure plan following completion of a post-closure care period.	Hazardous waste disposal unit	Cal. Code Regs. tit. 22, § 66264.120				Not an ARAR. The requirements are procedural in nature; to constitute an ARAR a requirement must be substantive.
South Coast Air Quality Management District (SCAQMD)*							
Air emission	Prohibits building, erection, installation, alteration, or replacement of any equipment or agricultural permit unit, the use of which may cause the issuance of air contaminants or the use of which may eliminate, reduce or control the issuance of air contaminants without first obtaining written authorization for such construction from the Executive Officer. A permit to construct shall remain in effect until the permit to operate the equipment or agricultural permit unit for which the application was filed is granted or denied, or the application is canceled.		SCAQMD Rule 201				Not an ARAR. In accordance with CERCLA Section 121 (e)(1) (42 U.S.C. § 9621[e]) and the NCP at 40 C.F.R. § 300.400(e)(1), no federal, state, or local permits are required for on-site response actions conducted pursuant to CERCLA.
	Prohibits operation or use of any equipment or agricultural permit unit, the use of which may cause the issuance of air contaminants, or the use of which may reduce or control the issuance of air contaminants, without first obtaining a written permit to operate from the Executive Officer or except as provided in Rule 202. Prohibits operation of equipment or agricultural permit unit contrary to the conditions specified in the permit to operate.		SCAQMD Rule 203				Not an ARAR. In accordance with CERCLA Section 121 (e)(1) (42 U.S.C. § 9621[e]) and the NCP at 40 C.F.R. § 300.400(e)(1), no federal, state, or local permits are required for on-site response actions conducted pursuant to CERCLA.
	Prohibits emissions of fugitive dust such that the presence of such dust remains visible in the atmosphere beyond the property line of the emission source and shall not cause or allow PM_{10} levels to exceed 50 micrograms per cubic meter when determined, by simultaneous sampling, as the difference between upwind and downwind samples		SCAQMD Rule 403	2, 3, 4			Fugitive dust emissions of particulate matter are expected from the excavation, grading, and earth-moving activities. Measures such as applying water to minimize fugitive dust emissions may be required.
	Limits equipment from discharging particulate emissions in excess of 0.01 to 0.196 grain per cubic foot based on a given volumetric (dry standard cubic feet per minute) exhaust gas flow rate averaged over one hour or on cycle of operation. It excludes steam generators or gas turbines.		SCAQMD Rule 404	2, 3, 4			The equipment used will comply with substantive requirements of this rule.

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Action/ Requirement	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
	Limits equipment from discharging particulate emissions in excess of 0.99 to 30 pounds per hour based on a given process weight.		SCAQMD Rule 405	2, 3, 4			The equipment used will comply with substantive requirements of this rule.
Air emission (continued)	Limits equipment from discharging carbon monoxide emissions in excess of 2000 ppm and sulfur dioxide emissions of 500 ppm or greater averaged over 15 minutes. It excludes stationary internal combustion engines, propulsion of mobile equipment or emergency venting.		SCAQMD Rule 407				Not an ARAR. Not pertinent to remedial action.
	Limits the emissions of particulate matter from the exhaust of a combustion source (such as a gas turbine) to 0.23 grams per cubic meter (0.1 grains per standard cubic foot) at 12 percent carbon dioxide averaged over 15 minutes. It excludes internal combustion engines.		SCAQMD Rule 409				Not an ARAR. Not pertinent to remedial action.
	Limits concentration of oxides of nitrogen (as nitrogen dioxide) averaged over 15 minutes, from any non-mobile fuel burning equipment, to a range of 125 to 300 ppm for gaseous fuels and 225 to 400 ppm for solid and liquid fuels depending on equipment size.		SCAQMD Rule 474				Not an ARAR. Not pertinent to remedial action.
	Establishes design and operational requirements for landfill gas collection and control systems for active and inactive municipal solid waste landfills. Also establishes landfill gas sampling and monitoring requirements.	Active or inactive municipal solid waste landfill	SCAQMD Rule 1150.1		2, 3, 4		AA 3 is not an active or inactive municipal solid waste landfill, therefore the requirements of SCAQMD Rule 1150.1 are not applicable. However, since AA 3 is a former military landfill, substantive provisions of SCAQMD Rule 1150.1 are relevant and appropriate for the landfill gas collection, control and monitoring systems to be installed at AA 3. The landfill gas collection and control system, and landfill gas monitoring network at AA 3 will be designed and operated based on an agreement between FFA signatories documented in the letter from DON dated 24 June 2004. The details of the design and operation of the landfill gas systems and landfill gas monitoring will be presented in remedial design work plan.

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Action/ Requirement	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
	Limits emissions of volatile organic compounds (VOCs) from contaminated soil to less than 50 ppm. For contaminated soil with 50 ppm or greater, an approved mitigation plan, describing removal methods and mitigation measures, must be obtained from the District prior to proceeding with the excavation. Uncontrolled spreading of contaminated soil is not permitted.		SCAQMD Rule 1166				Not an ARAR. Very low concentrations of VOCs were detected at AA 3. Therefore, negligible VOC emissions are expected during the remedial action.
Air emission (continued)	Applies to any new or modified equipment, which may cause the issuance of any non-attainment air contaminant, ozone depleting compound or ammonia. It requires all equipment to be constructed with best available control technology (BACT). For non-attainment emission increases, it requires the emission increases to be offset and substantiated with modeling that the equipment will not cause a significant increase in concentrations of non-attainment contaminants.		SCAQMD Regulation XIII				Not an ARAR. No equipment with potential to issue non-attainment air contaminant, ozone depleting compound or ammonia is planned for the remedial action.
Solid waste disposal facility	A facility or practice shall not: contaminate an underground drinking water source beyond the solid waste boundary or a court- or state-established alternative; cause a discharge of pollutants into waters of the United States that is in violation of the substantive requirements of the NPDES under CWA Section 402, as amended; cause a discharge of dredged material or fill material to waters of the United States that is in violation of the substantive requirements of CWA Section 404; or cause non-point source pollution of waters of the United States that violates applicable legal substantive requirements implementing an area-wide or statewide water quality management plan approved by the Administrator under CWA Section 208, as amended.	Solid waste disposal facility and practices except agricultural wastes, overburden resulting from mining operations, land application of domestic sewage, location and operations of septic tanks, solid or dissolved materials in irrigation return flows, industrial discharges that are point sources subject to permits under CWA, source special nuclear or by-product material as defined by the Atomic Energy Act, hazardous waste disposal facilities that are subject to regulation under RCRA subtitle C, disposal of solid waste by underground well injection, and municipal solid waste landfill units.	40 C.F.R. § 257.3–257.4 and Appendix I				Not an ARAR Criteria specified in 40 CFR Part 257 do not apply to landfill units which are subject to the revised criteria contained in 40 CFR Part 258.
Federal Hazardous Materials Transportation Law (49 U.S.C. §§ 5101–5127)*							
Transportation of hazardous	No person shall represent that a container or package is safe unless it meets the requirements of	Interstate carriers transporting hazardous waste and	49 C.F.R. § 171.2(f)		3, 4		Substantive portions of these requirements would be ARARs for

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Action/ Requirement	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
material	49 U.S.C. §§ 5101–5127.	substances by motor vehicle. Transportation of hazardous material under contract with any department of the executive branch of the federal government.					transport of hazardous materials onsite. Off-site transport must comply with both substantive and administrative requirements.
Transportation of hazardous material (continued)	No person shall unlawfully alter or deface labels, placards or descriptions, packages, containers, or motor vehicles used for transportation of hazardous materials.		49 C.F.R. § 171.2(g)		3, 4		Substantive portions of these requirements would be ARARs for transport of hazardous materials onsite. Off-site transport must comply with both substantive and administrative requirements.
Hazardous materials marking, labeling, and placarding	Each person who offers hazardous material for transportation or each carrier that transports it shall mark each package, container, and vehicle in the manner required.	Person who offers hazardous material for transportation; carries hazardous material; or packages, labels, or placards hazardous material.	49 C.F.R. § 172.300		3, 4		Substantive portions of these requirements would be ARARs for transport of hazardous materials onsite. Off-site transport must comply with both substantive and administrative requirements.
	Each person offering non-bulk hazardous materials for transportation shall mark the proper shipping name and identification number (technical name) and consignee's name and address.		49 C.F.R. § 172.301		3, 4		Substantive portions of these requirements would be ARARs for transport of hazardous materials onsite. Off-site transport must comply with both substantive and administrative requirements.
	Hazardous materials for transportation in bulk packages must be labeled with proper ID number, specified in 49 C.F.R. § 172.101 table, with required size of print. Packages must remain marked until cleaned or refilled with material requiring other marking.		49 C.F.R. § 172.302		3, 4		Substantive portions of these requirements would be ARARs for transport of hazardous materials onsite. Off-site transport must comply with both substantive and administrative requirements.
	No package marked with a proper shipping name or ID number may be offered for transport or transported unless the package contains the identified hazardous material or its residue.		49 C.F.R. § 172.303		3, 4		Substantive portions of these requirements would be ARARs for transport of hazardous materials onsite. Off-site transport must comply with both substantive and administrative requirements.

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Action/ Requirement	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
	The markings must be durable, in English, in contrasting colors, unobscured, and away from other markings.		49 C.F.R. § 172.304		3, 4		Substantive portions of these requirements would be ARARs for transport of hazardous materials onsite. Off-site transport must comply with both substantive and administrative requirements.
Hazardous materials marking, labeling, and placarding (continued)	Non-bulk combination packages containing liquid hazardous materials must be packed with closures upward, and marked with arrows pointing upward.		49 C.F.R. § 172.312		3, 4		Substantive portions of these requirements would be ARARs for transport of hazardous materials onsite. Off-site transport must comply with both substantive and administrative requirements.
	Labeling of hazardous material packages shall be as specified in the list.		49 C.F.R. § 172.400		3, 4		Substantive portions of these requirements would be ARARs for transport of hazardous materials onsite. Off-site transport must comply with both substantive and administrative requirements.
	Each bulk packaging or transport vehicle containing any quantity of hazardous material must be placarded on each side and each end with the type of placards listed in Tables 1 and 2 of 49 C.F.R. § 172.504.	Each person who offers for transport or transports any hazardous materials shall comply with these placarding requirements.	49 C.F.R. § 172.504		3, 4		Substantive portions of these requirements would be ARARs for transport of hazardous materials onsite. Off-site transport must comply with both substantive and administrative requirements.

Note:
* Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader. Listing the statutes and policies does not indicate that the DON accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirements of specific citations are considered potential ARARs.

Acronyms/Abbreviations:

§	section	C.F.R	Code of Federal Regulations
ARAR	Applicable or relevant and appropriate requirement	DON	Department of the Navy
BACT	best available control technology	EPA	Environmental Protection Agency
BMPs	best management practices	RCRA	Resource Conservation and Recovery Act
Cal. Code Regs.	California Code of Regulations	SCAQMD	South Coast Air Quality Management District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	TBC	to be considered

Table H-6: State Action-Specific ARARs for Remedial Action at AA 3

Alternative 1: No Action; Alternative 2: Limited Grading, Monitoring and Institutional Controls; Alternative 3: Containment, Monitoring and Institutional Controls; Four options for Alternative 3 include: Alternative 3a: Containment with Evapotranspiration Cover, Alternative 3b: Containment with Title 27 prescriptive Cap, Alternative 3c: Containment with Modified Title 27 prescriptive cap with Flexible Membrane Liner (FML), Alternative 3d: Containment with Modified Title 27 prescriptive cap with Geosynthetic Clay Liner (GCL); Alternative 4: Clean Closure and Groundwater Monitoring

Action	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
State Water Resources Control Board (SWRCB) and Regional Water Quality Control Board (RWQCB)*							
Landfill operation	Requires that existing landfills, waste piles, and surface impoundments be operated to ensure that wastes will be a minimum of five feet above the highest anticipated elevation of underlying ground water.	Discharge of waste to land after 18 July 1997.	Cal. Code Regs. tit. 27, § 20240 (c)				Not an ARAR. Since disposal of debris stopped at AA 3 prior to the effective date of Cal. Code. Regs. tit. 27, the cited regulation is not applicable. However, this provision was evaluated to determine if it is potentially relevant and appropriate. This evaluation indicated that although the requirements at Cal. Code Regs. tit. 27, § 20240 (c) are relevant, they are not appropriate at AA 3 since these requirements pertain to *construction and operation* of new landfills, and *operation* of existing landfills. Although AA 3 was historically a debris disposal area, it is presently inactive and not in operation. Therefore, 5-feet separation requirement between wastes and the highest anticipated groundwater level is not appropriate for AA 3. A requirement must be both relevant and appropriate in order to constitute an ARAR for a CERCLA site (40 C.F.R. § 300.400[g][2]). If the requirement is relevant but not appropriate, such a requirement does not constitute an ARAR. Based on this, the requirements at Cal. Code Regs. tit. 27, § 20240 (c) were determined not to be ARARs for AA 3.
Closure of a waste management unit	General closure and postclosure maintenance standards	Waste discharged after 18 July 1997.	Cal. Code Regs. tit. 27, § 20950(a)		2, 3, 4		Substantive requirements of Cal. Code Regs. tit. 27, § 20950(a)(2)(A) are relevant and appropriate for Alternatives 2 and 3. Substantive requirements of Cal. Code Regs. tit. 27, § 20950(a)(2)(B) are relevant and appropriate for Alternative 4 that constitutes clean closure.
	Requires that vegetative cover layer of the landfill shall meet the requirements of Cal. Code Regs. tit. 27, § 21090(a)(3)(A)	Waste discharged after 18 July 1997.	Cal. Code Regs. tit. 27, § 20950(e)		3b, 3c, and 3d		Substantive requirements are relevant and appropriate for remedial alternatives involving cap construction in accordance with Title 27 prescriptive cap.
Vegetation layer of landfill cap	Closed landfills shall be provided with an uppermost cover layer consisting of either a vegetative layer consisting of not less than 1 foot of soil capable of sustaining native or other suitable plant growth or a mechanically erosion-resistant layer.	Waste discharged after 18 July 1997.	Cal. Code Regs. tit. 27, § 21090(a)(3)		3b. 3c, and 3d		Substantive requirements are relevant and appropriate for remedial alternatives involving cap construction in accordance with Title 27 prescriptive cap.
Foundation layer of landfill cap	Closed landfills shall be provided with not less than 2 feet of appropriate materials as a foundation layer for the final cover. These materials may be soil, contaminated soil, incinerator ash, or other waste materials, provided that such materials have appropriate	Waste discharged after 18 July 1997.	Cal. Code Regs. tit. 27, § 21090 (a)(1)		3b, 3c, and 3d		Substantive requirements are relevant and appropriate for remedial alternatives involving cap construction in accordance with Title 27 prescriptive cap.

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Action	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
	engineering properties to be used for a foundation layer. The foundation layer shall be compacted to the maximum density obtainable at optimum moisture content using methods that are in accordance with accepted civil engineering practice. A lesser thickness may be allowed for units if the differential settlement of waste and ultimate land use will not affect the structural integrity of the final cover.						
Barrier layer of landfill cap	Closed landfills shall be provided with a low hydraulic- conductivity (or low through-flow rate) layer, consisting of not less than 1 foot of soil containing no waste or leachate, that is placed on top of the foundation layer and compacted to attain a hydraulic conductivity of either 1×10^{-6} cm/sec (i.e., 1 foot per year) or less, or equal to the hydraulic conductivity of any bottom liner system or underlying natural geologic materials. Another design which provides a correspondingly low through-flow rate throughout the post-closure maintenance period is also acceptable.	Waste discharged after 18 July 1997.	Cal. Code Regs. tit. 27, § 21090 (a)(2)		3b, 3c, and 3d		Substantive requirements are relevant and appropriate for remedial alternatives involving cap construction in accordance with Title 27 prescriptive cap.
Landfill capping	Alternatives to construction or prescriptive standards.	Waste discharged after 18 July 1997.	Cal. Code Regs. tit. 27, §§ 20080 (b) and (c) and 21090		2, 3a		Substantive requirements pertaining to criteria for justifying alternative means of meeting prescriptive standards are relevant and appropriate. Alternatives 2 and 3a meet the requirements as an engineered alternative to the prescriptive standard because they are as effective as the prescriptive cap in reducing infiltration into the landfill materials (see Section 4.3 for details and Appendix K).
Grading of final cover	Establishes requirements for design and grading, and maintenance of the final cover to prevent ponding and to prevent site erosion due to high runoff velocities. Slopes should be at least 3 percent.	Waste discharged after 18 July 1997.	Cal. Code Regs. tit. 27, 21090 (b)(1)		3b, 3c, and 3d		Substantive provisions are potentially relevant and appropriate for design and post-closure maintenance of final cover.
Post-closure maintenance of containment structures and final cover	Requires maintenance of structural integrity and effectiveness of all containment structures, and maintenance of final cover to correct the effects of settlement or other adverse factors.	Waste discharged after 18 July 1997.	Cal. Code Regs. tit. 27, 21090 (c)(1)				Not an ARAR. Not more stringent than equivalent federal provisions at Cal. Code Regs. tit. 22, § 66264.310(b)(1) are more stringent (see Table H-7).

Table H-6: State Action-Specific ARARs for Remedial Action at AA 3

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Action	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
Landfill leachate	Requires continued operation of the leachate collection and removal system as long as leachate is generated and detected.	Waste discharged after 18 July 1997.	Cal. Code Regs. tit. 27, 21090 (c)(2)				Not an ARAR. Not more stringent than equivalent federal provisions at Cal. Code Regs. tit. 22, § 66264.310(b)(2) (see Table H-7).
Monitoring	Requires maintenance of the monitoring systems and monitoring of groundwater, surface water, and the unsaturated zone in accordance with applicable requirements of art. 1, subch. 3, ch. 3, subdiv. 1 (§20380 et seq.).	Waste discharged after 18 July 1997.	Cal. Code Regs. tit. 27, 21090 (c)(3)				Not an ARAR. Not more stringent than equivalent federal provisions at Cal. Code Regs. tit. 22, § 66264.310(b)(2) (see Table H-7).
Post-closure erosion control	Requires prevention of erosion and related damage of the final cover due to drainage throughout the postclosure maintenance period.	Waste discharged after 18 July 1997.	Cal. Code Regs. tit. 27, 21090 (c)(4)		2, 3		Substantive provisions are potentially relevant and appropriate for design and post-closure maintenance of final cover.
Benchmark maintenance	Requires protection and maintenance of the surveyed monuments (installed under § 20950[d]) throughout the postclosure maintenance period.	Waste discharged after 18 July 1997.	Cal. Code Regs. tit. 27, 21090 (c)(5)				Not an ARAR. Not more stringent that equivalent federal provisions at Cal. Code Regs. tit. 22, § 66264.310(b)(5) (see Table H-7).
Post-closure settlement evaluation	Requires discharger to produce and submit to the RWQCB an iso-settlement map at least every five years to accurately depict the estimated total change in elevation of the each portion of the final cover's low-hydraulic-conductivity layer.	Waste discharged after 18 July 1997.	Cal. Code Regs. tit. 27, 21090 (e)(2)		3		Substantive requirements for evaluation of settlement at least every 5-years are relevant and appropriate. The requirement for submission of an iso-settlement map to RWQCB are procedural in nature and does not constitute an ARAR.
Groundwater Monitoring	Requires detection monitoring. Once a significant release has occurred, evaluation or corrective action monitoring is required.	Discharge of waste to land after 18 July 1997.	Cal. Code Regs. tit. 27, § 20385(a)(1) – (4), (b), and (c)				Not an ARAR. Not more stringent than equivalent federal regulations at tit. 22, § tit. 22, § 66264.91(a)(1)(see Table H-5). In addition, evaluation and corrective action monitoring program is not planned at AA 3.
Landfill Gas Monitoring	Establishes requirements for control of trace gases and concentration limits for methane generated at a disposal site.	Solid waste disposal sites that did not commence complete closure prior to 18 August 1989, which was fully implemented by 18 November 1990; and new postclosure activities with potential to jeopardize the integrity of the previously closed	Cal. Code Regs. tit. 27, § 20921(a)(1), (2), and (3)		2, 3		Since closure of AA 3 did not commence prior to 18 August 1989, and is not expected to be fully implemented until 2006, the substantive requirements of the cited regulations are not applicable but are relevant and appropriate. These substantive requirements include limits on concentrations of methane and trace gases from the generated at the sites.

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Action	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
		sites.					
	Requires that gas monitoring and control program (pursuant to §§ 20921 – 20937) shall continue for the period of 30 years or until the operator receives written authorization to discontinue by the Enforcement Authority with concurrence from the CIWMB.	Solid waste disposal sites that did not commence complete closure prior to 18 August 1989, which was fully implemented by 18 November 1990; and new postclosure activities with potential to jeopardize the integrity of the previously closed sites.	Cal. Code Regs. tit. 27, § 20921(b) except procedural requirements		2, 3		The gas monitoring will be conducted for a period of 30 years or until monitoring data indicates that landfill gas does not present a risk to human health. The requirement for receiving written authorization from the Enforcement Authority is procedural in nature and does not constitute an ARAR for the remedial action.
Landfill Gas Monitoring (continued)	Requires that gas monitoring program be described in a postclosure maintenance plan.	Solid waste disposal sites that did not commence complete closure prior to 18 August 1989, which was fully implemented by 18 November 1990; and new postclosure activities with potential to jeopardize the integrity of the previously closed sites.	Cal. Code Regs. tit. 27, § 20921(c)				Not an ARAR. The requirements are procedural in nature.
	Requires gas monitoring and control systems be modified during closure and postclosure maintenance period to reflect changing on-site and adjacent land uses. Also states that postclosure land use shall not interfere with the function of gas monitoring and control systems.	Solid waste disposal sites that did not commence complete closure prior to 18 August 1989, which was fully implemented by 18 November 1990; and new postclosure activities with potential to jeopardize the integrity of the previously closed sites.	Cal. Code Regs. tit. 27, § 20921(d)		2, 3		Substantive requirements are potentially relevant and appropriate for design and implementation of gas monitoring and control systems.

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Action	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
	Establishes requirements for implementation of gas monitoring program to ensure that the concentration limits for landfill gases prescribed in Cal. Code Regs. tit. 27, § 20921 are met.	Solid waste disposal sites that did not commence complete closure prior to 18 August 1989, which was fully implemented by 18 November 1990; and new postclosure activities with potential to jeopardize the integrity of the previously closed sites.	Cal. Code Regs. tit. 27, § 20923 except procedural requirements		2, 3		The design of the gas monitoring network will take into account factors such as local geological and hydrogeological, conditions, and adjacent land-use. The requirement that the gas monitoring network be designed by a registered civil engineer or certified engineering geologist is procedural in nature and does not constitute an ARAR.
Landfill Gas Monitoring (continued)	Establishes requirements for location, spacing, and depth of gas monitoring wells.	Solid waste disposal sites that did not commence complete closure prior to 18 August 1989, which was fully implemented by 18 November 1990; and new postclosure activities with potential to jeopardize the integrity of the previously closed sites.	Cal. Code Regs. tit. 27, § 20925 (a), (b), and (c)		2, 3		The design of the landfill gas monitoring network will be based on the agreement between FFA signatories documented in the letter from DON dated 24 June 2004. The details of the design of the landfill gas monitoring will be presented in the post-ROD deliverables and will be based on the conceptual design presented in this RI/FS.
	Establishes requirements for monitoring well construction for gas monitoring.	Solid waste disposal sites that did not commence complete closure prior to 18 August 1989, which was fully implemented by 18 November 1990; and new postclosure activities with potential to jeopardize the integrity of the previously closed sites.	Cal. Code Regs. tit. 27, § 20925 (d)(1) and (3) except procedural requirements		2, 3		Substantive requirements are relevant and appropriate for monitoring well drilling and construction. The requirements that the drilling be conducted by a licensed drilling contractor or under the supervision of the design engineer or engineering geologist are procedural in nature and do not constitute ARARs.

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Action	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
	Establishes requirements for keeping record of monitoring wells.	Solid waste disposal sites that did not commence complete closure prior to 18 August 1989, which was fully implemented by 18 November 1990; and new postclosure activities with potential to jeopardize the integrity of the previously closed sites.	Cal. Code Regs. tit. 27, § 20925 (d)(2)				Not an ARAR. The requirements are procedural in nature.
Landfill Gas Monitoring (continued)	Establishes requirements for gas monitoring for on-site structures.	Solid waste disposal sites that did not commence complete closure prior to 18 August 1989, which was fully implemented by 18 November 1990; and new postclosure activities with potential to jeopardize the integrity of the previously closed sites.	Cal. Code Regs. tit. 27, § 20931				Not an ARAR. No on-site structures are planned within AA 3 boundary and 100 feet of the edge of the landfills.
	Requires all monitoring probes and on-site structures be sampled for methane during monitoring period. Sampling for other trace gases may be required by the Enforcement Agency if there is possibility of acute or chronic exposure due to carcinogenic or toxic compounds.	Solid waste disposal sites that did not commence complete closure prior to 18 August 1989, which was fully implemented by 18 November 1990; and new postclosure activities with potential to jeopardize the integrity of the previously closed sites.	Cal. Code Regs. tit. 27, § 20932		2, 3		Substantive requirements are relevant and appropriate for landfill gas monitoring design.

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Action	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
	Establishes requirements for monitoring frequency for landfill gas. Stipulates that at a minimum, quarterly monitoring is required. A more frequent monitoring may be required by the Enforcement Authority based upon site-specific factors.	Solid waste disposal sites that did not commence complete closure prior to 18 August 1989, which was fully implemented by 18 November 1990; and new postclosure activities with potential to jeopardize the integrity of the previously closed sites.	Cal. Code Regs. tit. 27, § 20933		2, 3		The landfill gas will be monitored quarterly until stabilized.
Landfill Gas Monitoring (continued)	Requires preparation and submission of monitoring reports to the Enforcement Authority explaining the results of gas monitoring.		Cal. Code Regs. tit. 27, § 20934				Not an ARAR. The requirements are procedural in nature.
	Establishes control measures if monitoring results indicate concentration of methane in excess of the compliance levels established in § 20921 (a).		Cal. Code Regs. tit. 27, § 20937 except procedural requirements of 29307 (a)(2), (a)(4), (a)(5), and (f)(1) through (3)		2, 3		The substantive provisions are relevant and appropriate if gas monitoring results indicate methane concentrations exceeding the compliance levels established in § 20921 (a).
Postclosure care period	The landfill shall be maintained and monitored for a period of not less than 30 years after completion of closure of the entire solid waste landfill.	Discharge of waste to land after 18 July 1997.	Cal. Code Regs. tit. 27, § 21180 (a) and (b)		2, 3		Substantive provisions related to post closure care period are potentially relevant and appropriate.
	Requires submission of maps and reports describing the amount of differential settlement to the CIWMB and the Enforcement Authority.	Discharge of waste to land after 18 July 1997.	Cal. Code Regs. tit. 27, § 21180 (c)				Not an ARAR. The requirements are procedural in nature.
Postclosure land use	Establishes requirements for design and maintenance of proposed postclosure land uses. Also stipulates that site closure design should show one or more proposed uses of the closed site or show development that is compatible with open space.	Discharge of waste to land after 18 July 1997.	Cal. Code Regs. tit. 27, § 21190 (a) and (b)		2, 3		Substantive provisions are relevant and appropriate for design and maintenance of postclosure land use.

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Action	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
	Requires that all proposed land uses be submitted to the Enforcement Authority, RWQCB, local air district, and local land use agency for review and/or approval. Requires that any construction on the site maintain the integrity of the cover system.	Discharge of waste to land after 18 July 1997.	Cal. Code Regs. tit. 27, § 21190 (c) and (d)		2, 3		Substantive provisions are relevant and appropriate for future land use and proposed construction within the buffer zone associated with AA 3. The Navy has reached an agreement with the CIWMB (see Appendix L) regarding buffer zone around AA 3. In accordance with this agreement, a 100-foot buffer zone is proposed around the final waste boundary. The ICs proposed for AA 3 prohibit land uses that may lead to unacceptable risk to human health and stipulate that any proposed construction at AA 3 including the buffer zone will require approval from the Federal Facility Agreement (FFA) signatories and CIWMB (see Section 12.2.2 of the main text).
	Establishes requirements for construction of structural improvement or buildings on closed landfill site.	Construction on a closed landfill site	Cal. Code Regs. tit. 27, § 21190 (e), (f), and (g)				Not an ARAR. The DON is not planning to construct any structures within AA 3 boundary and 100 feet buffer zone, following closure. However, the provisions at Cal. Code Regs. tit. 27, § 21190 (a), (b), (c), and (d) accepted as ARARs require that future land uses and any proposed construction at AA 3 (including buffer zone) will require approval from the FFA signatories and and CIWMB (see Section 12.2.2 of the main text).
California Civil Code*							
Institutional controls	Provides conditions under which landuse restrictions will apply to successive owners of land.	Transfer property from the DON to a nonfederal agency.	Cal. Civ. Code § 1471	2, 3			Generally, Cal. Civ. Code § 1471 allows an owner of land to make a covenant to restrict the use of land for the benefit of a covenantee. The covenant runs with the land to bind successive owners, and the restrictions must be reasonably necessary to protect present or future human health or safety or the environment as a result of the presence on the land of hazardous materials, as defined in Cal. Health & Safety Code § 25260. Substantive provisions are the following general narrative standard: "to do or refrain from doing some act on his or her own land . . . where (c) Each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety or the environment as a result of the presence of hazardous materials, as defined in Section 25260 of the California Health and Safety Code." This narrative standard would be implemented through incorporation of restrictive covenants in the deed and Environmental Restriction and Covenant Agreement at the time of transfer.

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Action	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
California Health and Safety Code*							
Institutional controls	Allows DTSC to enter into an agreement with the owner of a hazardous waste facility to restrict present and future land uses.	Transfer property from the DON to a nonfederal agency.	Cal. Health & Safety Code § 25202.5	2, 3			The substantive provisions of Cal. Health & Safety Code § 25202.5 are the general narrative standards to restrict "present and future uses of all or part of the land on which the . . . facility . . . is located . . ."
	Provides a streamlined process to be used to enter into an agreement to restrict specific use of property in order to implement the substantive use restrictions of Cal. Health & Safety Code § 25232(b)(1)(A)–(E).	Transfer property from the DON to a nonfederal agency.	Cal. Health & Safety Code §§ 25222.1 and 25355.5(a)(1)(C)	2, 3			Generally, Cal. Health & Safety Code §§ 25222.1 and 25355.5(a)(1)(C) provide the authority for the DTSC to enter into voluntary agreements with land owners to restrict the use of property. The agreements run with the land restricting present and future uses of the land. The substantive requirements of the following Cal. Health & Safety Code § 25222.1 provisions are "relevant and appropriate": (1) the general narrative standard: "restricting specified uses of the property…" and (2) "…the agreement is irrevocable, and shall be recorded by the owner, …as a hazardous waste easement, covenant, restriction or servitude, or any combination thereof, as appropriate, upon the present and future uses of the land." The substantive requirements of the following Cal. Health & Safety Code § 25355.5(a)(1)(C) provisions are "relevant and appropriate": "…execution and recording of a written instrument that imposes an easement, covenant, restriction, or servitude, or combination thereof , as appropriate, upon the present and future uses of the land."
	Prohibits certain uses of land containing hazardous waste without a specific variance.	Hazardous waste property.	Cal. Health & Safety Code § 25232(b)(1)(A)–(E)	2, 3			Land-use restrictions will be used to prohibit the following activities at AA 3: residential use of the site, construction of hospitals for humans, schools for persons under 21 years of age, day care centers for children, or any permanently occupied human habitation on the sites. See Section 4.2 for the DTSC and EPA positions.
	Provides processes and criteria for obtaining written variances from a landuse restriction and for removal of the land use restrictions.	Transfer property from the DON to a nonfederal agency.	Cal. Health & Safety Code §§ 25233(c) and 25234	2, 3			Cal. Health & Safety Code § 25233(c) sets forth "relevant and appropriate" substantive criteria for granting variances based upon specified environmental and health criteria. Cal. Health & Safety Code § 25234 sets forth the following "relevant and appropriate" substantive criteria for the removal of a land-use restriction on the grounds that "…the waste no longer creates a significant existing or potential hazard to present or future public health or safety."
Cal/EPA Department of Toxic Substances Control*							
Land Use Covenants	A land use covenant imposing appropriate limitations on land use shall be executed and recorded when Facility closure, corrective	Property transfer by federal government to	Cal. Code Regs. tit. 22,		2, 3		Cal. Code Regs. tit. 22 § 67391.1 provides for a land-use covenant to be executed and recorded when remedial actions are taken and hazardous substances will remain at

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Action	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
	action, remedial or removal action, or other response actions are undertaken and Hazardous materials, hazardous wastes or constituents, or hazardous substances will remain at the property at levels which are not suitable for unrestricted use of the land.	non-federal entity.	§ 67391.1				the property at concentrations that are unsuitable for unrestricted use of the land. The substantive provisions of this regulation have been determined to be "relevant and appropriate" state ARARs by the DON. EPA considers the following provisions to be relevant and appropriate: Cal. Code Regs. tit. 22, § 67391.1(a)(1), (a)(2), (d), (e)(1) and (e)(2).
California Integrated Waste Management Board*							
Emergency response	Establishes requirements for maintenance and content of a written postclosure emergency response plan.	Disposal sites that did not complete closure prior to November 18, 1990; new postclosure activities that may jeopardize the integrity of previously closed disposal sites.	Cal. Code Regs. tit. 27, § 21130				Not an ARAR. The requirements for preparation and maintenance of an emergency response plan are procedural in nature and therefore do not constitute ARARs. However, emergency response procedures following closure of AA 3 will be delineated in an operation and maintenance manual for the remedial action at the landfill sites.
Site security	Establish requirements for placing signs stating the intended date of the last receipt of the waste at the site. Also establishes requirements for protection of sedimentation and detention basins.	Disposal sites that did not complete closure prior to November 18, 1990; new postclosure activities that may jeopardize the integrity of previously closed disposal sites.	Cal. Code Regs. tit. 27, § 21135 (a), (b), (c), (d) and (e)				Not an ARAR. Placement of construction debris at AA 3 occurred between 1972 and 1988, after which the site has been largely inactive. There are no sedimentation or detention basins at AA 3.
	All points of access to the site must be restricted. All monitoring, control, and recovery systems shall be protected from unauthorized access. Once closure activities are complete, site access by the public may be allowed in accordance with the approved postclosure maintenance plan.	Disposal sites that did not complete closure prior to November 18, 1990; new postclosure activities that may jeopardize the integrity of previously closed disposal sites.	Cal. Code Regs. tit. 27, § 21135 (f) and (g)	2, 3, 4			The requirements are applicable for implementing controls for access restriction and protection of monitoring systems.
Structure removal	Requires that site structures, and leachate and gas controls systems not intended for reuse be dismantled and removed at the time of closure to protect public health and safety.	Disposal sites that did not complete closure prior to November 18, 1990; new postclosure	Cal. Code Regs. tit. 27, § 21137				Not an ARAR. AA 3 does not contain any structure or leachate and gas control system that needs dismantling.

Table H-6: State Action-Specific ARARs for Remedial Action at AA 3

Alternative 1: No Action; Alternative 2: Limited Grading, Monitoring and Institutional Controls; Alternative 3: Containment, Monitoring and Institutional Controls; Four options for Alternative 3 include: Alternative 3a: Containment with Evapotranspiration Cover, Alternative 3b: Containment with Title 27 prescriptive Cap, Alternative 3c: Containment with Modified Title 27 prescriptive cap with Flexible Membrane Liner (FML), Alternative 3d: Containment with Modified Title 27 prescriptive cap with Geosynthetic Clay Liner (GCL); Alternative 4: Clean Closure and Groundwater Monitoring

Action	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
		activities that may jeopardize the integrity of previously closed disposal sites.					
Final Cover	Requires that final cover shall function with minimum maintenance and provide waste containment to protect public health and safety by controlling at a minimum, vectors, fire, odor, litter and landfill gas migration. The final cover shall also be compatible with postclosure land use.	Disposal sites that did not complete closure prior to November 18, 1990; new postclosure activities that may jeopardize the integrity of previously closed disposal sites.	Cal. Code Regs. tit. 27, § 21140	2, 3			The requirements are applicable for final cover design.
Final grading	Requires that final grades be designed and maintained to reduce impacts to health and safety, and take into consideration any postclosure land use. Also requires discharger to produce and submit to the Enforcement Authority an iso-settlement map at least every five years only if RWQCB does not require such maps.	Disposal sites that did not complete closure prior to November 18, 1990; new postclosure activities that may jeopardize the integrity of previously closed disposal sites.	Cal. Code Regs. tit. 27, § 21142, except procedural requirements of 21142 (b)	2, 3			The requirements for the design and maintenance of final cover grades are applicable. Substantive requirements for evaluation of settlement at least every 5-years are relevant and appropriate. The requirement for submission of an iso-settlement map to the Enforcement Authority are procedural in nature and does not constitute an ARAR.
Cover seismic requirements	The owner shall assure the integrity of final slopes under both static and dynamic conditions to protect public health and safety and prevent damage to postclosure land uses, roads, structures, utilities, gas monitoring and control systems, leachate collection and control systems to prevent public contact with leachate, and prevent exposure of waste.	Disposal sites that did not complete closure prior to November 18, 1990; new postclosure activities that may jeopardize the integrity of previously closed disposal sites.	Cal. Code Regs. tit. 27, § 21145, except procedural requirements of 21145 (b)	2, 3			The substantive requirements are applicable to the design of the cap.
Erosion control	The drainage and erosion control system shall be designed and maintained to assure integrity of postclosure land uses, roads, and structures; to prevent public contact with waste and leachate; to assure integrity of gas monitoring and control systems; to prevent safety hazards; and to prevent exposure of waste.	Disposal sites that did not complete closure prior to November 18, 1990; new postclosure activities that may jeopardize the integrity of previously	Cal. Code Regs. tit. 27, § 21150	2, 3			The requirements are applicable for design and maintenance of erosion control system.

Table H-6: State Action-Specific ARARs for Remedial Action at AA 3

Alternative 1: No Action; Alternative 2: Limited Grading, Monitoring and Institutional Controls; Alternative 3: Containment, Monitoring and Institutional Controls; Four options for Alternative 3 include: Alternative 3a: Containment with Evapotranspiration Cover, Alternative 3b: Containment with Title 27 prescriptive Cap, Alternative 3c: Containment with Modified Title 27 prescriptive cap with Flexible Membrane Liner (FML), Alternative 3d: Containment with Modified Title 27 prescriptive cap with Geosynthetic Clay Liner (GCL); Alternative 4: Clean Closure and Groundwater Monitoring

Action	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
		closed disposal sites.					
	During the postclosure maintenance period, the owner/operator shall assure that landfill gas control and leachate collection and control is done in a manner that prevents public contact and controls vectors, nuisance, and odors.	Disposal sites that did not complete closure prior to November 18, 1990; new postclosure activities that may jeopardize the integrity of previously closed disposal sites.	Cal. Code Regs. tit. 27, § 21160 (a) and (b) except where the provisions refer to leachate collection and control.	2, 3			The landfill gas control system will be implemented and maintained in accordance with the substantive provisions of Cal. Code Regs. tit. 27, §§ 20921 – 20937, that have been determined to be ARARs for AA 3 remedial action. The leachate production and accumulation has not been evident at AA 3, therefore the provisions for leachate collection and control are not ARARs.
Final Closure Plan	Provides the purpose and content requirements for closure plan for solid waste disposal sites.	Solid waste disposal sites that received waste after November 1990.	Cal. Code Regs. tit. 27, § 21800				Not an ARAR. The requirements are procedural in nature and are therefore not ARARs. However, remedial design/implementation activities will be presented in detail in remedial design/action work plan which will be prepared following finalization of the ROD.
Final Postclosure Maintenance Plan	Provides the purpose and content requirements for postclosure plan for solid waste disposal sites	Solid waste disposal sites that received waste after November 1990.	Cal. Code Regs. tit. 27, § 21830				Not an ARAR. The requirements are procedural in nature and are therefore not ARARs. However, following closure of AA 3, the plan for postclosure activities will be presented in an operation and maintenance manual for the landfills.
Certification of closure	Establishes requirements for obtaining certification of closure of the solid waste landfill from CIWMB, RWQCB, and the Enforcement Authority.	Solid waste disposal sites that received waste after November 1990.	Cal. Code Regs. tit. 27, § 21880				Not an ARAR. The requirements are procedural in nature.
California Labor Code*							
Employment in the State of California	Establishes requirements for ensuring safe and healthful working conditions for working men and women in California.		Cal. Health & Safety Code §6300 et seq.				Not an ARAR. The provisions at Cal. Health & Safety Code §6300 et seq. do not meet the definition of an ARAR since they are not cleanup standards, standards of control or other substantive environmental protection requirements, criteria, or limitations. However, the remedial action activities at Site 2 will be conducted in accordance with the health and safety plan which will comply with all applicable federal and state health and safety regulations.
South Coast Air Quality Management District							
Air emission	Visible emissions standard that states a person shall not discharge any air contaminant into the atmosphere from any single source of emission for a period or	Discharge of visible emissions	SCAQMD Rule 401	3, 4			Grading and excavation activities have the potential to produce visible emissions due to fugitive dust. Substantive requirements pertaining to visible emissions, such as wetting the soil or waste, may be required to minimize

Table H-6: State Action-Specific ARARs for Remedial Action at AA 3

Alternative 1: No Action; Alternative 2: Limited Grading, Monitoring and Institutional Controls; Alternative 3: Containment, Monitoring and Institutional Controls; Four options for Alternative 3 include: Alternative 3a: Containment with Evapotranspiration Cover, Alternative 3b: Containment with Title 27 prescriptive Cap, Alternative 3c: Containment with Modified Title 27 prescriptive cap with Flexible Membrane Liner (FML), Alternative 3d: Containment with Modified Title 27 prescriptive cap with Geosynthetic Clay Liner (GCL); Alternative 4: Clean Closure and Groundwater Monitoring

Action	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
	periods aggregating more than 3 minutes in a 60-minute period, which is (a) as dark or darker in shade as that designated No. 1 on the Ringelmann Chart, or (b) of such opacity as to obscure an observer's view to a degree equal to or greater than does smoke described in (a).						fugitive dust.
	Nuisance standard that states a person shall not discharge fro any source such quantities for air contaminants or other material that cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public.	Discharge to air	SCAQMD Rule 402				Not an ARAR The nuisance rule includes subjective non-environmental criteria such as "annoyance", "comfort", and "repose". AS such, the DON is troubled by the vague and subjective nature of the nuisance rule and the lack of objective "standard, requirements, criteria, or limitations" within the meaning of Section 121 (d)(2) of CERCLA. Other federal and state ARARs addressing actual and potential air emissions will ensure adequate protection of human health and the environment. Grading and excavation activities have the potential to produce visible emissions due to fugitive dust. Control measures, such as wetting the soil or waste and limiting the amount of waste exposed at any on time may be necessary to achieve compliance.
	Prohibits a person from building, erecting, installing or using any equipment, the use of which reduces or conceals an emission which would otherwise constitute a violation of these rules or Chapter 3 (starting with 41700) of Part 4, of Division 26 of the Health and Safety Code.		SCAQMD Rule 408				Not an ARAR. Not pertinent to remedial action.
	Limit sulfur compounds from combustion of gaseous fuels not to exceed 40 ppm, 0.05 percent by weight for liquid fuels and 0.56 pounds of sulfur per million BTU for solid fossil fuels.		SCAQMD Rules 431.1, 431.2, 431.3				Not an ARAR. Not pertinent to remedial action.
Excavation of landfill sites	Requires person excavating a landfill to identify mitigation measures to ensure that a public nuisance condition does not occur.	Any activity that exposes buried waste to the atmosphere	SCAQMD Rule 1150		3, 4		Substantive provisions are relevant and appropriate for on-site consolidation that exposes buried waste to the atmosphere.
	New source review of carcinogenic air contaminants		SCAQMD Rule 1401				Not an ARAR. Not pertinent to the scope of the response action. U.S. EPA has approved this rule into the SIP, therefore it is should be presented in Table H-5 - Federal Action-specific table.

Table H-6: State Action-Specific ARARs for Remedial Action at AA 3

Alternative 1: No Action; Alternative 2: Limited Grading, Monitoring and Institutional Controls; Alternative 3: Containment, Monitoring and Institutional Controls; Four options for Alternative 3 include: Alternative 3a: Containment with Evapotranspiration Cover, Alternative 3b: Containment with Title 27 prescriptive Cap, Alternative 3c: Containment with Modified Title 27 prescriptive cap with Flexible Membrane Liner (FML), Alternative 3d: Containment with Modified Title 27 prescriptive cap with Geosynthetic Clay Liner (GCL); Alternative 4: Clean Closure and Groundwater Monitoring

Action	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
	Implements the provisions of Part 61, Chapter I, Title 40 of the C.F.R. under the supervision of the Air Quality Management District (AQMD) Executive Officer. It specifies emissions testing, monitoring procedures or handling of hazardous pollutants such as beryllium, benzene, mercury, vinyl chloride and asbestos.		SCAQMD Regulation X				Not an ARAR. Emissions of hazardous pollutants not expected.
Cal-EPA/DTSC Advisories, Guidance, and Criteria							
Ecological risk assessment	Provides guidance for conducting ecological risk assessment at hazardous waste sites and permitted facilities.		Guidance for Conducting Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities (DTSC, July 1996)				Not an ARAR or TBC. The guidance does not contain promulgated requirements; therefore, does not constitute an ARAR. Although ecological risk assessment was conducted for AA 3 as a part of CERCLA remedial action evaluation process, the scope of remedial action at the site does not include ecological risk assessment.
Human health risk assessment	Provides guidance for conducting human health risk assessment for hazardous waste sites and permitted facilities.		Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities (DTSC, July 1992)				Not an ARAR or TBC. The guidance does not contain promulgated requirements; therefore, does not constitute an ARAR. Although human health risk assessment was conducted for AA 3 as a part of CERCLA remedial action evaluation process, the scope of remedial action at the site does not include human health risk assessment.

Note:
* Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific actions are considered potential ARARs.

Acronyms/Abbreviations:

§	section
ARAR	Applicable or relevant and appropriate requirement
AQMD	Air Quality Management District
BACT	best available control technology
BMPs	best management practices
Cal. Code Regs.	California Code of Regulations
Cal. Fish & Game Code	California Fish and Game Code
Cal. Water Code	California Water Code
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COCs	contaminants of concern
DOT	Department of Transportation, California
NPDES	National Pollutant Discharge Elimination System
RWQCB	Regional Water Quality Control Board
SCAQMD	South Coast Air Quality Management District
SIP	state implementation plan
SWRCB	State Water Resources Control Board
TBC	to be considered
tit.	title

Table H-7: Comparison of Potential Closure and Postclosure Requirements for Landfill Sites [a, b]

Closure Activity	POTENTIAL FEDERAL ARARs		POTENTIAL STATE ARARs	
	Cal. Code Regs. tit. 22, RCRA	40 C.F.R. pt. 258, subpt. F	Cal. Code Regs. tit. 27	Controlling[c] ARARs
Security	§ 66264.117(c): Continue security requirements specified in §66264.14, which require 24-hour surveillance, a barrier surrounding entire facility, entry control, and placarding if hazardous waste remains exposed after final closure or if access by public or livestock may pose a threat to human health.	Not specified.	§ 21135(f) and (g): All points of access to the site must be restricted. All monitoring, control, and recovery systems shall be protected from unauthorized access. Once closure activities are complete, site access by the public may be allowed in accordance with the approved postclosure maintenance plan.	Cal. Code Regs. tit. 27, § 21135(f) and (g)
Final grading	§ 66264.228(e)(13): Permanent disposal areas shall be graded at closure so that, with allowance for settling and subsidence, the slope of the land surface above all portions of the cover shall be sufficient to prevent ponding of water.	Not specified.	§ 21090(b)(1): The final cover of closed landfills shall be designed, graded, and maintained to prevent ponding and to prevent site erosion due to high runoff velocities. Slopes should be at least 3 percent.	Cal. Code Regs. tit. 27, § 21090(b)(1)
Landfill gas	§ 66264.310(c): The owner or operator shall provide a control system designed to prevent migration of gas unless it is demonstrated that no gas or vapor will be emitted by waste and no gas will be emitted capable of disrupting cover or causing other property damage.	§ 258.61(a)(4): Maintain and operate the gas monitoring system in accordance with §258.23, which requires monitoring to assure less than 25 percent lower explosive limit for methane in site facilities and less than the lower explosive limit for methane at the facility property boundary.	§ 20921(a)(1), (2), and (3): The operator shall ensure that landfill gases generated at a disposal site are controlled. Methane must not exceed 1.25 percent by volume in air within on-site structures, concentrations of methane gas migrating from the landfill must not exceed 5 percent by volume in air at the property boundary, and trace gases shall be controlled to prevent adverse acute and chronic exposure to toxic and/or carcinogenic compounds.	Cal. Code Regs. tit. 27, § 20921(a)(1), (2), and (3)
Landfill leachate	§ 66264.310(b)(2): Continue to operate leachate collection and removal system until leachate is no longer detected.	§ 258.61(a)(2): Maintain and operate the leachate collection system.	§ 21160(a) and (c): During the postclosure maintenance period, the owner/operator shall assure that leachate collection and control is done in a manner that prevents public contact and controls vectors, nuisance, and odors. § 21090(c)(2): Continue to operate the leachate collection and removal system as long as leachate is generated and detected.	Cal. Code Regs. tit. 22, § 66264.310(b) (2) and Cal. Code Regs. tit. 27, § 21160(a) and (c)
Groundwater monitoring	§ 66264.310(b)(3): After final closure, maintain and monitor the groundwater system and comply with all other applicable requirements of art. 6, ch. 14.	§ 258.61(a)(3): Monitor the groundwater in accordance with requirements of subpt. E of this part and maintain as applicable.	§ 21090(c)(3): Maintain monitoring systems and monitor groundwater, surface water, and the unsaturated zone in accordance with applicable requirements of art. 1, subch. 3, ch. 3, subdiv. 1 (§20380 et seq.).	Cal. Code Regs. tit. 22, § 66264.310(b)(3)
Compaction	§ 66264.228(e)(1): If waste is to remain in a unit, the unit shall be compacted before any portion of the final cover is installed.	Not specified.	Not specified.	Cal. Code Regs. tit. 22, § 66264.228(e) (1)

Table H-7: Comparison of Potential Closure and Postclosure Requirements for Landfill Sites [a, b]

Closure Activity	POTENTIAL FEDERAL ARARs		POTENTIAL STATE ARARs	
	Cal. Code Regs. tit. 22, RCRA	40 C.F.R. pt. 258, subpt. F	Cal. Code Regs. tit. 27	Controlling[c] ARARs
Postclosure care period	§ 66264.117(b)(1) and (2): Postclosure care shall begin after completion of closure and continue for approximately 30 years, based on protectiveness to human health and the environment.	§ 258.61(a) and (b): Postclosure care must be conducted for approximately 30 years, based on protection of human health and the environment.	§ 20950(a): The postclosure maintenance period shall extend as long as the wastes pose a threat to water quality. § 21180(a): The landfill shall be maintained and monitored for a period of not less than 30 years after completion of closure of the entire solid waste landfill.	Cal. Code Regs. tit. 27, §§ 20950(a) and 21180(a)
Postclosure care	§ 66264.310(b)(1): Maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events throughout the postclosure period.	§ 258.61(a)(1): Maintain the integrity and effectiveness of any final cover, including making repairs to the cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and runoff from eroding or otherwise damaging the final cover during the postclosure care period.	§ 21090(c)(1): Maintain the structural integrity and effectiveness of all containment structures and maintain the final cover as necessary to correct the effects of settlement or other adverse factors.	Cal. Code Regs. tit. 22, § 66264.310 (b)(1)[e]
Erosion control	§ 66264.310(b)(4): Prevent run-on and runoff from eroding or otherwise damaging the final cover throughout the postclosure period.	Not specified.	§ 21090(c)(4): Prevent erosion and related damage of the final cover due to drainage throughout the postclosure maintenance period. § 21150: The drainage and erosion control system shall be designed and maintained to assure integrity of postclosure land uses, roads, and structures; to prevent public contact with waste and leachate; to assure integrity of gas monitoring and control systems; to prevent safety hazards; and to prevent exposure of waste.	Cal. Code Regs. tit. 27, §§ 21090(c)(4), and 21150
Benchmark maintenance	§ 66264.310(b)(5): Protect and maintain surveyed benchmarks throughout the postclosure period.	Not specified.	§ 21090(c)(5): Throughout the postclosure maintenance period, the discharger shall protect and maintain surveyed monuments (installed under § 20950[d]).	Cal. Code Regs. tit. 22, § 66264.310(b) (5)

Table H-7: Comparison of Potential Closure and Postclosure Requirements for Landfill Sites [a, b]

Closure Activity	POTENTIAL FEDERAL ARARs		POTENTIAL STATE ARARs	
	Cal. Code Regs. tit. 22, RCRA	40 C.F.R. pt. 258, subpt. F	Cal. Code Regs. tit. 27	Controlling[c] ARARs
Engineered alternatives to final cover standard	§ 66264.310(a)(7): At final closure of the landfill or upon closure of any cell, the owner or operator shall cover the landfill or cell with a final cover designed and constructed to conform to the provisions of subsections (e) through (r) of § 66264.228, except that a variance shall be granted from any requirement of subsections (e) through (r) that the owner or operator demonstrates is not necessary to protect public health, water quality, or other environmental quality.	§ 258.60(b)(1) and (2): An alternative final cover design may be approved that includes: (1) an infiltration layer that achieves a reduction in infiltration equivalent to the infiltration layer specified in paragraphs (a)(1) and (a)(2) of this section, and (2) an erosion layer that provides protection from wind and water erosion equivalent to the erosion layer specified in paragraph (a)(3) of this section.	§ 20080(b) and (c): Alternatives to prescriptive standards may be considered provided the prescriptive standard is not feasible and there is a specific engineered alternative that is consistent with the performance goal and affords equivalent protection against water quality impairment. § 21090(a): The RWQCB can allow any alternative final cover that it finds will continue to isolate the waste and irrigation waters at least as well as would a final cover built in accordance with applicable prescriptive standards.	Cal. Code Regs. tit. 27, §§ 20080(b) and (c) and 21090(a)

Notes:

[a] Landfill closure and postclosure requirements in potential federal ARARs Cal. Code Regs. tit. 22 and 40 C.F.R. § 258 and potential state ARARs Cal. Code Regs. tit. 27 are "relevant and appropriate" rather than "applicable" if the landfills ceased operation prior to the effective date of the regulations

[b] This table is a general comparison of potential ARARs and does not constitute a site-specific ARAR determination. See Section 4.5.1 and Tables H-5 and H-6 for the determination of potential action-specific ARARs for AA 3, former MCAS El Toro.

[b] Controlling – because 40 C.F.R. § 258, Cal. Code Regs. tits. 22 and 27 contain overlapping requirements, this table was used to compare the three sets of regulations and to select the most stringent as the controlling ARAR; where regulations were judged to be equally stringent, the federal regulations were selected as the controlling ARARs

Acronyms/Abbreviations:

ARAR – applicable or relevant and appropriate requirement
app. – appendix
art. – article
Cal. Code Regs. – *California Code of Regulations*
C.F.R. – *Code of Federal Regulations*
ch. – chapter
cm/sec – centimeters per second
MSWLF – municipal solid waste landfill
pt. – part
RCRA – Resource Conservation and Recovery Act
RWQCB – Regional Water Quality Control Board
§ – section
subdiv. – subdivision
subpt. – subpart
tit. – title

Attachment A
Correspondence – State ARAR Identification

Alan C. Lloyd, Ph.D.
Agency Secretary
Cal/EPA

Department of Toxic Substances Control

5796 Corporate Avenue
Cypress, California 90630

Arnold Schwarzenegger
Governor

September 8, 2005

Mr. Darren Newton
BRAC Environmental Coordinator
Base Realignment and Closure
Marine Corps Air Station El Toro
7040 Trabuco Road
Irvine, California 92618

IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR ANOMALY AREA 3 AT THE FORMER MARINE CORPS AIR STATION (MCAS) EL TORO, CALIFORNIA

Dear Mr. Newton:

This letter transmits the potential ARARs the Navy requested in the preparation of a Remedial Investigation / Feasibility Study (RI/FS) for Anomaly Area 3 at the former MCAS El Toro. At this time, we are forwarding the enclosed ARARs received from the following agencies:

- California Department of Toxic Substances Control
- Air Resources Board
- South Coast Air Quality Management District

In addition, the ARARs for post closure care on landfills sites 3 and 5, received from California Integrated Waste Management Board are also included. DTSC will forward any additional ARARs if received from non-responding agencies at a later date. As you already know, the ARAR analysis is an iterative process and when the remedial alternatives are more fully developed in the RAP, certain ARARs may no longer apply or additional ARARs may become apparent.

received
9/12/05

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ADDRESS OF PRIVATE CITIZEN

FOR ADDITIONAL INFORMATION, CONTACT:

DIANE C. SILVA, RECORDS MANAGER
NAVAL FACILITIES ENGINEERING COMMAND, SOUTHWEST
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132

TELEPHONE: (619) 556-1280
E-MAIL: diane.silva@navy.mil

DTSC looks forward to working closely with the Navy on the remediation at the former MCAS El Toro. If you have any questions, please call me at (714) 484-5395.

Sincerely,

Frank Cheng, P.E.
Remedial Project Manager
Office of Military Facilities
Southern California Operations

Enclosures

cc: Mr. Robert Woodings
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POTENTIAL DTSC CHEMICAL-SPECIFIC ARARS FOR A POTENTIAL REMEDIAL ACTION AT IRP SITE: ANOMALY AREA 3, MCAS EL TORO

CHEMICAL	REQUIREMENT	CRITERIA	CITATION	ARARs DETERMINA-TION	COMMENTS
Hazardous Waste Control Act (HWCA) Primary standards – inorganic and organic chemicals	Maximum contaminant Levels (MCLs) list for drinking water.		Title 22, CCR, Div 4, Ch 15, §64431, §64444	Applicable	State MCLs for tap water standards are more stringent than primary federal standards.
Secondary standards	Secondary MCLs list for drinking water.		Title 22, CCR, Div 4, Ch 15, §64449	Applicable	State secondary MCLs for tap water standards.
Hazardous waste listing and identification	Defines RCRA and non-RCRA hazardous waste. Identification of hazardous waste that poses a potential hazard to human health or the environment when it is improperly treated, stored, transported, or disposed.	Hazardous waste storage, treatment, or disposal.	Title 22, CCR, Div 4.5, Ch 11, Article 1 §66261.2, §66261.3	Applicable	Excavated soil, investigation derived waste, or extracted groundwater from this site may meet the definition of hazardous waste.
Hazardous waste listing and identification	TCLP regulatory levels; persistent and bioaccumulative toxic substances total threshold limit concentrations (TTLC) and soluble threshold limit concentration (STLC)	Hazardous waste storage, treatment, or disposal.	Title 22, CCR, Div 4.5, Ch 11, Article 3, §66261.24	Applicable	Applicable for determining whether waste is hazardous. Using the definition of hazardous waste, excavated soil or investigation derived waste may exceed TCLP for some of the chemicals of concern, making it a characteristic hazardous waste.
Concentration limits of regulated units effluent to groundwater, surface water, and soil	Groundwater and vadose zone protection standards: RCRA hazardous waste TSD facilities shall comply and ensure that hazardous constituents entering the groundwater, surface water, and soil from a regulated unit do not exceed the concentration limit from contaminants of concern in the uppermost aquifer underlying the waste management area beyond the point of compliance.	Hazardous waste treatment, storage, or disposal; uppermost aquifer underlying a waste management unit beyond the point of compliance.	Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.94	Relevant and Appropriate	Applicable for hazardous waste TSD facilities; potentially relevant and appropriate in site-specific circumstances, such as when the source of waste is unknown but the waste is similar in composition to listed waste or when waste constituents have released or have the potential to release to groundwater.

TO BE CONSIDERED STATE ADVISORIES, GUIDANCE, CRITERIA AND PROPOSED STANDARDS, CAL/EPA, DTSC

1. *Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities*
   DTSC Human and Ecological Risk Division
   July 1996

2. *Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities*
   DTSC Human and Ecological Risk Division
   July 1992

POTENTIAL DTSC LOCATION-SPECIFIC ARARS FOR A POTENTIAL REMEDIAL ACTION AT
IRP SITE: ANOMALY AREA 3, MCAS EL TORO

LOCATION	REQUIREMENT	CRITERIA	CITATION	ARARs DETERMINA-TION	COMMENTS
Within a 100-year floodplain	Facility must be designed, constructed, operated, and maintained to prevent washout by flood or maximum high tide.	RCRA and non-RCRA (California) hazardous waste; treatment, storage, or disposal of hazardous waste.	Title 22, CCR, Div 4.5, Ch 14, Article 2, §66264.18(b)	Relevant and Appropriate	The location requirements are considered relevant and appropriate for the siting of remedial systems to reduce the toxicity, volume and/or mobility of chemicals. Under RCRA, new treatment facilities shall not be affected by a 100-year flood or maximum high tide.

TO BE CONSIDERED STATE ADVISORIES, GUIDANCE, CRITERIA AND PROPOSED STANDARDS, CAL/EPA, DTSC

1. *Drilling, Coring, Sampling and Logging at Hazardous Substance Release sites*
   Guidance Manual for Ground Water Investigations
   Cal/EPA, July 1995

2. *Reporting Hydrogeologic Characterization Data at Hazardous Substance Release sites*
   Guidance Manual for Ground Water Investigations
   Cal/EPA, July 1995

3. *Guidelines for Hydrogeologic Characterization of Hazardous Substance Release Sites, Volume 1 & 2*
   Cal/EPA, July 1995

4. *Aquifer Testing for Hydrogeologic Characterization*
   Guidance Manual for Ground Water Investigations
   Cal/EPA, July 1995

5. *Application of Borehole Geophysics at Hazardous Substance Release Sites*
   Guidance Manual for Ground Water Investigations
   Cal/EPA, July 1995

6. *Ground Water Modeling for Hydrogeologic Characterization*
Guidance Manual for Ground Water Investigations
Cal/EPA, July 1995

7. *Monitoring Well Design and Construction for Hydrogeologic Characterization*
Guidance Manual for Ground Water Investigations
Cal/EPA, July 1995

8. *Advisory – Active Soil Gas Investigation*
DTSC/CRWQCB-Los Angeles Region, January 2003

9. *Representative Sampling of Ground Water for Hazardous Substances*
Cal/EPA, July 1995

10. *Accumulating Hazardous Waste at Generator Sites*
Cal/EPA, July 1995

POTENTIAL DTSC ACTION-SPECIFIC ARARS FOR A POTENTIAL REMEDIAL ACTION AT IRP SITE: ANOMALY AREA 3, MCAS EL TORO

ACTION	REQUIREMENT	CRITERIA	CITATION	ARARs DETERMINA-TION	COMMENTS
Hazardous Waste Control Act (HWCA) Standards applicable to generators of hazardous waste a. Determine whether waste is a hazardous waste	Owners or operators who generate waste shall determine whether waste is a hazardous waste.	Generators of hazardous waste who transport or offer hazardous waste for transportation.	Title 22, CCR, Div 4.5, Ch 12, Article 1, §66262.11	Applicable	Applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities are hazardous shall be made when the wastes are generated.
b. Identification number for the generator	A generator shall not treat, store, dispose of, transport or offer for transportation, hazardous waste without having received an identification number.	Generators of hazardous waste who transport or offer hazardous waste for transportation.	Title 22, CCR, Div 4.5, Ch 12, Article 1, §66262.12	Applicable	Applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities are hazardous shall be made when the wastes are generated.
c. Use of mainfest	A generator of hazardous waste who transports or offers hazardous waste for transportation shall prepare a manifest.	Generators of hazardous waste who transport or offer hazardous waste for transportation.	Title 22, CCR, Div 4.5, Ch 12, Article 2, §66262.20, §66262.22	Applicable	Applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities are hazardous shall be made when the wastes are generated.
d. Packaging, Labeling, Marking, Placarding	Before transporting hazardous waste or offering hazardous waste for transportation off-site, the generator must do the following in accordance with DOT regulations: package the waste, label and mark each package of hazardous waste, and ensure that the transport vehicle is correctly placarded.	Generators of hazardous waste who transport or offer hazardous waste for transportation.	Title 22, CCR, Div 4.5, Ch 12, Article 3, §66262.30, §66262.31, §66262.32, §66262.33	Applicable	Applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities are hazardous shall be made when the wastes are generated.
e. Storage of hazardous waste on-site	Requires a generator to accumulate waste on-site for 90 days or less without a permit.	Standards for generators of hazardous waste.	Title 22, CCR, Div 4.5, Ch 12, Article 3, §66262.34	Applicable	Applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities are hazardous shall be made when the wastes are generated.

ACTION	REQUIREMENT	CRITERIA	CITATION	ARARs DETERMINA-TION	COMMENTS
f. Recording keeping and reporting	Establishes requirements for record keeping of manifests, test results, waste analyses, and Biennial Reports.	Standards for generators of hazardous waste.	Title 22, CCR, Div 4.5, Ch 12, Article 4, §66262.40, §66262.41	Applicable	Applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities are hazardous shall be made when the wastes are generated.
Management of hazardous waste at transfer, and TSD facilities	Establish requirements for a hazardous waste treatment facility to have a plan for waste analysis, develop a security system, conduct regular inspections, provide training to facility personnel, and use a quality assurance program during construction.	Standards for owners and operators of hazardous waste transfer and TSD facilities	Title 22, CCR, Div 4.5, Ch 14, Article 2	Relevant and Appropriate	The requirements may be applicable if CERCLA response action constitutes treatment, storage, or disposal as defined under RCRA, or may be relevant and appropriate if the requirements address problems or situations sufficiently similar to the specific circumstances at the site that their usage will be well suited. AA3 is not a TSD facility; however, because contamination in groundwater or soil is similar in composition to listed waste, this requirement is determined to be relevant and appropriate.
Management of hazardous waste at transfer, and TSD facilities	Establish requirements for a facility to plan for emergency conditions. In addition, the design and operation of the facility must be done to prevent releases. Other requirements include testing and maintenance of equipment and incorporation of communication and alarm systems and contingency plan.	Standards for owners and operators of hazardous waste transfer and TSD facilities	Title 22, CCR, Div 4.5, Ch 14, Articles 3 and 4	Relevant and Appropriate	The requirements may be applicable if CERCLA response action constitutes treatment, storage, or disposal as defined under RCRA, or may be relevant and appropriate if the requirements address problems or situations sufficiently similar to the specific circumstances at the site that their usage will be well suited. AA3 is not a TSD facility; however, because contamination in groundwater or soil is similar in composition to listed waste, this requirement is determined to be relevant and appropriate.
Groundwater monitoring and response	Owners or operators of a RCRA surface impoundment, waste pile, land treatment unit, or landfill shall conduct a monitoring and response program for each regulated unit.	Constituents in or derived from the units may pose a threat to human health or the environment.	Title 22, CCR, Div 4.5, Ch 14, Article 6 §66264.91 (a) and (c)	Relevant and Appropriate	Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.
Monitoring	Requirements for monitoring groundwater, surface water, and vadose zone.	RCRA hazardous waste TSD facilities	Title 22, CCR, Div 4.5, Ch 14, Article 6 §66264.97 (b), (c), (d) and (e)(1) through (e)(5)	Relevant and Appropriate	Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.

ACTION	REQUIREMENT	CRITERIA	CITATION	ARARs DETERMINA-TION	COMMENTS
Detection monitoring	Requires the owner or operator of a regulated unit to develop a detection monitoring program that will provide reliable indication of a release.	RCRA hazardous waste TSD facilities	Title 22, CCR, Div 4.5, Ch 14, Article 6 §66264.98	Relevant and Appropriate	Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.
Evaluation monitoring	Requires the owner or operator of a regulated unit to develop an evaluation monitoring program that can be used to assess the nature and extent of a release from the unit.	RCRA hazardous waste TSD facilities	Title 22, CCR, Div 4.5, Ch 14, Article 6 §66264.99	Relevant and Appropriate	Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.
Corrective action	The owner or operator is required to take corrective action under Title 22, CCR, §66264.91 to remediate releases from the regulated unit and to ensure that the regulated unit achieves compliance with the water quality protection standard.	RCRA hazardous waste TSD facilities	Title 22, CCR, Div 4.5, Ch 14, Article 6 §66264.100 (a) through (d), (f), (g)(1), and (h)	Relevant and Appropriate	Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.
Corrective action for Waste Management Units	The owner or operator is required to take corrective action to remediate releases from any solid or hazardous waste management unit at the facility to protect public health and the environment.	RCRA hazardous waste TSD facilities	Title 22, CCR, Div 4.5, Ch 14, Article 6 §66264.101	Relevant and Appropriate	Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.
Closure and post-closure care	Owners and operators shall close a facility and perform post-closure care when contaminated subsurface soil cannot be practically removed or decontaminated.	Waste residues, contaminated containment system components, contaminated soil, and structures and equipment left in place at final closure triggers post-closure care requirements when clean closure is not achieved.	Title 22, CCR, Div 4.5, Ch 14, Article 7, §66264.111, §66264.112, §66264.115 through 120	Relevant and Appropriate	Contaminated soil, residues, or groundwater from remedial action at a site will achieve clean closure; otherwise, post-closure care requirements will be relevant and appropriate.
Use and management of containers	Containers used for the transfer or storage of hazardous waste must be in good condition, compatible with the waste, kept closed except to add or remove materials and be inspected weekly. The area used to store the containers must provide adequate secondary containment and be designed with runoff controls. Also, appropriate closure of the containers must take place.	Standards for owners and operators of all hazardous waste facilities that transfer or store containers of hazardous waste.	Title 22, CCR, Div 4.5, Ch 14, Article 9	Relevant and Appropriate	The requirements may be applicable if CERCLA response action constitutes treatment, storage, or disposal as defined under RCRA, or may be relevant and appropriate if the requirements address problems or situations sufficiently similar to the specific circumstances at the site that their usage will be well suited. AA3 is not a TSD facility.

ACTION	REQUIREMENT	CRITERIA	CITATION	ARARs DETERMINA-TION	COMMENTS
Tank systems	The remedial activities may involve storage and/or treatment in tanks. These tanks are required to have secondary containment, be monitored and inspected, be provided with overfill and spill protection controls, and operated with adequate freeboard. Also, appropriate closure must take place.	Standards for owners and operators of facilities that use tank systems for transferring, storing or treating hazardous waste.	Title 22, CCR, Div 4.5, Ch 14, Article 10	Relevant and Appropriate	The requirements may be applicable if CERCLA response action constitutes treatment, storage, or disposal as defined under RCRA, or may be relevant and appropriate if the requirements address problems or situations sufficiently similar to the specific circumstances at the site that their usage will be well suited. AA3 is not a TSD facility.
Waste piles	The waste piles should be placed upon a lined foundation or base with a leachate system, protected from precipitation and wind dispersal, designed to prevent run on and run off. Also, closure and post-closure care requirements.	Standards for owners and operators of facilities that store or treat hazardous waste in piles.	Title 22, CCR, Div 4.5, Ch 14, Article 12	Relevant and Appropriate	Remedial action may involve soil excavation and the compiling of soil in a temporary waste pile. This requirement is determined to be relevant and appropriate. Applicable if the excavated waste meets RCRA hazardous waste criteria.
Landfills	The requirements for landfills include the design and operation, action leakage rate, monitoring and inspection, response actions, surveying and recordkeeping and closure and post-closure care.	Standards for owners and operators of facilities that dispose of hazardous waste in landfills.	Title 22, CCR, Div 4.5, Ch 14, Article 14	Relevant and Appropriate	
Miscellaneous units	Applies to waste management unit not otherwise regulated under RCRA. It may include pumps, auxiliary equipment, air strippers, etc. The substantive requirements include design, construction, operation, maintenance and closure of the unit that will ensure protection of human health and the environment. The actions include general inspections for safety and operation efficiency, testing and maintenance of the equipment (including testing of warning systems).	Standards for owners and operators of facilities that treat, store or dispose of hazardous waste in miscellaneous units.	Title 22, CCR, Div 4.5, Ch 14, Article 16	Relevant and Appropriate	Applicable if pumps are used for extraction and treatment of leachate that meets RCRA hazardous waste criteria.
Land Disposal Restrictions (LDR) for RCRA wastes and non-RCRA wastes	Movement of hazardous waste to new locations and placed in or on land will trigger LDR. General applicability, dilution prohibited, waste analysis and record keeping, and special rules apply for wastes that exhibit a characteristic waste. Best Demonstrated Available Technology (BDA) standards for each hazardous constituent in each listed waste, if residual is to be disposed. Utilize treatment standards table when necessary.	Hazardous waste land disposal. Defines hazardous wastes that are restricted from land disposal and prohibited waste that may be land disposed.	Title 22, CCR, Div 4.5, Ch 18, Articles 1, 3, 4, 10, 11	Applicable	Where applicable, hazardous waste generated from remedial activities must comply with LDR and meet the treatment standards or notify the disposal facility of the treatment standards before disposal at an appropriate offsite disposal facility.

ACTION	REQUIREMENT	CRITERIA	CITATION	ARARs DETERMINA-TION	COMMENTS
Land-use Restrictions	Provides conditions under which land-use restrictions will apply to successive owners of land.	Institutional Controls is a component of the remedy	Cal. Civ. Code § 1471	Relevant and appropriate	Generally, Cal. Civ. Code § 1471 allows an owner of land to make a covenant to restrict the use of land for the benefit of a covenantee. The covenant runs with the land to bind successive owners, and the restrictions must be reasonably necessary to protect present or future human health or safety or the environment as a result of the presence on the land of hazardous materials, as defined in section 25260 of the California Health and Safety Code. Substantive provisions are the following general narrative standard: "to do or refrain from doing some act on his or her own land...where (c) Each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety or the environment as a result of the presence of hazardous materials, as defied in Section 25260 of the California Health and Safety Code." This narrative standard would be implemented through incorporation of restrictive covenants in the deed and Covenant to Restrict Use of Property at the time of transfer.
Land-use Restrictions	Allows DTSC to enter into an agreement with the owner of a hazardous waste facility to restrict present and future land uses.	Institutional Controls is a component of the remedy	Cal. Health & Safety Code § 25202.5	Relevant and appropriate	The substantive provisions of Cal. Health & Safety Code § 25202.5 are the general narrative standards to restrict "present and future uses of all or part of the land on which the...facility...is located..."

ACTION	REQUIREMENT	CRITERIA	CITATION	ARARs DETERMINA-TION	COMMENTS
Land-use Restrictions	Provides a streamlined process to be used to enter into an agreement to restrict specific use of property.	Institutional Controls is a component of the remedy	Cal. Health & Safety Code §§ 25222.1 and 25355.5(a)(1)(C)	Relevant and appropriate	Generally, Cal. Health & Safety Code §§ 25222.1 and 25355.5(a)(1)(C) provides the authority for the Department of Toxic Substances Control to enter into voluntary agreements with landowners to restrict the use of property. The agreements run with the land restricting present and future uses of the land. The substantive requirements of the following Cal. Health & Safety Code § 25222.1 provisions are "relevant and appropriate": (1) the general narrative standard: "restricting specified uses of the property..." and (2) "...the agreement is irrevocable, and shall be recorded by the owner, ...as a hazardous waste easement, covenant, restriction or servitude, or any combination thereof, as appropriate, upon the present and future uses of the land." The substantive requirements of the following Cal. Health and Safety Code 25355.5(a)(1)(C) provisions are "relevant and appropriate": "...execution and recording of a written instrument that imposes an easement, covenant, restriction, or servitude, or combination thereof, as appropriate, upon the present and future uses of the land."
Land-use Restrictions	Provides processes and criteria for obtaining written variances from a land-use restriction and for removal of the land-use restrictions.	Institutional Controls is a component of the remedy	Cal. Health & Safety Code §§ 25233(c) and 25234	Relevant and appropriate	Cal. Health & Safety Code § 25233(c) sets forth "relevant and appropriate" substantive criteria for granting variances based upon specified environmental and health criteria. Cal. Health & Safety Code § 25234 sets forth the following "relevant and appropriate" substantive criteria for the removal of a land-use restriction on the grounds that "...the waste no longer creates a significant existing or potential hazard to present or future public health or safety."

ACTION	REQUIREMENT	CRITERIA	CITATION	ARARs DETERMINA-TION	COMMENTS
Land-use Covenants	Requirements for land-use covenants.	Institutional Controls is a component of the remedy	Cal..Code Regs. Title 22, § 67391.1	Relevant and appropriate	Cal. Code Regs. Tit. 22 § 67391.1 provides for a land-use covenant to be executed and recorded when remedial actions are taken and hazardous substances will remain at the property at concentrations that are unsuitable for unrestricted use of the land. The substantive provisions of this regulation have been determined to be "relevant and appropriate" state ARARs by the DON.
Occupational Health and Safety Act	Specific requirements that employers must meet to ensure the safety of their employees.		Cal. Health & Safety Code, Div 5, §6300 et seq.	Relevant and Appropriate	The provisions of this act should be followed for the remedial action.

TO BE CONSIDERED STATE ADVISORIES, GUIDANCE, CRITERIA AND PROPOSED STANDARDS, CAL/EPA, DTSC

1. *Transportation Plan*
   Preparation Guidance for Site Remediation
   DTSC, May 1994

California Regional Water Quality Control Board
Santa Ana Region

Alan C. Lloyd, Ph.D.
Secretary

3737 Main Street, Suite 500, Riverside, California 92501-3348
Phone (951) 782-4130 – FAX (951) 781-6288 – TTY (951) 782-3221
http://www.waterboards.ca.gov/santaana

Arnold Schwarzenegger
Governor

September 28, 2005

Base Realignment and Closure
Attn: Mr. Darren Newton
BRAC Environmental Coordinator
7040 Trabuco Road
Irvine, California 92618

REQUEST FOR IDENTIFICATION OF APPLICABLE OR RELEVANT AND OR APPROPRIATE REQUIREMENTS (ARARs) FOR ANOMALY AREA 3 (LANDFILL), FORMER MARINE CORPS AIR STATION, EL TORO, SWRCB GEOTRACKER ID: DOD100131500

Dear Mr. Newton:

This letter is in response to your request of July 22, 2005 for our agency to identify ARARs for the landfill Anomaly Area 3 Site. Below please find our ARARs.

1. Please add each of the following:
   - **Santa Ana River Basin Water Quality Control Plan, 1995, amended by Regional Board Resolutions:**
     - **Resolution No. 97-20** – Bacterial Objectives for Ocean Waters,
     - **Resolution No. 98-100** – Newport Bay Watershed Nutrient TMDL,
     - **Resolution No. 98-101** – Newport Bay Watershed Sediment TMDL,
     - **Resolution No. 99-10** – Newport Bay Fecal Coliform TMDL,
     - **Resolution No. 00-27**– Incorporate Language Authorizing Compliance Schedules in NPDES, and
     - **Resolution No. R8-2004-0001** – Incorporate an Updated Total Dissolved Solids (TDS) Management Plan.

   Note that the Basin Plan designates beneficial uses and water quality objectives for all surface waters and groundwater management zones within the Region. Groundwater and soil cleanup goals are based on protection of designated beneficial uses and water quality objectives.

2. **Porter-Cologne Water Quality Control Act - §13000, §13140-13147, §13172, §13260, §13263, §13267 and §13304** must be appropriately cited and incorporated as ARARs.

3. **Title 27 California Code of Regulations** – Regulations include disposal of solid waste. Specific topics of concern are addressed in:
   §20240(c) – Five-Foot Separation;
   §20385 - Monitoring Requirements;
   §20950(a), (e) – General Closure and Post-Closure Maintenance; &
   §21090(b)(1), (c), (e)(2) – General Post-Closure Maintenance.

received
9/28/05

4. **State Water Resources Control Board Resolution No. 68-16** – Requires that high quality surface and groundwater be maintained to the maximum extent possible.

5. **State Water Resources Control Board Resolution No. 92-49** – Establishes requirements for investigation and cleanup and abatement of discharges.

For any questions, please call me at (951) 782-4494, or send email to jbroderick@waterboards.ca.gov.

Sincerely,

John Broderick
SLIC/DoD Section

cc via email: Mr. Jorge Leon, SWRCB, OCC
Mr. Richard Muza, US EPA, Region 9
Mr. Frank Cheng, DTSC, Office of Military Facilities
Ms. Content Arnold, NAVFACENGCOM, Southwest Division

Air Resources Board

Cindy K. Tuck, Chair
1001 I Street • P.O. Box 2815
Sacramento, California 95812 • www.arb.ca.gov

Alan C. Lloyd, Ph.D.
Agency Secretary

Arnold Schwarzenegger
Governor

TO: Frank Cheng, P.E.
Remedial Project Manager
Southern California Operations Branch
Office of Military Facilities
Department of Toxic Substances Control
5796 Corporate Avenue
Cypress, California 90630

FROM: Jim Aguila, Manager
Substance Evaluation Section
Air Quality Measures Branch
Stationary Source Division

DATE: August 14, 2005

SUBJECT: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR ANOMALY AREA 3 AT FORMER MARINE CORPS AIR STATION, EL TORO

This memorandum is in response to your request for potential California "Applicable or Relevant and Appropriate Requirements (ARARs) for Anomaly Area 3 at the former Marine Corps Air Station, El Toro. State law, as codified in the Health and Safety Code (Division 26, section 40000), provides to local and regional authorities the primary responsibilities for control of air pollution from sources other than emissions from motor vehicles. Air pollution control districts and air quality management districts are required to adopt and enforce rules to achieve or maintain the state and federal ambient air quality standards in all areas affected by emission sources under their jurisdiction.

Rules and regulations of the South Coast Air Quality Management District (SCAQMD) should be considered as potential action-specific ARARs for this site. If you have not contacted the SCAQMD, we recommend that you contact Mr. Jay Chen, Manager, Toxics Section, at (909) 396-2664. SCAQMD rules that may apply include:

201	Permit to Construct
203	Permit to Operate
402	Nuisance
1150.1	Control of Gaseous Emissions from Municipal Solid Waste Landfills
1401	New Source Review of Carcinogenic Air Contaminants

In addition, the California Ambient Air Quality Standards (CAAQS, list enclosed) may apply as chemical-specific ARARs. During construction of a landfill cover, the CAAQS for particulate matter (PM10) should be considered as a potential chemical-specific ARAR. This is to ensure that activities undertaken to remediate this site do not cause ambient air concentrations above the health protection levels of the CAAQS.

If you have questions, please call Mr. Lynn Baker of my staff at (916) 324-6997.

Enclosure

cc: Mr. Jay Chen (w/o Enclosure)
Manager
Toxics Section
South Coast AQMD
21865 East Copley Drive
Diamond Bar, California 91765

Mr. Lynn Baker (w/o Enclosure)
Staff Air Pollution Specialist
Substance Evaluation Section
Air Resources Board

South Coast
Air Quality Management District
21865 Copley Drive, Diamond Bar, CA 91765-4178
(909) 396-2000 • www.aqmd.gov

August 18, 2005

Department of Toxic Substances Control
Office of Military Facilities
5796 Corporate Avenue
Cypress, CA 90630

Attn: Frank Cheng, P.E.
Remedial Project Manager

The AQMD appreciates your request for input into compiling Applicable or Relevant and Appropriate Requirements (ARAR's), pursuant to Superfund Amendments and Reauthorization Act (SARA), for the Remedial Investigation/Feasibility Study (RI/FS) for Anomaly 3 at the former Marine Corps Air Station (MCAS), El Toro, California, as stated in your letter, dated August 1, 2005.

The following AQMD Rules and Regulations, which are available at our website, www.aqmd.gov, should be incorporated in the ARAR's.

Regulation IV - Prohibitions

Rule 401 - Visible Emissions
This rule limits any visible emissions from any single source to less than Ringlemann No. 1 or 20 percent opacity for 3 minutes in any hour (Ref. Health and Safety Code 41701).

Rule 402 - Nuisance
This rule prohibits the discharge of any air contaminant or other material (including odorous compounds) that causes injury or annoyance to the public, endangers the comfort, repose, health or safety of the public, or causes damage to business or property. In general, a Notice of Violation may be issued upon receipt of six verified complaints, or for any property damage, or personal injury (Ref. Health and Safety Code 41700).

Rule 403 - Fugitive Dust
This rule limits on-site activities so that the concentrations of fugitive dust at the property line shall not be visible. In addition, PM_{10} levels shall not exceed 50 micrograms per cubic meter as determined by the difference between upwind and downwind samples collected on high volume particulate matter samplers. These requirements do not apply if the wind gusts exceed 25 miles per hour. The rule also requires every reasonable precaution to minimize fugitive dust and the prevention and cleanup of any material accidentally deposited on paved streets. This rule shall not apply during life-threatening situations, or during a declared disaster, or state of emergency.

Rule 404 - Particulate Matter
This rule limits equipment from discharging particulate emissions in excess of 0.01 to 0.196 grain per cubic foot based on a given volumetric (dry standard cubic feet per minute) exhaust gas flow rate averaged over one hour or one cycle of operation. It excludes steam generators or gas turbines.

Rule 405 - Solid Particulate Matter
This rule limits equipment from discharging particulate emissions in excess of 0.99 to 30 pounds per hour based on a given process weight.

Rule 407 - Liquid and Gaseous Air Contaminants
This rule limits equipment from discharging carbon monoxide emissions in excess of 2000 ppm and sulfur dioxide emissions of 500 ppm or greater averaged over 15 minutes. It excludes stationary internal combustion engines, propulsion of mobile equipment or emergency venting.

Rule 408 - Circumvention
This rule prohibits a person from building, erecting, installing or using any equipment, the use of which reduces or conceals an emission which would otherwise constitute a violation of these rules or Chapter 3 (starting with 41700) of Part 4, of Division 26 of the Health and Safety Code.

Rule 409 - Fuel Combustion Contaminants
This rule limits the emissions of particulate matter from the exhaust of a combustion source (such as a gas turbine) to 0.23 grams per cubic meter (0.1 grains per standard cubic foot) at 12 percent CO_2 averaged over 15 minutes. It excludes internal combustion engines.

Rules 431.1, 431.2, 431.3 - Sulfur Content of Gaseous, Liquid or Fossil Fuels
These rules limit sulfur compounds from combustion of gaseous fuels not to exceed 40 ppm, 0.05 percent by weight for liquid fuels and 0.56 pounds of sulfur per million BTU for solid fossil fuels.

Rule 474 - Fuel Burning Equipment-Oxides of Nitrogen
This rule limits the concentration of oxides of nitrogen (as NO_2) averaged over 15 minutes, from any non-mobile fuel burning equipment, to a range of 125 to 300 ppm for gaseous fuels and 225 to 400 ppm for solid and liquid fuels depending on equipment size.

<u>Regulation X - National Emission Standards for Hazardous Air Pollutants</u>

This regulation implements the provisions of Part 61, Chapter I, Title 40 of the Code of Federal Regulations (CFR) under the supervision of the AQMD Executive Officer. It specifies emissions testing, monitoring procedures or handling of hazardous pollutants such as beryllium, benzene, mercury, vinyl chloride and asbestos.

Regulation XI - Source Specific Standards

Rule 1150 - Excavation of Landfill Sites
This rule states that no person shall initiate excavation of an active or inactive landfill without an Excavation Management Plan approved by the Executive Officer of AQMD. The Plan shall provide information regarding the quantity and characteristics of the material to be excavated and transported and shall identify mitigation measures including gas collection and disposal, baling, encapsulating, covering the material and chemical neutralizing.

Rule 1166 - Volatile Organic Compound Emissions from Decontamination of Soil
This rule limits the emissions of volatile organic compounds (VOCs) from contaminated soil to less than 50 ppm. For contaminated soil with 50 ppm or greater, an approved mitigation plan, describing removal methods and mitigation measures, must obtained from the District prior to proceeding with the excavation. Uncontrolled spreading of contaminated soil is not permitted.

Regulation XIII - New Source Review

This regulation applies to any new or modified equipment, which may cause the issuance of any non-attainment air contaminant, ozone depleting compound or ammonia. It requires all equipment to be constructed with BACT (Best Available Control Technology). For non-attainment emission increases, it requires the emission increases to be offset and substantiated with modeling that the equipment will not cause a significant increase in concentrations of non-attainment contaminants.

Regulation XIV - Toxics

Rule 1401 - New Source Review of Carcinogenic Air Contaminants
This rule specifies limits for cancer risk and excess cancer cases from new stationary sources and modifications to existing stationary sources that emit carcinogenic air contaminants. The rule establishes allowable emission impacts for all such stationary sources requiring new permits pursuant to AQMD Rules 201 or 203. Best Available Control Technology for Toxics (T-BACT) will be required for any system where a lifetime (70 years) maximum individual cancer risk of one in one million or greater is estimated to occur. Limits are calculated using risk factors for specific contaminants.

DTSC
AUG 2 4 2005
CYPRESS

Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards [1]		Federal Standards [2]		
		Concentration [3]	Method [4]	Primary [3,5]	Secondary [3,6]	Method [7]
Ozone (O_3)	1 Hour	0.09 ppm (180 µg/m^3)	Ultraviolet Photometry	0.12 ppm (235 µg/m^3)[8]	Same as Primary Standard	Ultraviolet Photometry
	8 Hour	—		0.08 ppm (157 µg/m^3)[8]		
Respirable Particulate Matter (PM10)	24 Hour	50 µg/m^3	Gravimetric or Beta Attenuation	150 µg/m^3	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	20 µg/m^3		50 µg/m^3		
Fine Particulate Matter (PM2.5)	24 Hour	No Separate State Standard		65 µg/m^3	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	12 µg/m^3	Gravimetric or Beta Attenuation	15 µg/m^3		
Carbon Monoxide (CO)	8 Hour	9.0 ppm (10mg/m^3)	Non-Dispersive Infrared Photometry (NDIR)	9 ppm (10 mg/m^3)	None	Non-Dispersive Infrared Photometry (NDIR)
	1 Hour	20 ppm (23 mg/m^3)		35 ppm (40 mg/m^3)		
	8 Hour (Lake Tahoe)	6 ppm (7 mg/m^3)		—	—	—
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	—	Gas Phase Chemiluminescence	0.053 ppm (100 µg/m^3)	Same as Primary Standard	Gas Phase Chemiluminescence
	1 Hour	0.25 ppm (470 µg/m^3)		—		
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean	—	Ultraviolet Fluorescence	0.030 ppm (80 µg/m^3)	—	Spectrophotometry (Pararosaniline Method)
	24 Hour	0.04 ppm (105 µg/m^3)		0.14 ppm (365 µg/m^3)	—	
	3 Hour	—		—	0.5 ppm (1300 µg/m^3)	
	1 Hour	0.25 ppm (655 µg/m^3)		—	—	—
Lead[9]	30 Day Average	1.5 µg/m^3	Atomic Absorption	—	—	—
	Calendar Quarter	—		1.5 µg/m^3	Same as Primary Standard	High Volume Sampler and Atomic Absorption
Visibility Reducing Particles	8 Hour	Extinction coefficient of 0.23 per kilometer — visibility of ten miles or more (0.07 — 30 miles or more for Lake Tahoe) due to particles when relative humidity is less than 70 percent. Method: Beta Attenuation and Transmittance through Filter Tape.		No Federal Standards		
Sulfates	24 Hour	25 µg/m^3	Ion Chromatography			
Hydrogen Sulfide	1 Hour	0.03 ppm (42 µg/m^3)	Ultraviolet Fluorescence			
Vinyl Chloride[9]	24 Hour	0.01 ppm (26 µg/m^3)	Gas Chromatography			

See footnotes on next page ...

1. California standards for ozone, carbon monoxide (except Lake Tahoe), sulfur dioxide (1 and 24 hour), nitrogen dioxide, suspended particulate matter—PM10, PM2.5, and visibility reducing particles, are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.

2. National standards (other than ozone, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest eight hour concentration in a year, averaged over three years, is equal to or less than the standard. For PM10, the 24 hour standard is attained when the expected number of days per calender year with a 24-hour average concentration above 150 $\mu g/m^3$ is equal to or less than one. For PM2.5, the 24 hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard. Contact U.S. EPA for further clarification and current federal policies.

3. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

4. Any equivalent procedure which can be shown to the satisfaction of the ARB to give equivalent results at or near the level of the air quality standard may be used.

5. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.

6. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

7. Reference method as described by the EPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the EPA.

8. New federal 8-hour ozone and fine particulate matter standards were promulgated by U.S. EPA on July 18,1997. Contact U.S. EPA for further clarification and current federal policies.

9. The ARB has identified lead and vinyl chloride as 'toxic air contaminants' with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

Sta ARARs for Solid Waste Disposal Site C ure and Postclosure Maintenance

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description	Comment	Associated Site
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	27 CCR 20921-20937 Ch. 3, Sub. 4, Article 6, Closure & Postclosure Maint. Standards for Disposal Sites and Landfills	Applicable or Relevant and Appropriate	Gas Monitoring and Control During Closure and Postclosure; to protect public health and safety and the environment, landfill gases generated at a disposal site will be controlled to ensure that: 1) concentrations of methane gas do not exceed 1.25% by volume in air within on-site structures, 2) concentrations of methane do not exceed 5% by volume in air at the property or designated landfill boundary and 3) trace gases do not pose an acute or chronic exposure to toxic or carcinogenic compounds	Closure or Postclosure Maintenance Standards for Disposal Sites and Landfills of 27 CCR, Ch. 3, Subh. 5, Art. 2, Scope & Applicability pursuant 27 CCR 21100	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	27 CCR 21180 Ch. 3, Sub. 5, Article 2, Closure & Postclosure Maint. Standards for Disposal Sites and Landfills	Applicable or Relevant and Appropriate	Postclosure Maintenance: the landfill must be maintained and monitored for no less than 30 years following closure.	Closure or Postclosure Maintenance Standards for Disposal Sites and Landfills of 27 CCR, Ch. 3, Subch. 5, Art. 2, Scope & Applicability pursuant 27 CCR 21100.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	27 CCR 21190 Ch. 3, Sub. 5, Article 2, Closure & Postclosure Maint. Standards for Disposal Sites and Landfills	Applicable or Relevant and Appropriate	Postclosure Land Use: Site Closure Design shall show one or more proposed uses of the closed site or show development that is compatible with open space. Changes in postclosure land use must be approved by the appropriate State agency prior to implementation.	Closure or Postclosure Maintenance Standards for Disposal Sites and Landfills of 27 CCR, Ch. 3, Subch. 5, Art. 2, Scope & Applicability pursuant 27 CCR 21100	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43509	27 CCR 21800 Ch. 4, Subch. 4, Final Closure Plan Contents	Relevant and Appropriate	Provides the content requirements for closure plans for solid waste disposal sites.	Applies to solid waste disposal sites that received waste after November 1990. Relevant and appropriate for closing sites that did not receive waste after November 1990	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43509	27 CCR 21830 Ch. 4, Subch. 4, Final Closure Plan Contents	Relevant and Appropriate	Provides the content requirements for postclosure maintenance plans for solid waste disposal sites.	Applies to solid waste disposal sites that received waste after November 1990. Relevant and appropriate for closing sites that did not receive waste after November 1990.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43509	27 CCR 21880 Ch. 4, Subch. 4, Final Closure Plan Contents	Relevant and Appropriate	Provides the content requirements to obtain certification that the solid waste disposal sites has closed pursuant to state standards.	Applies to solid waste disposal sites that received waste after November 1990. Relevant and appropriate for closing sites that did not receive waste after November 1990	For closing sites

27 CCR - California Code of Regulations, Title 27 ARAR - applicable or relevant and appropriate requirement ROD - Record of Decision RD/RA - remedial design/remedial action

State ARARs for Solid Waste Disposal Site Closure and Postclosure Maintenance

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description	Comment	Associated Site
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	27 CCR 21130 Ch. 3, Subch. 5, Art. 2, Closure & Postclosure Maint. Standards for Disposal Sites and Landfills	Applicable or Relevant and Appropriate	Emergency Response: potential emergency conditions that may exceed the design of the site and could endanger the public health or environment must be anticipated. Response procedures for these conditions must be addressed in the RD/RA plans.	Closure or Postclosure Maintenance Standards for Disposal Sites and Landfills of 27 CCR, Ch. 3, Subch. 5, Art. 2. Scope & Applicability pursuant 27 CCR 21100.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	27 CCR 21135 Ch. 3, Subch. 5, Art. 2, Closure & Postclosure Maint. Standards for Disposal Sites and Landfills	Applicable or Relevant and Appropriate	Site Security: all points of access to the site must be restricted, except permitted entry points. All monitoring, control, and recovery systems shall be protected from unauthorized access.	Closure or Postclosure Maintenance Standards for Disposal Sites and Landfills of 27 CCR, Ch. 3, Subch. 5, Art. 2. Scope & Applicability pursuant 27 CCR 21100	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	27 CCR 21137 Ch. 3, Subch. 5, Art. 2, Closure & Postclosure Maint. Standards for Disposal Sites and Landfills	Applicable or Relevant and Appropriate	Structure Removal: site structures and leachate and gas control systems not intended for reuse will be dismantled and removed at the time of closure to protect public health and safety.	Closure or Postclosure Maintenance Standards for Disposal Sites and Landfills of 27 CCR, Ch. 3, Subch. 5, Art. 2. Scope & Applicability pursuant 27 CCR 21100	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	27 CCR 21140 Ch. 3, Subch. 5, Art. 2, Closure & Postclosure Maint. Standards for Disposal Sites and Landfills	Applicable or Relevant and Appropriate	Final Cover: the final cover shall function with minimum maintenance and provide waste containment to protect public health and safety by controlling at a minimum, vectors, fire, odor, litter and landfill gas migration. The final cover shall also be compatible with postclosure land use.	Closure or Postclosure Maintenance Standards for Disposal Sites and Landfills of 27 CCR, Ch. 3, Subch. 5, Art. 2. Scope & Applicability pursuant 27 CCR 21100	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	27 CCR 21142 Ch. 3, Sub. 5, Article 2, Closure & Postclosure Maint. Standards for Disposal Sites and Landfills	Applicable or Relevant and Appropriate	Final Grading: final grades must be designed and maintained to reduce impacts to health and safety and take into consideration any postclosure land use.	Closure or Postclosure Maintenance Standards for Disposal Sites and Landfills of 27 CCR, Ch. 3, Subch. 5, Art. 2. Scope & Applicability pursuant 27 CCR 21100	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	27 CCR 21145 Ch. 3, Subch. 5, Art. 2, Closure & Postclosure Maint. Standards for Disposal Sites and Landfills	Applicable or Relevant and Appropriate	Slope Stability: the operator shall ensure the integrity of final slopes under both static and dynamic conditions to protect public health & safety and prevent damage to postclosure land uses, roads, structures, utilities, gas monitoring and control systems, leachate collection and control systems to prevent public contact with leachate, and prevent exposure of waste.	Closure or Postclosure Maintenance Standards for Disposal Sites and Landfills of 27 CCR, Ch. 3, Subch. 5, Art. 2. Scope & Applicability pursuant 27 CCR 21100.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	27 CCR 21150 Ch. 3, Subch. 5, Art. 2, Closure & Postclosure Maint. Standards for Disposal Sites and Landfills	Applicable or Relevant and Appropriate	Drainage and Erosion Control: the drainage and erosion control system shall be designed and maintained to ensure integrity of postclosure land uses, roads, and structures; to prevent public contact with waste and leachate; to ensure integrity of gas monitoring and control systems; to prevent safety hazards; and to prevent exposure of waste.	Closure or Postclosure Maintenance Standards for Disposal Sites and Landfills of 27 CCR, Ch. 3, Sub. 5, Art. 2. Scope & Applicability pursuant to 27 CCR 21100	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	27 CCR 21160 Ch. 3, Sub. 5, Article 2, Closure & Postclosure Maint. Standards for Disposal Sites and Landfills	Applicable or Relevant and Appropriate	Landfill Gas Control and Leachate Contact: landfill gas control shall be implemented and maintained; leachate must be collected and controlled in a manner which prevents public contact and controls vectors, nuisance and odor.	Closure or Postclosure Maintenance Standards for Disposal Sites and Landfills of 27 CCR, Ch. 3, Subch. 5, Art. 2, Scope & Applicability pursuant 27 CCR 21100. The state does not intend that subsurface leachate monitoring and collecting systems need to be added to existing landfills unless leachate production and/or accumulation is evident.	For closing sites

Appendix I
HEC-RAS Model

HEC RAS Analysis

To support the remedial design for the Anomaly Area 3 construction demolition disposal site, a hydraulic analysis has been conducted to further characterize site conditions of Anomaly Area 3 at MCAS El Toro, California.

METHODOLOGY

The Army Corps of Engineers River Analysis System (HEC RAS) was used to determine 100 year flooding limits within Anomaly Area 3. HEC RAS is used to calculate steady flow water surface profiles for steady gradually varied flow. The computational procedure is based on the solution of the one-dimensional energy equation. Energy losses are evaluated by frictions (Manning's equation) and contraction/expansion (a coefficient multiplied by the change in velocity head). The momentum equation is utilized in situations where the water surface profile is rapidly varied. These situations include mixed flow regime calculations such as hydraulic jumps and hydraulics of bridges.

Hydrologic Data used for this study is based on a Hydrologic Study of the Agua Chinon Wash and San Diego Creek prepared by Tettemer & Associates, dated April, 1989 which was provided by Orange County Flood Control District. The 100-year 24-hour rainfall event was calculated to be 596 CFS (cubic feet per second) at the upstream end of the study area per this study. Allowing for discharge from that area immediately adjacent to Anomaly Area 3 and adjusting for an increase in run-off resulting from the increased urbanization of drainages incidental to the flow entering the concrete box culvert (CBC) at the upstream end of the study area, a more conservative flow rate of 800 CFS was used to model the surface water elevation within the AA3 Reach to determine if flood conditions could impact the Anomaly Area 3 remedial design.

DISCUSSION OF RESULTS

Directly upstream of the project area, Agua Chinon Wash is channeled into an 8-foot high by 9-foot wide CBC (concrete box culvert). This CBC discharges its flow into that portion of the Agua Chinon Wash Channel (AA3 Reach) immediately adjacent and flowing parallel to the southern edge of Anomaly Area 3. The initial water surface elevation at the downstream face of the culvert was determined using Culvert Master. Using this water surface elevation as the upstream boundary condition for the HEC RAS analysis, the 100 year water surface elevation within the AA3 Reach was calculated at approximately 100' foot intervals to determine if flood conditions could impact the Anomaly Area 3 remedial design. Manning's coefficients within the channel were determined based on a site investigation.

Based upon the HEC-RAS computer model out-put for the existing condition, the 100 year flood stage surface elevation of the Agua Chinon Wash will be 478.78-feet immediately upon leaving the CBC. As the flood stage progresses downstream the surface elevation of the water drops significantly. At a distance of ten feet from the CBC the waster surface elevation is 477.28-feet. At one-hundred feet from the CBC, it is 472.78-feet. At two-hundred feet from the CBC, it is 470.25-feet. At three-hundred feet from the CBC, it is 467.99-feet. At four-hundred feet from the CBC, it is 466.721-feet. At five-hundred feet from the CBC, it is 464.86-feet.

The depth of waste for the portion of Anomaly Area 3 immediately adjacent to the AA3 Reach varies from an elevation of approximately 470-feet to approximately 464-feet. The following table correlates the elevation of the waste with the elevation of the water surface at approximately the same stream station.

Distance from CBC	Stream Surface Elevation	Elevation of Waste
0-feet	478.78	470.0
10-feet	477.27	470.0
100-feet	472.60	469.0
200-feet	470.10	468.0
300-feet	467.98	466.0
400-feet	466.72	464.0
500-feet	464.86	464.0

As shown in the subsequent Figure, it is evident that for the first four-hundred feet of the AA3 Reach Channel, the flooding limits approaches the boundaries of the waste resulting in potential exposure to erosion and inundation during the 100-year 24-hour rainfall event. To alleviate the potential impact of the 100-year 24-hour flood, a "Finger Dike" has been designed to separate the waste and the stream flow. The top of the "Finger Dike" will be four-feet in width and set at an elevation of 480.0-feet. The sideslopes will be armored with RIPRAP and constructed at a slope of 3-feet horizontally to 1-foot vertical. As shown in the Figure, the "Finger Dike" will be approximately 350-feet in length and will tie-into the slope immediately north of the CBC outlet. With the "Finger Dike" in place, a second HEC-RAS hydrologic computer model was run. The results of that run are illustrated in the following table.

Distance from CBC	Revised Stream Surface Elevation	Elevation of Waste
0-feet	478.78	470.0
10-feet	477.28	470.0
100-feet	472.78	469.0
200-feet	470.25	468.0
300-feet	467.99	466.0
400-feet	466.72	464.0
500-feet	464.86	464.0

Based upon the information presented in the above table and illustrated in the Figure, the "Finger Dike" provides adequate protection for the 100-year 24-hour storm event by limiting the boundary of inundation on the northern side of the channel, thereby minimizing the potential for the waste to be exposed to inundation and/or erosion during the 100-year 24-hour rainfall event. With the "Finger Dike in-place, the 100-year flows are adequately conveyed through this reach.

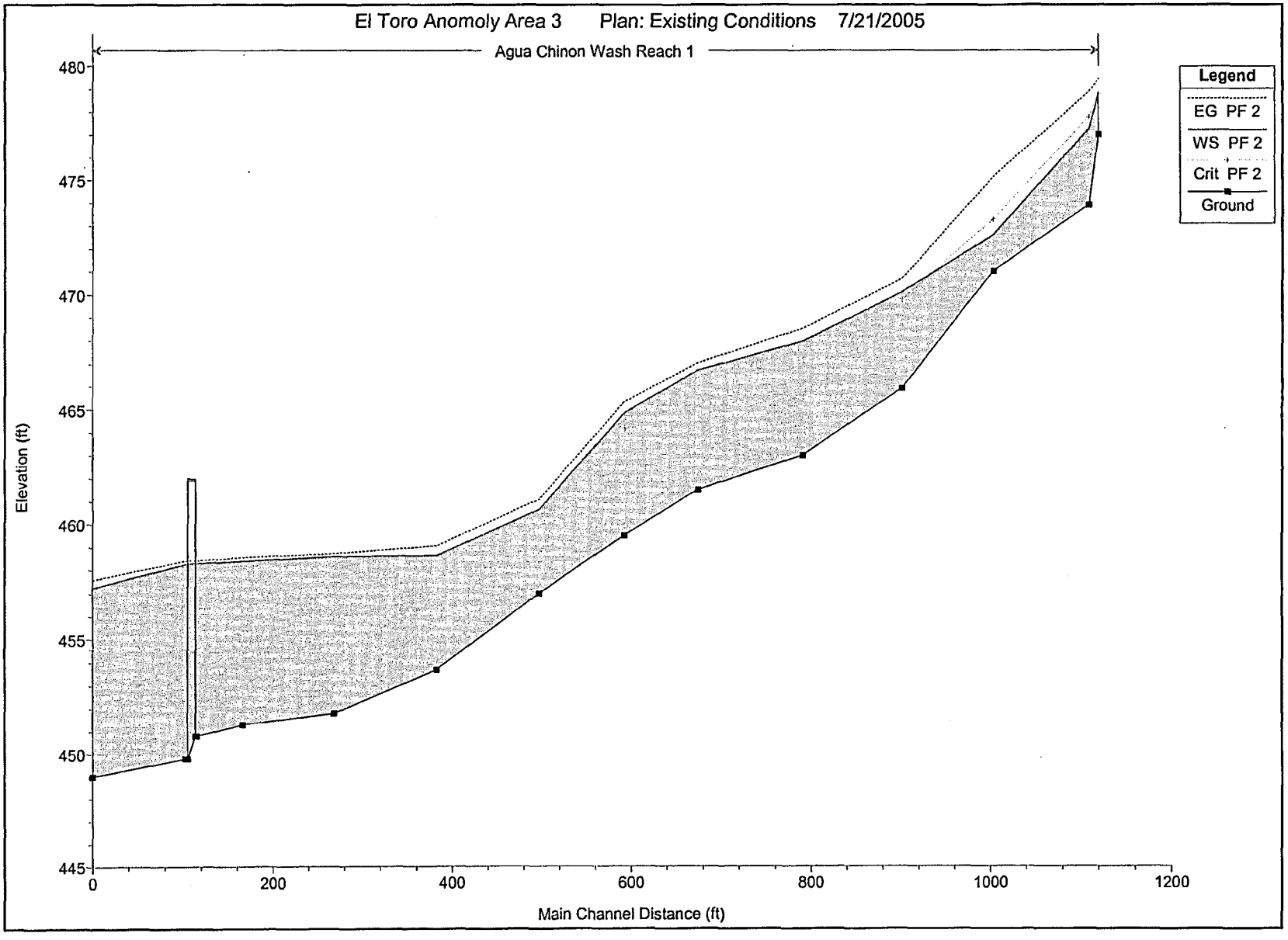
- The channel goes through critical depth approximately 250 feet downstream of the CBC.
- The channel downstream of cross section 4700 appears to have the capacity to convey the 100-year flow without potential encroachment into areas containing waste.
- Relatively high water velocities are present in this reach.

The HEC-RAS analysis recommendations for AA3 Reach are as follows:

- Install the "Finger Dike" as proposed.
- Channel improvements may be required in this reach to protect the landfill.
- Due to high water velocities in this reach, slope protection will be required to protect side slope of the Anomaly Area 3 Cap from erosion.

HEC-RAS Plan: EX COND River: Agua Chinon Wash Reach: Reach 1 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	5000	PF 1	596.00	477.00	478.54	478.54	479.09	0.122366	5.97	100.53	93.93	1.00
Reach 1	4990	PF 1	596.00	473.90	476.87	477.37	478.46	0.026806	10.37	68.49	63.60	1.28
Reach 1	4900	PF 1	596.00	471.00	472.48	473.05	474.47	0.057819	11.73	63.50	116.85	2.09
Reach 1	4800	PF 1	596.00	465.90	469.69	469.37	470.20	0.030595	6.12	109.10	67.42	0.63
Reach 1	4700	PF 1	596.00	463.00	467.52		467.99	0.013759	5.68	115.48	59.87	0.58
Reach 1	4600	PF 1	596.00	461.50	466.33		466.57	0.011114	4.12	153.14	64.07	0.38
Reach 1	4500	PF 1	596.00	459.50	464.16	463.83	464.69	0.063969	5.82	102.55	58.91	0.77
Reach 1	4400	PF 1	596.00	457.00	460.74		460.96	0.025316	3.77	159.00	86.43	0.48
Reach 1	4300	PF 1	596.00	453.70	457.83	457.83	458.52	0.021402	7.78	103.95	74.67	0.74
Reach 1	4200	PF 1	596.00	451.80	457.68	455.72	457.81	0.002098	3.57	235.41	101.02	0.27
Reach 1	4100	PF 1	596.00	451.30	457.46		457.61	0.001953	3.42	214.95	69.96	0.26
Reach 1	4000	PF 1	596.00	450.80	457.38	453.97	457.46	0.002716	2.38	250.70	64.66	0.21
Reach 1	3950		Bridge									
Reach 1	3900	PF 1	596.00	449.80	457.32		457.44	0.005578	2.73	218.08	56.22	0.24
Reach 1	3800	PF 1	596.00	449.00	456.32	453.93	456.60	0.012304	4.29	138.77	36.58	0.39


El Toro Anomoly Area 3 Plan: Existing Conditions 7/21/2005
Agua Chinon Wash Reach 1
Legend
EG PF 2
WS PF 2
Crit PF 2
Ground
Elevation (ft)
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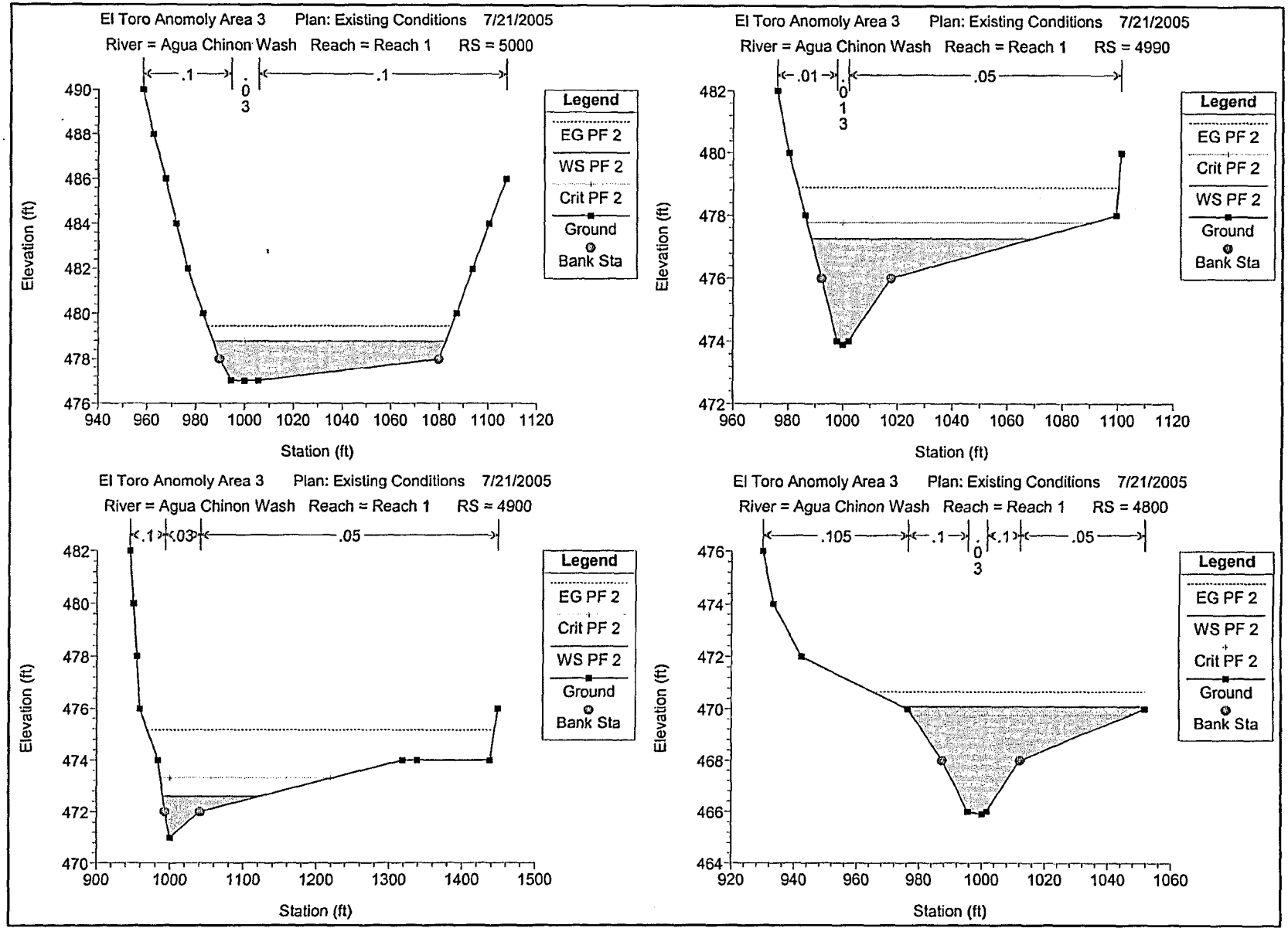
475
470
465
460
455
450
445
0
200
400
600
800
1000
1200
Main Channel Distance (ft)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.1
.03
.1
Legend
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WS PF 2
Crit PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
El Toro Anomoly Area 3 Plan: Existing Conditions 7/21/2005
River = Agua Chinon Wash Reach = Reach 1 RS = 4990
.01
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Legend
EG PF 2
Crit PF 2
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
El Toro Anomoly Area 3 Plan: Existing Conditions 7/21/2005
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.1
.03
.05
Legend
EG PF 2
Crit PF 2
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
El Toro Anomoly Area 3 Plan: Existing Conditions 7/21/2005
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Crit PF 2
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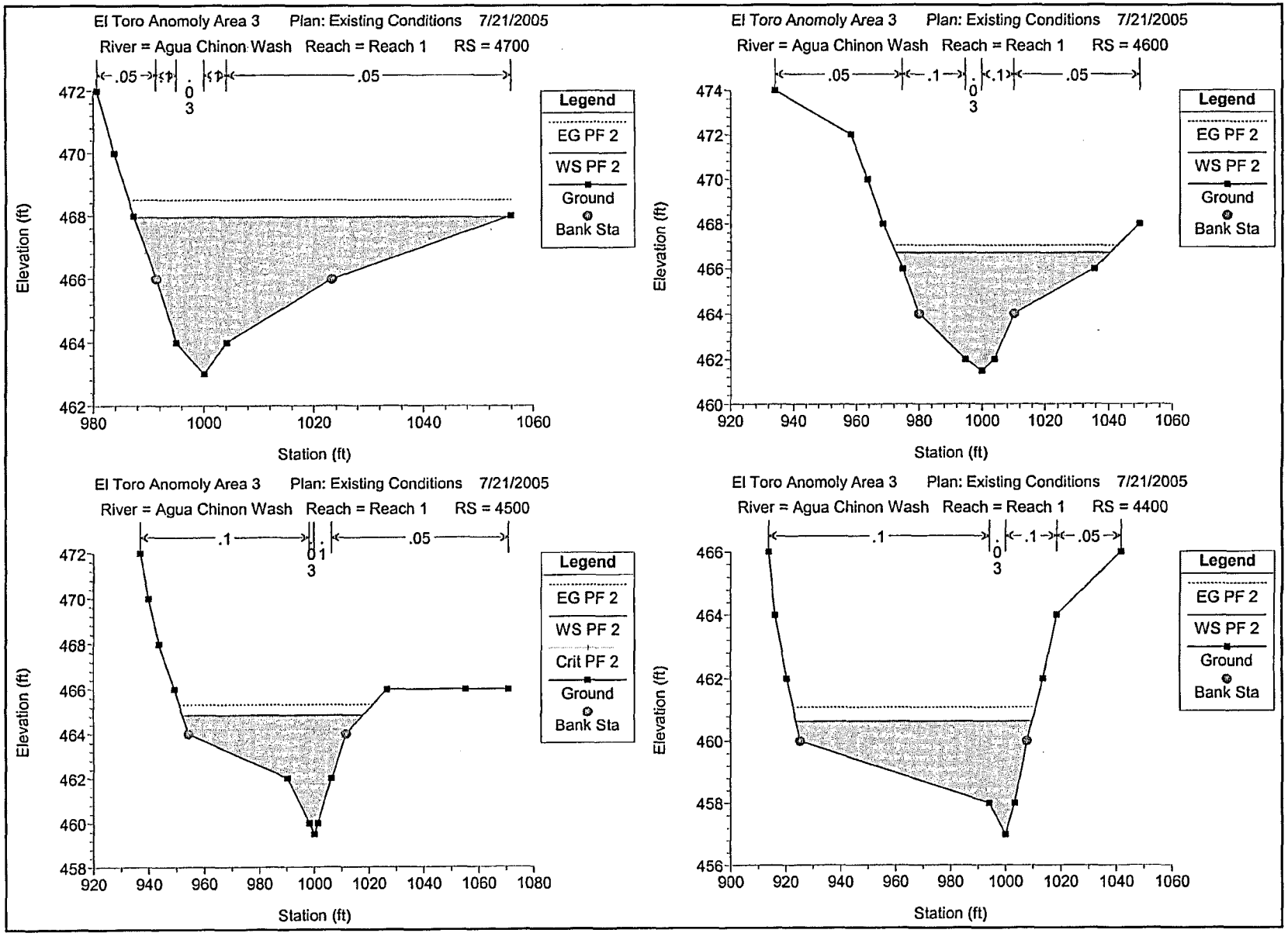
Bank Sta
Elevation (ft)
Station (ft)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Elevation (ft)
Station (ft)
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Legend
EG PF 2
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
El Toro Anomoly Area 3 Plan: Existing Conditions 7/21/2005
River = Agua Chinon Wash Reach = Reach 1 RS = 4500
Legend
EG PF 2
WS PF 2
Crit PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
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WS PF 2
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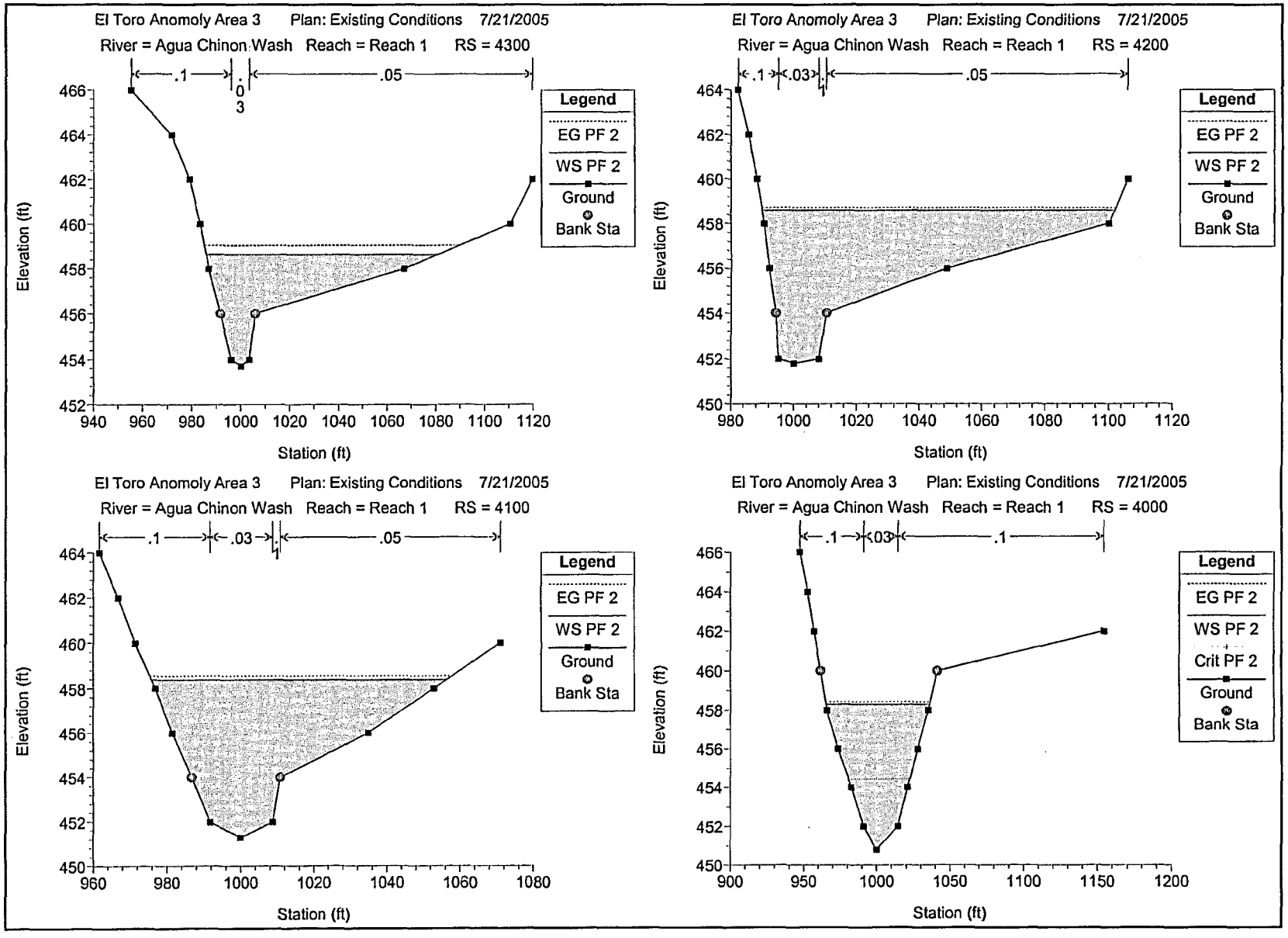
Bank Sta
Elevation (ft)
Station (ft)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Bank Sta
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Station (ft)
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Bank Sta
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Station (ft)
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Bank Sta
Elevation (ft)
Station (ft)
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Crit PF 2
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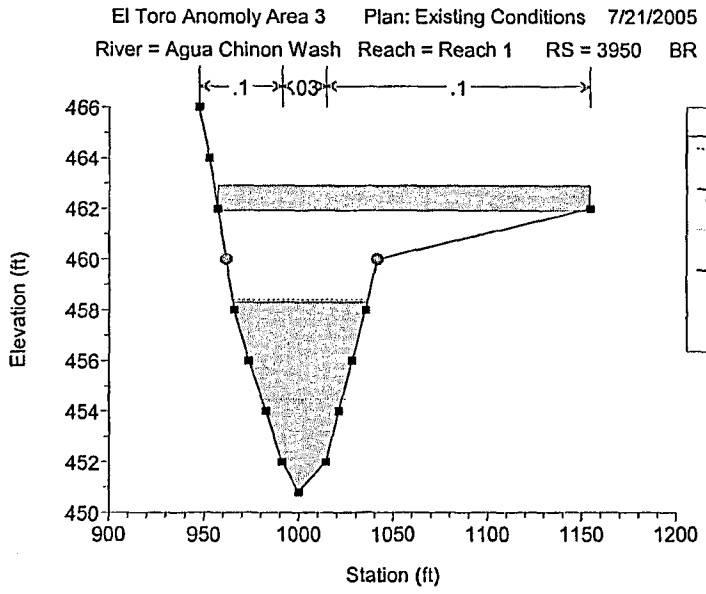
Station (ft)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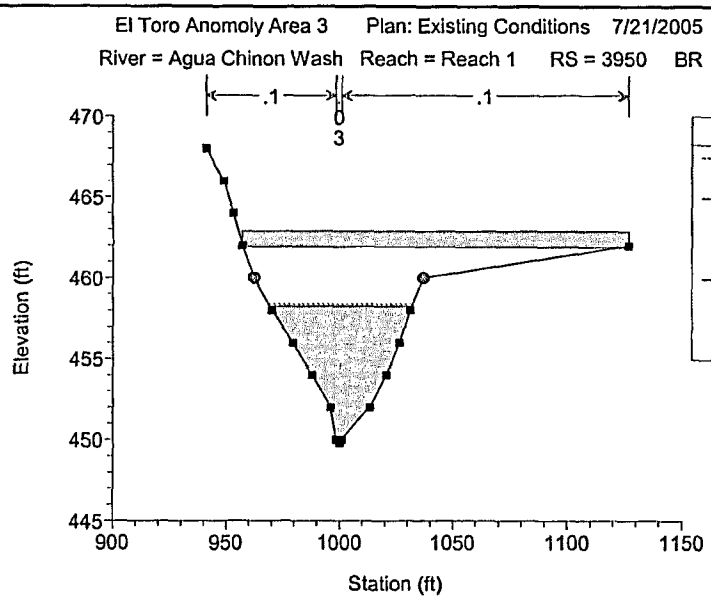
Crit PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)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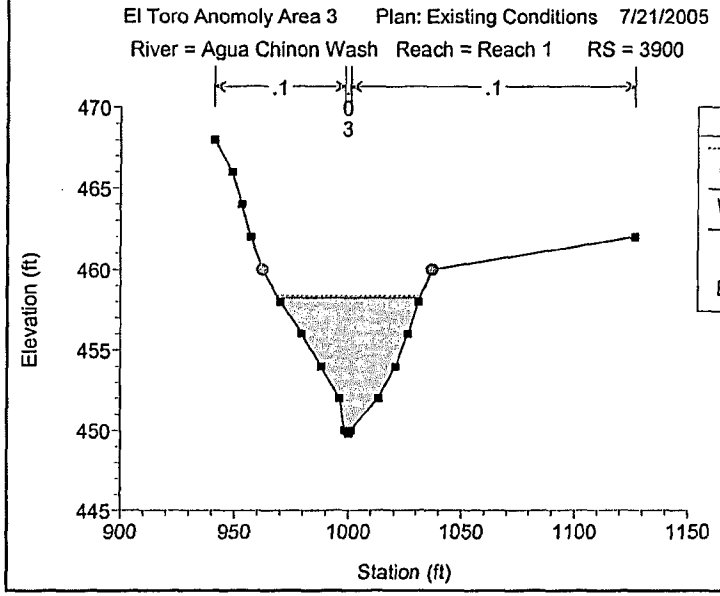
Crit PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)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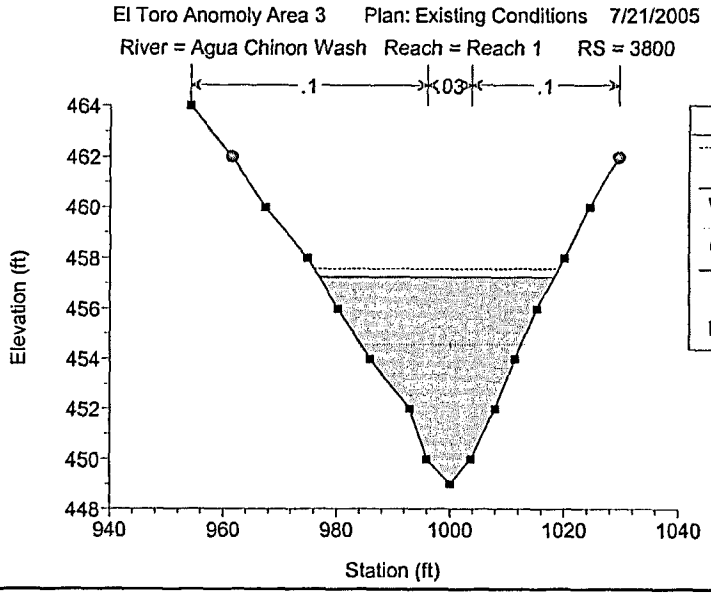
Bank Sta
Elevation (ft)
Station (ft)


El Toro Anomoly Area 3 Plan: Existing Conditions 7/21/2005
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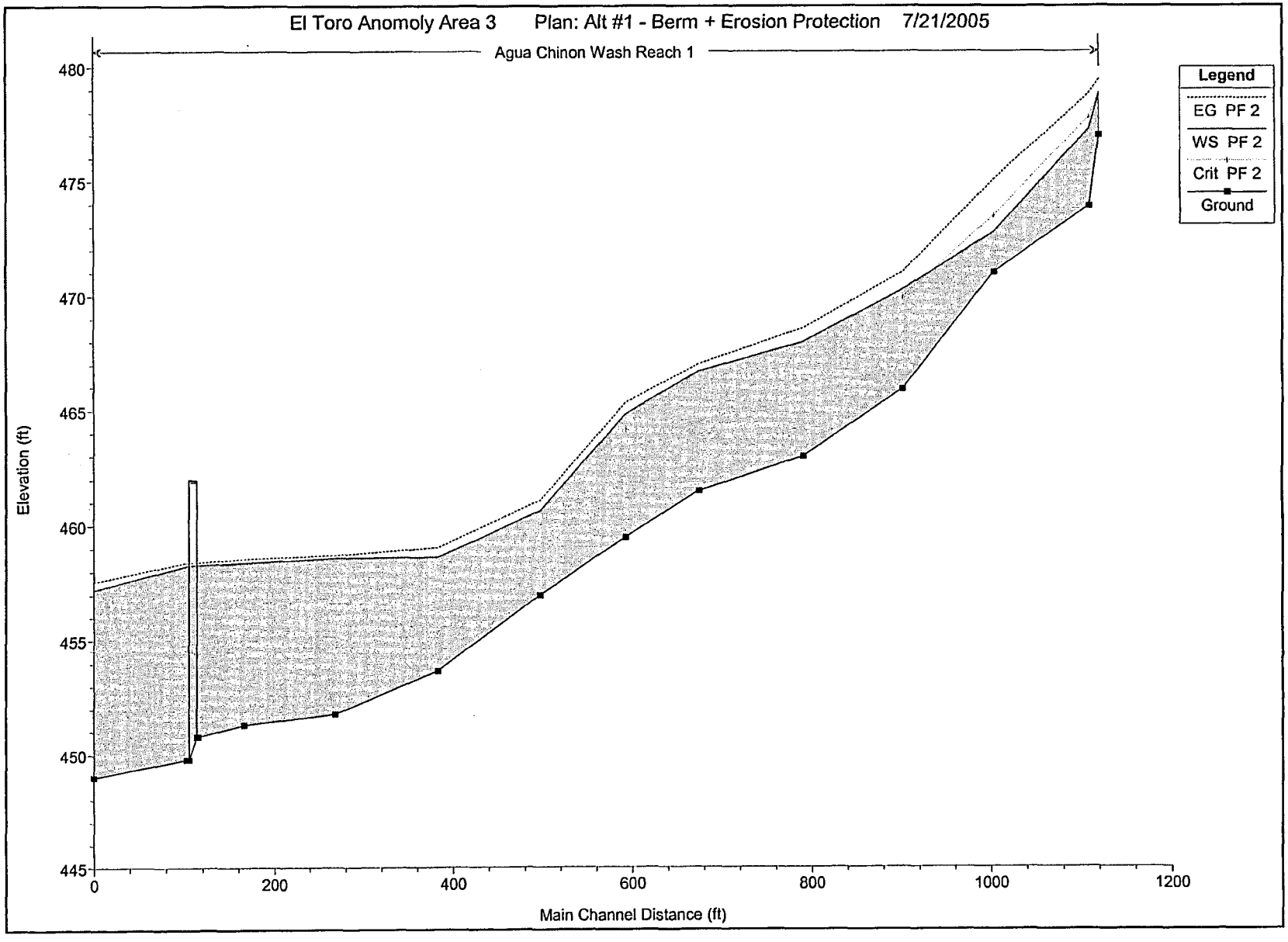
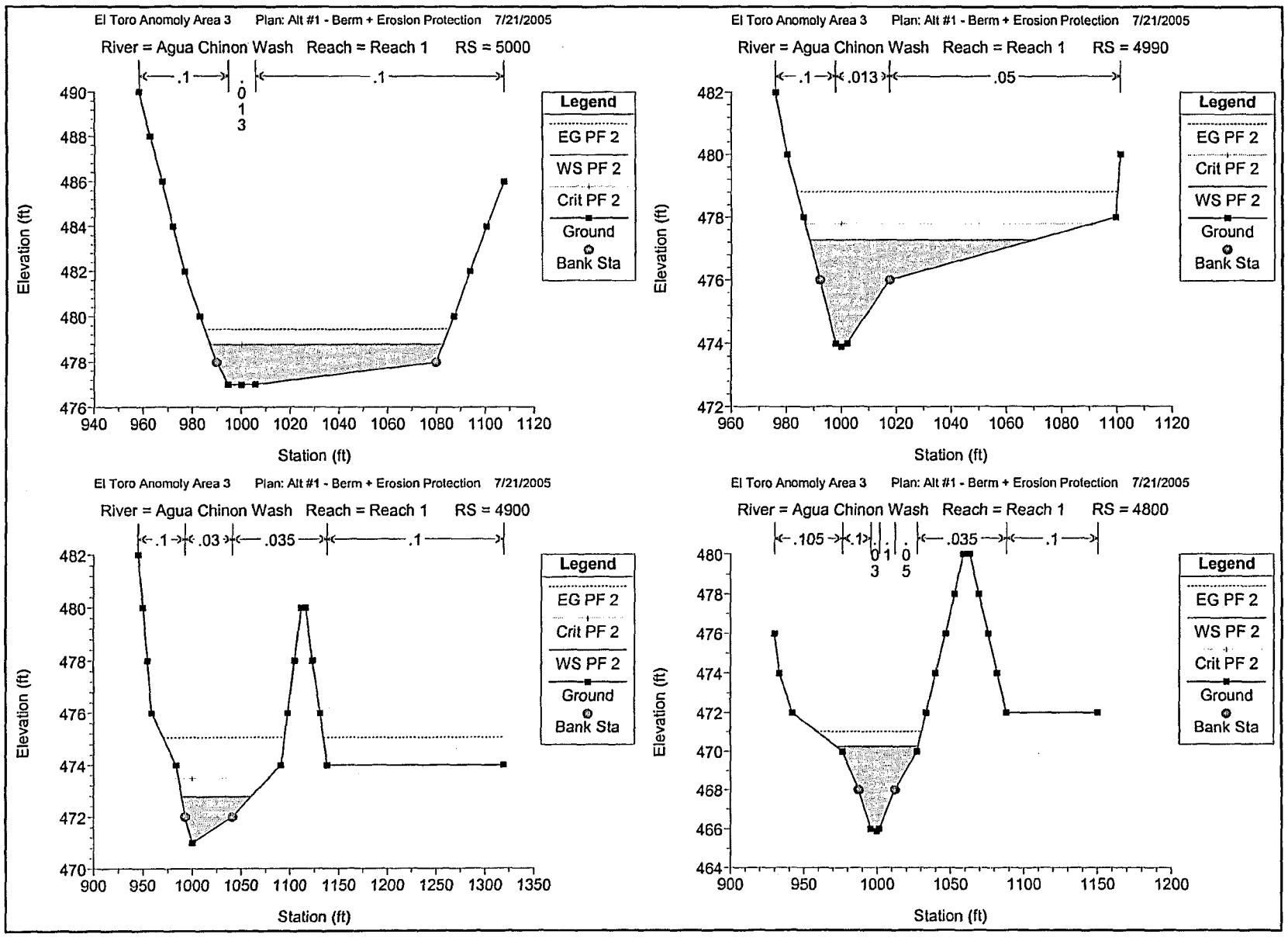
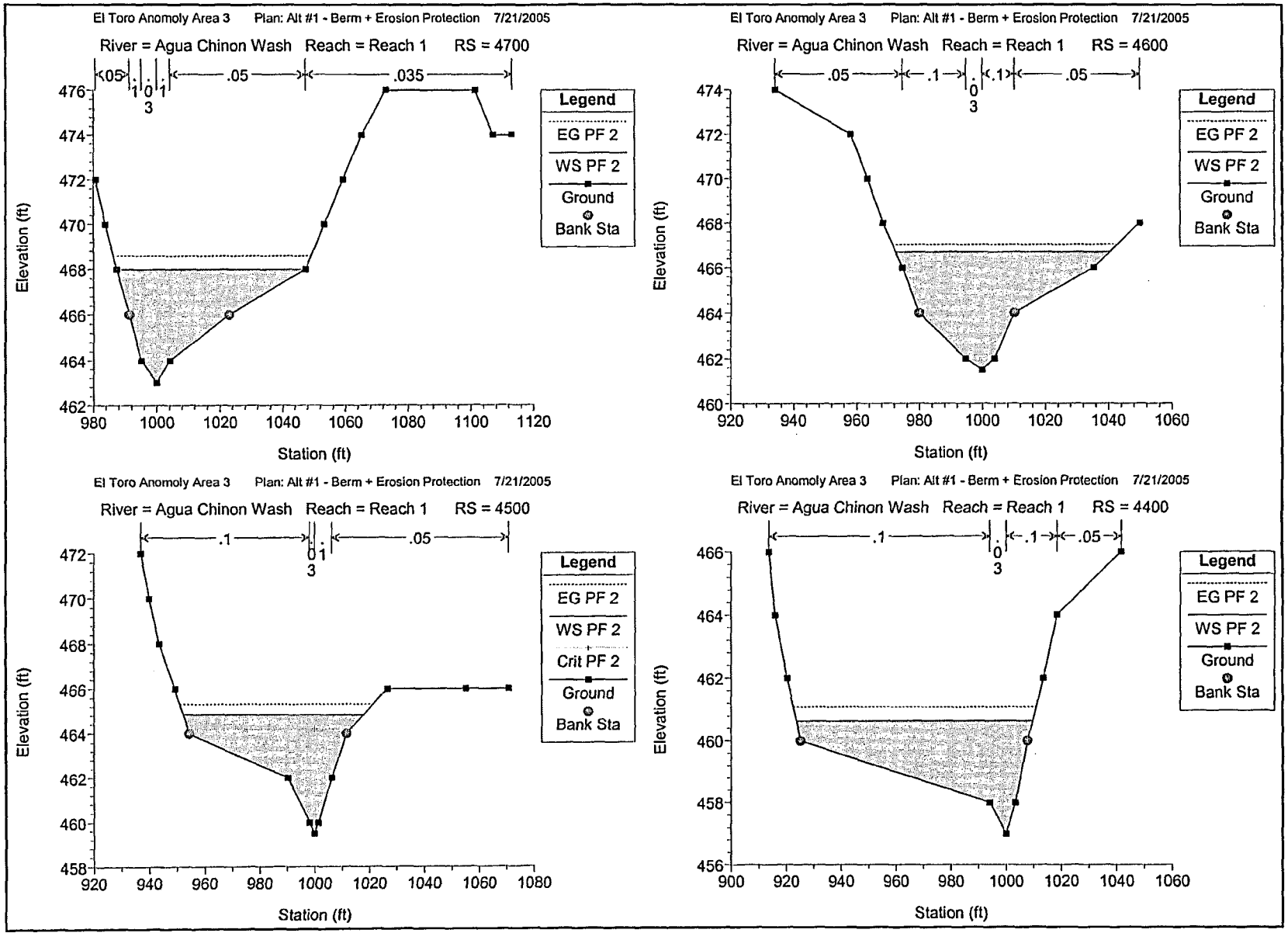
.1
Legend
EG PF 2
WS PF 2
Crit PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)

HEC-RAS Plan: ALT #1 River: Agua Chinon Wash Reach: Reach 1 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	5000	PF 1	596.00	477.00	478.54	478.54	479.09	0.119793	5.97	100.51	93.93	1.00
Reach 1	4990	PF 1	596.00	473.90	476.91	477.40	478.39	0.032278	10.21	71.17	65.43	1.25
Reach 1	4900	PF 1	596.00	471.00	472.59	473.16	474.43	0.044440	11.03	57.48	65.51	1.86
Reach 1	4800	PF 1	596.00	465.90	469.80	469.41	470.45	0.035309	6.73	96.85	48.28	0.68
Reach 1	4700	PF 1	596.00	463.00	467.54		468.03	0.014399	5.82	110.67	53.46	0.60
Reach 1	4600	PF 1	596.00	461.50	466.33		466.57	0.011114	4.12	153.14	64.07	0.38
Reach 1	4500	PF 1	596.00	459.50	464.16	463.83	464.69	0.063969	5.82	102.55	58.91	0.77
Reach 1	4400	PF 1	596.00	457.00	460.74		460.96	0.025316	3.77	159.00	86.43	0.48
Reach 1	4300	PF 1	596.00	453.70	457.83	457.83	458.52	0.021402	7.78	103.95	74.67	0.74
Reach 1	4200	PF 1	596.00	451.80	457.68	455.72	457.81	0.002098	3.57	235.41	101.02	0.27
Reach 1	4100	PF 1	596.00	451.30	457.46		457.61	0.001953	3.42	214.95	69.96	0.26
Reach 1	4000	PF 1	596.00	450.80	457.38	453.97	457.46	0.002716	2.38	250.70	64.66	0.21
Reach 1	3950		Bridge									
Reach 1	3900	PF 1	596.00	449.80	457.32		457.44	0.005578	2.73	218.08	56.22	0.24
Reach 1	3800	PF 1	596.00	449.00	456.32	453.93	456.60	0.012304	4.29	138.77	36.58	0.39


El Toro Anomoly Area 3 Plan: Alt #1 - Berm + Erosion Protection 7/21/2005
Agua Chinon Wash Reach 1
Legend
EG PF 2
WS PF 2
Crit PF 2
Ground
Elevation (ft)
480
475
470
465
460
455
450
445
0
200
400
600
800
1000
1200
Main Channel Distance (ft)


El Toro Anomoly Area 3 Plan: Alt #1 - Berm + Erosion Protection 7/21/2005
River = Agua Chinon Wash Reach = Reach 1 RS = 5000
.1
.013
.1
Legend
EG PF 2
WS PF 2
Crit PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
El Toro Anomoly Area 3 Plan: Alt #1 - Berm + Erosion Protection 7/21/2005
River = Agua Chinon Wash Reach = Reach 1 RS = 4990
.1
.013
.05
Legend
EG PF 2
Crit PF 2
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
El Toro Anomoly Area 3 Plan: Alt #1 - Berm + Erosion Protection 7/21/2005
River = Agua Chinon Wash Reach = Reach 1 RS = 4900
.1
.03
.035
.1
Legend
EG PF 2
Crit PF 2
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
El Toro Anomoly Area 3 Plan: Alt #1 - Berm + Erosion Protection 7/21/2005
River = Agua Chinon Wash Reach = Reach 1 RS = 4800
.105
.1
.013
.015
.035
.1
Legend
EG PF 2
WS PF 2
Crit PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)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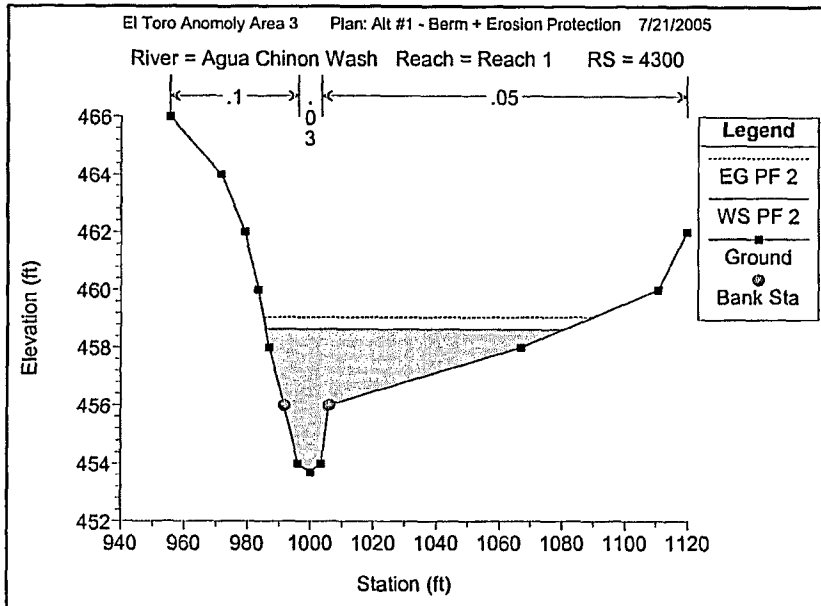
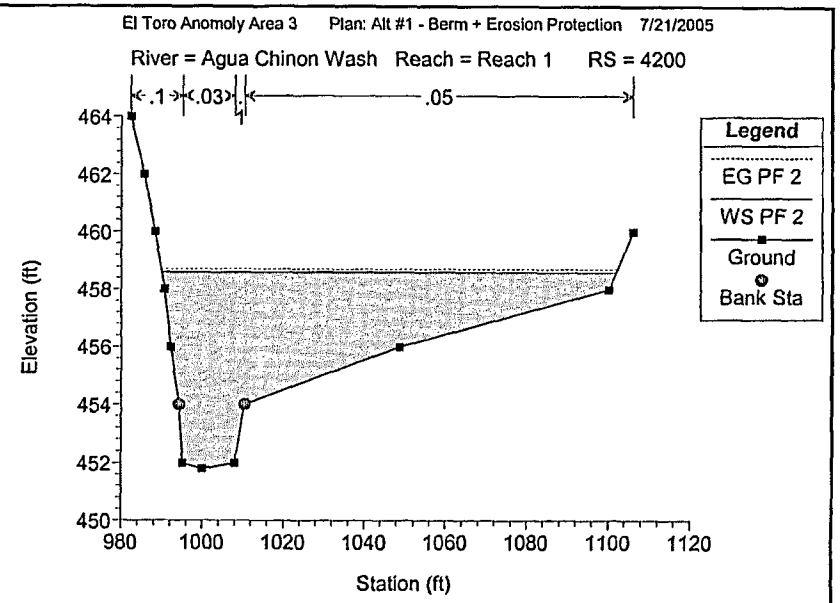
River = Agua Chinon Wash Reach = Reach 1 RS = 4700
.05
.05
.035
Legend
EG PF 2
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
El Toro Anomoly Area 3 Plan: Alt #1 - Berm + Erosion Protection 7/21/2005
River = Agua Chinon Wash Reach = Reach 1 RS = 4600
.05
.1
.1
.05
Legend
EG PF 2
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
El Toro Anomoly Area 3 Plan: Alt #1 - Berm + Erosion Protection 7/21/2005
River = Agua Chinon Wash Reach = Reach 1 RS = 4500
.1
.05
Legend
EG PF 2
WS PF 2
Crit PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
El Toro Anomoly Area 3 Plan: Alt #1 - Berm + Erosion Protection 7/21/2005
River = Agua Chinon Wash Reach = Reach 1 RS = 4400
.1
.1
.05
Legend
EG PF 2
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)


El Toro Anomoly Area 3 Plan: Alt #1 - Berm + Erosion Protection 7/21/2005
River = Agua Chinon Wash Reach = Reach 1 RS = 4300
.1
.05
Legend
EG PF 2
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)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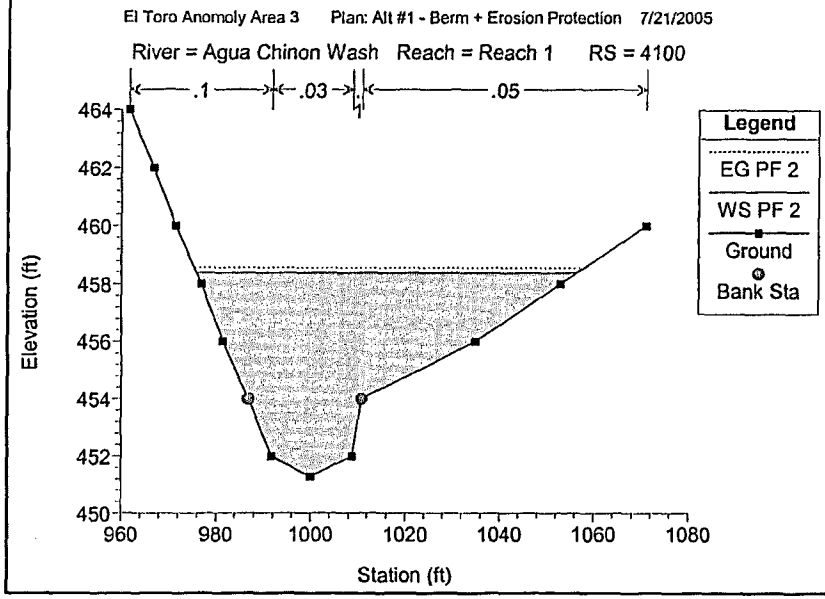
River = Agua Chinon Wash Reach = Reach 1 RS = 4200
.1
.03
.05
Legend
EG PF 2
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)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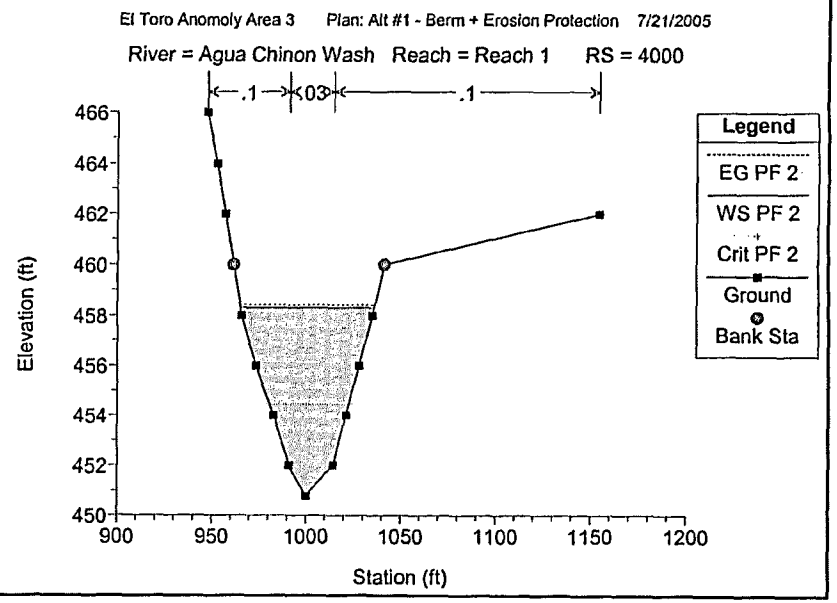
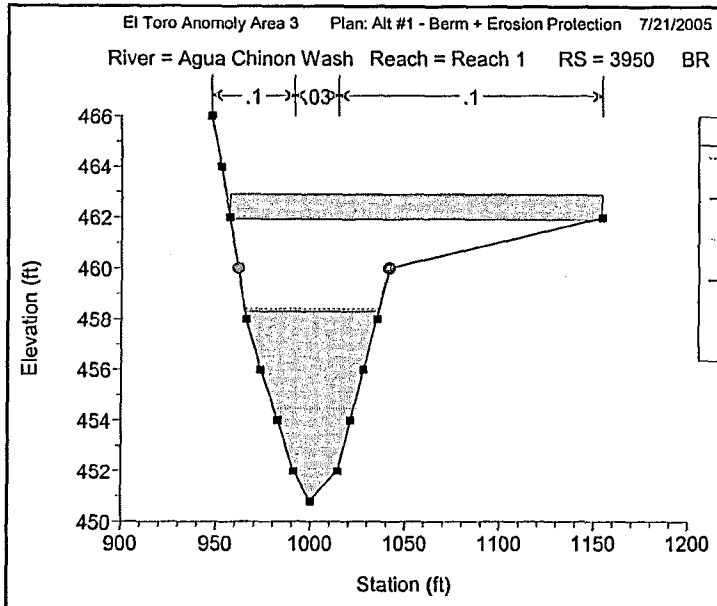
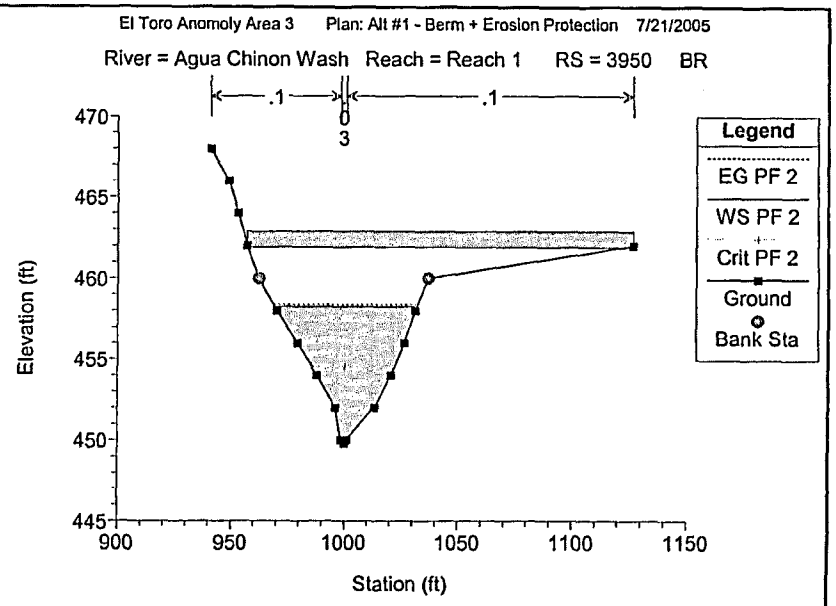
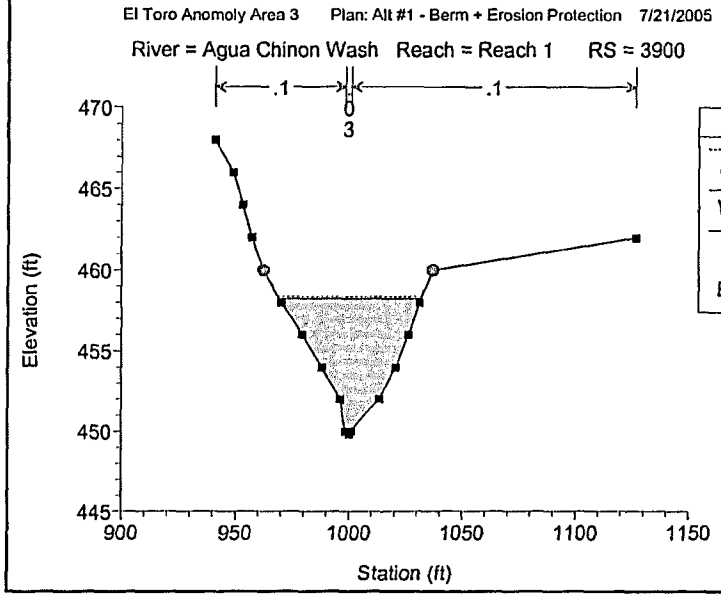
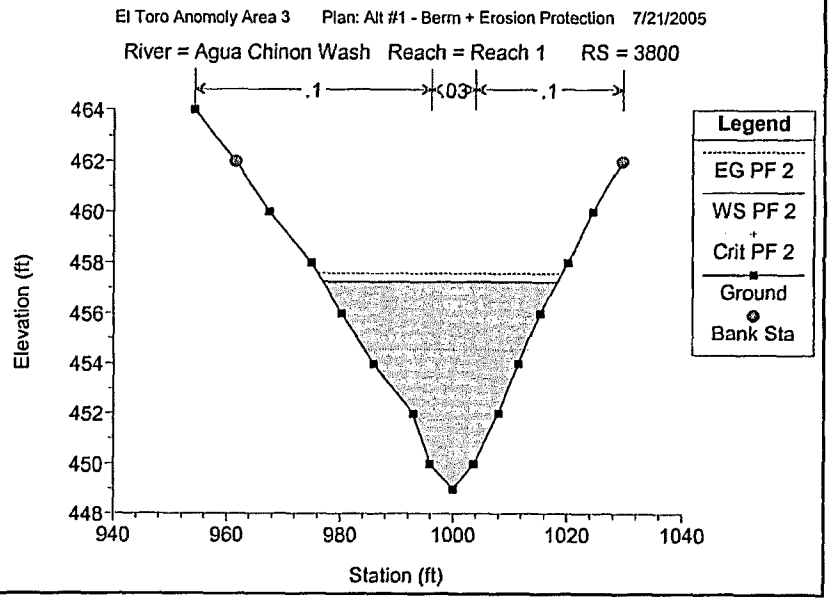
River = Agua Chinon Wash Reach = Reach 1 RS = 4100
.1
.03
.05
Legend
EG PF 2
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)

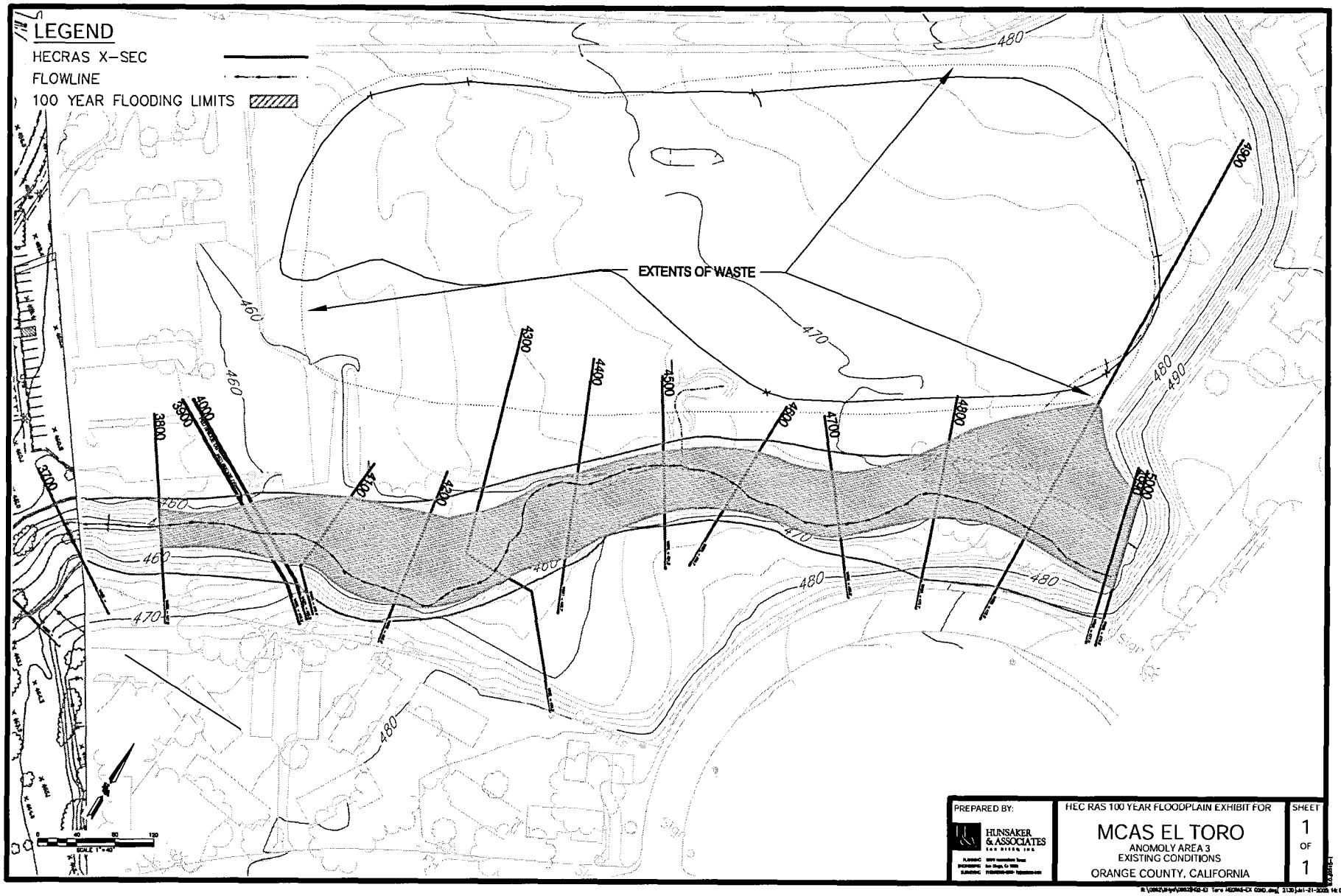

El Toro Anomoly Area 3 Plan: Alt #1 - Berm + Erosion Protection 7/21/2005
River = Agua Chinon Wash Reach = Reach 1 RS = 4000
.1
.03
.1
Legend
EG PF 2
WS PF 2
Crit PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)


El Toro Anomoly Area 3 Plan: Alt #1 - Berm + Erosion Protection 7/21/2005
River = Agua Chinon Wash Reach = Reach 1 RS = 3950 BR
.1
03
.1
Legend
EG PF 2
WS PF 2
Crit PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)


El Toro Anomoly Area 3 Plan: Alt #1 - Berm + Erosion Protection 7/21/2005
River = Agua Chinon Wash Reach = Reach 1 RS = 3950 BR
.1
0
3
.1
Legend
EG PF 2
WS PF 2
Crit PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)


El Toro Anomoly Area 3 Plan: Alt #1 - Berm + Erosion Protection 7/21/2005
River = Agua Chinon Wash Reach = Reach 1 RS = 3900
.1
0
3
.1
Legend
EG PF 2
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)


El Toro Anomoly Area 3 Plan: Alt #1 - Berm + Erosion Protection 7/21/2005
River = Agua Chinon Wash Reach = Reach 1 RS = 3800
.1
03
.1
Legend
EG PF 2
WS PF 2
Crit PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)


LEGEND
HECRAS X-SEC
FLOWLINE
100 YEAR FLOODING LIMITS
EXTENTS OF WASTE
3100
3800
3900
4000
4100
4200
4300
4400
4500
4600
4700
4800
4900
5000
460
470
480
490
SCALE 1"=40'
PREPARED BY:
HUNSAKER & ASSOCIATES
HEC RAS 100 YEAR FLOODPLAIN EXHIBIT FOR
MCAS EL TORO
ANOMOLY AREA 3
EXISTING CONDITIONS
ORANGE COUNTY, CALIFORNIA
SHEET
1
OF
1

Appendix J
RACER Cost Estimates

APPENDIX J-1. GENERAL NOTES FOR ANOMALY AREA 3 COST ESTIMATES

GENERAL NOTES REGARDING COST ESTIMATES

Cost estimates were prepared in accordance with *A Guide To Developing and Documenting Cost Estimates During the Feasibility Study* (USEPA 2000a). All costs were generated using Remedial Action Cost Engineering and Requirements (RACER™) 2005 software. The following general assumptions were used:

- Default costs for labor, material, and equipment were used, except as noted.
- The location was specified as El Toro Marine Corps Air Station, California.
- Remedial design and action start in 2008.
- A "moderate" project complexity level was selected for professional labor management.
- The cost estimates generated in 2005 as part of Draft RI/FS report were escalated to year 2008 using an escalation index of 1.079. The escalation index was obtained from the Naval Center for Cost Analysis Inflation Calculator for Fiscal Year 09 Budget, Ver. 1, (January 2008).
- As recommended by EPA guidance (USEPA 2000a), the present value costs were estimated using a real discount rate of 2.8-percent presented in the Office of Management and Budget (OMB) Circular A-94, Appendix C (OMB 2008).
- RACER™ 2005 is not capable of calculating annual sampling costs, such as long-term monitoring (LTM), for years with differing numbers of samples as proposed. Therefore, two separate monitoring technologies (years 1 through 5 and years 6 through 30) were used to estimate LTM for groundwater and soil gas.
- The LTM technology was used to incorporate annual facility inspection, reporting, and maintenance costs into the cost estimate.
- The Munitions and Explosives of Concern (MEC) Land Use Controls technology provided by RACER™ 2005 was used as a placeholder to estimate costs for the implementation of general land use controls.
- Site closeout activities would start after the conclusion of LTM activities.

The following sections present detailed assumptions for Alternatives 2 through 4, along with the tables summarizing the estimated costs. No costs are associated with the "No Action" alternative (Alternative 1).

APPENDIX J-2. ASSUMPTIONS AND COSTS FOR ALTERNATIVE 2

SUMMARY DESCRIPTION

Alternative 2 includes the implementation of land use controls, existing access controls, drainage improvements, monitoring well abandonments and replacements, debris relocation, construction of a landfill gas collection system, long-term groundwater and soil gas monitoring, five year site reviews, limited site grading, survey monument installation, facility inspection and maintenance, and site closeout.

Land use controls include restrictions on the use of the land limit human exposure to on site contamination. Land use controls will be supplement with access controls such as existing fencing, and additional signs and locks (if necessary). Drainage improvements would be made to control the flow from Agua Chinon Wash on to Anomaly Area 3 (AA 3) and to prevent erosion in the vicinity of AA 3. Five monitoring wells (four inside and one outside the debris limits) would be abandoned in conjunction with remedial construction activities. The five groundwater and three soil gas monitoring wells would be replaced after ten and twenty years. Approximately 12,000 cubic yards of debris would be relocated to provide a 100-foot clearance from the edge of debris to the proposed buffer zone boundary. A passive landfill gas collection system would be constructed and converted to an active system if necessary. Long-term groundwater monitoring includes sampling of five monitoring wells semi-annually for five years, and annually for the following 25 years. Long term soil gas monitoring includes sampling three wells and the landfill gas collection system quarterly for five years, and semi-annually for the following 25 years. Five year reviews would be performed to assess site conditions and provide recommendations for future actions. Limited site grading would be performed to promote stormwater runoff, and prevent stormwater ponding and run-on. Ten survey monuments would be installed to serve as benchmarks to monitor settlement. Inspection and maintenance would be implemented for access controls, groundwater and soil gas monitoring wells, the landfill gas collection system, and the performance of site grading with respect to stormwater control. Estimated costs for this alternative are presented in Tables J-1.

The cost analysis for Alternative 2 includes the tasks described above. These tasks and cost estimation assumptions are described below:

CAPITAL COSTS

Drainage Improvements

This cost element is based on the following assumptions:

- Approximately 350 feet long finger dike would be constructed and riprap would be placed to prevent erosion and control stormwater flow in the vicinity of AA 3.

APPENDIX J-2. ASSUMPTIONS AND COSTS FOR ALTERNATIVE 2

Monitoring Well Abandonments

This cost element is based on the following assumptions:

- Five monitoring wells (four inside and one outside the debris limits) would be abandoned in conjunction with remedial construction activities.

Debris Relocation

This cost element is based on the following assumptions:

- A debris consolidation area would be excavated near the center of Anomaly Area 3.
- Approximately 12,000 cubic yards of debris would be excavated from the southwest and southeast portions of AA3 and relocated within the existing debris boundary to provide a 100-foot clearance from the edge of debris to the proposed buffer zone boundary.
- The areas excavated to relocate the debris would be backfilled with on-site fill material. The backfill would be placed in six-inch lifts and compacted to a relative density of 90-percent.

Landfill Gas Collection System

This cost element is based on the following assumptions:

- A passive landfill gas collection system would be installed. The system is assumed to include approximately 25 vertical vent wells spaced at 100 feet throughout the existing debris area cover.
- If necessary, the passive landfill gas collection system would be converted to an active one by connecting the wells with piping, and plumbing the system to a vacuum blower and associated equipment.
- The pad for the blower and associated equipment would be located to the northeast of existing monitoring wells MW-09A and MW-09B.

Limited Site Grading

This cost element is based on the following assumptions:

- Approximately 50 percent of the surface area of AA3 would be graded to promote stormwater runoff, and prevent stormwater ponding and run-on.
- It is assumed that site grading requires soil disturbance to an average depth of ½ foot.
- The disturbed areas would be revegetated with native grasses. The seeding mix would be amended with mulch and irrigated with a water truck.

- Site topography would be surveyed prior to grading for design purposes.
- Site topography would be surveyed after grading to confirm conformance with design.

Survey Monument Installation

This cost element is based on the following assumptions:

- Ten survey monuments would be installed to monitor potential settlement of the debris disposal area. Four monuments would be located in native soil outside the debris area boundary to establish vertical and horizontal control for settlement surveys.

OPERATIONS AND MAINTENANCE COSTS

Land Use Controls

This cost element is based on the following assumptions:

- The Munitions and Explosives of Concern (MEC) Land Use Controls technology provided by RACER™ 2005 was used as a placeholder to estimate costs for the implementation of general land use controls.
- The capital costs for the potential addition of signs and locks to Anomaly Area 3 (AA3) are minimal, therefore, it was assumed these costs are negligible for this cost estimate.

Long Term Monitoring

This cost element is based on the following assumptions:

- The five groundwater monitoring wells would be sampled for metals by EPA Method 6010B, volatile organic compounds (VOCs) by EPA Method 8260B, semi-volatile organic compounds (SVOCs) by EPA Method 8270, pesticides and herbicides by EPA Methods 8081/8151, and general chemistry semi-annually for five years, and annually for the following 25 years.
- The three soil gas monitoring wells would be sampled quarterly for fixed gases by American Society for Testing and Materials (ASTM) Method D1946 and VOCs by EPA Method TO-15 for five years, and semi-annually for the following 25 years.
- One duplicate sample would be collected from the groundwater and soil gas wells for Quality Assurance/Quality Control purposes.
- Ten percent of the landfill gas vent wells would be monitored quarterly for landfill gases with field instruments for five years, and semi-annually for the following 25 years.
- Groundwater samples would be collected using low-flow sampling pumps (already installed).

- Purge water would be collected in 55-gallon drums and disposed as investigation-derived waste.

Facility Inspection and Maintenance

This cost element is based on the following assumptions:

- Facility inspection, reporting, and maintenance would be conducted for a period of thirty years.
- Site inspections and reporting would be performed semi-annually.
- The monitoring technology was used to incorporate annual facility inspection, reporting, and maintenance costs into the cost estimate. The average annual cost for these elements was assumed to be approximately $4,000 for the site with a passive landfill gas collection system and $6,000 with an active landfill gas system.

PERIODIC COSTS

Monitoring Well Replacements

This cost element is based on the following assumptions:

- The five groundwater and three soil gas monitoring wells would be abandoned and replaced with new ones after ten and twenty years.

Five Year Reviews

This cost element is based on the following assumptions:

- Site specific documents, such as monitoring reports and decision documents would be reviewed after 5, 10, 15, 20, 25, and 30 years..
- An inspection would be conducted to assess site conditions as a part of each review.
- Each five year review would include a report providing conclusions and recommendations for future activities at the site.

APPENDIX J-2. ASSUMPTIONS AND COSTS FOR ALTERNATIVE 2

Site Closeout

This cost element is based on the following assumptions:

- Site closeout activities would start in January 2038, after 30 years of groundwater and soil gas monitoring.
- Site closeout activities would include meetings, closure reports and decision documents, a monitoring well abandonment workplan, and abandonment of five groundwater and three soil gas monitoring wells.

APPENDIX J-3. ASSUMPTIONS AND COSTS FOR ALTERNATIVE 3a

SUMMARY DESCRIPTION

Alternative 3a includes the construction of an evapotranspiration (ET) landfill cover system, stormwater control system construction, the implementation of land use controls, existing access controls, monitoring well abandonments and installations, debris relocation, construction of a landfill gas collection system, long-term groundwater and soil gas monitoring, access road construction, five-year site reviews, facility inspection and maintenance, and site closeout.

The ET cover system consists of a two-foot-thick foundation layer consisting of existing cover soils, and a four-foot-thick monolithic soil layer consisting of existing cover soils blended with imported borrow soil. The landfill design also includes construction of stormwater control and drainage systems. Drainage improvements would be made to control the flow from Agua Chinon Wash on to Anomaly Area (AA 3). In addition, drainage channels would be constructed around the landfill cap to prevent erosion and stormwater run-on, and divert run off.

Land use controls include administrative controls such as deed restrictions and access controls such as existing fencing, and additional signs and locks (if necessary). Five monitoring wells (four inside and one outside the debris limits) would be abandoned in conjunction with landfill cap construction. In addition, four monitoring well casings and completions would be modified as a result of landfill cap construction. The five groundwater and three soil gas monitoring wells would be replaced after ten and twenty years. Approximately 12,000 cubic yards of debris would be relocated to provide a 100-foot clearance from the edge of debris to the proposed buffer zone boundary. A passive landfill gas collection system would be constructed and converted to an active system if necessary. Long-term groundwater monitoring includes sampling of five monitoring wells semi-annually for five years, and annually for the following 25 years. Long term soil gas monitoring includes sampling three wells and the landfill gas collection system quarterly for five years, and semi-annually for the following 25 years. Ten survey monuments would be installed to serve as benchmarks to monitor cap settlement. A single lane gravel perimeter road would be constructed around the landfill to facilitate monitoring well access and discourage vehicle traffic from traveling across the landfill cap. Five year reviews would be performed to assess site conditions and provide recommendations for future actions. Inspection and maintenance would be implemented for a period of thirty years for the landfill access controls, groundwater and soil gas monitoring wells, stormwater control system, and landfill cap. Estimated costs for this alternative are presented in Tables J-2.

The cost analysis for Alternative 3a includes the tasks described above. These tasks and cost estimation assumptions are described below:

CAPITAL COSTS

ET Landfill Cover System

This cost element is based on the following assumptions:

- The top six inches of the existing four-foot-thick soil cover would be removed and stockpiled for use as topsoil for the vegetative cover.

APPENDIX J-3. ASSUMPTIONS AND COSTS FOR ALTERNATIVE 3a

- A debris consolidation area would be excavated near the center of Anomaly Area 3.
- Approximately 12,000 cubic yards of debris would be excavated from the southwest and southeast portions of AA3 and relocated within the existing debris boundary to provide a 100-foot clearance from the edge of debris to the proposed buffer zone boundary.
- The areas excavated to relocate the debris would be backfilled with on-site fill material. The backfill would be placed in six-inch lifts and compacted to a relative density of 90-percent.
- The existing layer of soil cover between six inches and two feet in depth would be blended with imported soils and used for the ET cover. The ET cover would be constructed in six inch lifts.
- The bottom two feet of the existing cover soils would be removed as necessary, scarified, and recompacted to a relative density of 90 percent in six-inch lifts to construct the foundation layer.
- The landfill cover would incorporate a 3 percent maximum surface grade, as specified by Title 27 of the CCR. The side slopes of the landfill cover would be graded at 3:1.
- The area of the landfill cap would total approximately 5.75 acres, including the section directly above the debris disposal area and the side slopes.
- Approximately 9 acres of the site would be cleared and grubbed prior to construction of the landfill cap and other site improvements. The organic materials would be mulched and used as a topsoil amendment.
- Ten survey monuments would be installed to monitor potential settlement or subsidence as required by Title 27 of the CCR.
- The landfill cap would be vegetated with native grasses after construction.
- Approximately 350 feet long finger dike would be constructed and riprap would be placed to prevent erosion and control stormwater flow in the vicinity of AA 3.
- Approximately 1,800 linear feet of drainage channels would be constructed around the perimeter of the landfill cap to prevent run on and direct run off from the cap and adjacent areas towards Agua Chinon Wash. These channels would be four feet wide with an average depth of three feet. Approximately 500 cubic feet of shotcrete would be used to construct critical sections of the stormwater system.
- One pipe culvert would be constructed in conjunction with the gravel road at the landfill cap perimeter.

Monitoring Well Modifications and Abandonments

This cost element is based on the following assumptions:

- Five monitoring wells (four inside and one outside the debris limits) would be abandoned in conjunction with landfill cap construction.

- Casing extensions would be required for four monitoring wells to accommodate surface elevation changes associated with landfill cap construction and site grading. This task includes the demolition and replacement of surface completions (including concrete slabs, well monuments, and bollards).

Landfill Gas Collection System Construction

This cost element is based on the following assumptions:

- A passive landfill gas collection system would be installed. The system is assumed to include approximately 25 vertical vent wells spaced at 100 feet throughout the existing debris area cover.

- If necessary, the passive landfill gas collection system would be converted to an active one by connecting the wells with piping, and plumbing the system to a vacuum blower and associated equipment.

- The pad for the blower and associated equipment would be located to the northeast of existing monitoring wells MW-09A and MW-09B.

Access Road Construction

This cost element is based on the following assumptions:

- Approximately ½-mile of new access roads and existing access roads would be constructed or improved.

- The roads would be constructed as ten foot wide single lane, and would slope away from the landfill cap to promote runoff.

- A 6-inch-thick layer of ¾ minus aggregate would be placed and compacted over a compacted sub-base.

APPENDIX J-3. ASSUMPTIONS AND COSTS FOR ALTERNATIVE 3a

OPERATIONS AND MAINTENANCE COSTS

Land Use Controls

This cost element is based on the following assumptions:

- The Munitions and Explosives of Concern (MEC) Land Use Controls technology provided by RACER™ 2005 was used as a placeholder to estimate costs for the implementation of general land use controls.
- The capital costs for the potential addition of signs and locks to Anomaly Area 3 are minimal, therefore, it was assumed these costs are negligible for the cost estimate.

Long Term Monitoring

This cost element is based on the following assumptions:

- The five groundwater monitoring wells would be sampled for metals by EPA Method 6010B, volatile organic compounds (VOCs) by EPA Method 8260B, semi-volatile organic compounds (SVOCs) by EPA Method 8270, pesticides and herbicides by EPA Methods 8081/8151, and general chemistry semi-annually for five years, and annually for the following 25 years.
- The three soil gas monitoring wells would be sampled quarterly for fixed gases by American Society for Testing and Materials (ASTM) Method D1946 and VOCs by EPA Method TO-15 for five years, and semi-annually for the following 25 years.
- Ten percent of the landfill gas vent wells would be monitored quarterly for landfill gases with field instruments for five years, and semi-annually for the following 25 years.
- Groundwater samples would be collected using low-flow sampling pumps (already installed).
- Purge water would be collected in 55-gallon drums and disposed as investigation-derived waste.

Facility Inspection and Maintenance

This cost element is based on the following assumptions:

- Facility inspection, reporting, and maintenance would be conducted for a period of thirty years.
- Site inspections and reporting would be performed semi-annually.
- The monitoring technology was used to incorporate annual facility inspection, reporting, and maintenance costs into the cost estimate. The average annual cost for these elements was assumed to be approximately $8,000 for the site with a passive landfill gas collection system and $10,000 with an active landfill gas system.

APPENDIX J-3. ASSUMPTIONS AND COSTS FOR ALTERNATIVE 3a

PERIODIC COSTS

Monitoring Well Replacements

This cost element is based on the following assumptions:

- The five groundwater and three soil gas monitoring wells would be abandoned and replaced with new ones after ten and twenty years.

Five Year Reviews

This cost element is based on the following assumptions:

- Site specific documents, such as monitoring reports and decision documents would be reviewed after 5, 10, 15, 20, 25, and 30 years..
- An inspection would be conducted to assess site conditions as a part of each review.
- Each five year review would include a report providing conclusions and recommendations for future activities at the site.

Site Closeout

This cost element is based on the following assumptions:

- Site closeout activities would start in January 2038, after 30 years of groundwater and soil gas monitoring.
- Site closeout activities would include meetings, closure reports and decision documents, a monitoring well abandonment workplan, and abandonment of five groundwater and three soil gas monitoring wells.

APPENDIX J-4. ASSUMPTIONS AND COSTS FOR ALTERNATIVE 3b

SUMMARY DESCRIPTION

Alternative 3b includes the construction of a state prescriptive landfill cover system, stormwater control system construction, the implementation of land use controls, existing access controls, monitoring well abandonments and installations, debris relocation, construction of a landfill gas collection system, long-term groundwater and soil gas monitoring, access road construction, five-year site reviews, facility inspection and maintenance, and site closeout.

The state prescriptive landfill cover design consists of a two-foot-thick foundation layer composed of existing cover soils, a one-foot-thick barrier layer consisting of imported clay, and a two-foot thick vegetative cover layer. The landfill design also includes construction of stormwater control and drainage systems. Drainage improvements would be made to control flow from Agua Chinon Wash on to Anomaly Area 3 (AA 3). In addition, drainage channels would be constructed around the landfill cap to prevent erosion and stormwater run-on, and divert run off.

Land use controls include administrative controls such as deed restrictions and access controls such as existing fencing, and additional signs and locks (if necessary). Five monitoring wells (four inside and one outside the debris limits) would be abandoned in conjunction with landfill cap construction. In addition, four monitoring well casings and completions would be modified as a result of landfill cap construction. The five groundwater and three soil gas monitoring wells would be replaced after ten and twenty years. Approximately 12,000 cubic yards of debris would be relocated to provide a 100-foot clearance from the edge of debris to the proposed buffer zone boundary. A passive landfill gas collection system would be constructed and converted to an active system if necessary. Long-term groundwater monitoring includes sampling of five monitoring wells semi-annually for five years, and annually for the following 25 years. Long term soil gas monitoring includes sampling three wells and the landfill gas collection system quarterly for five years, and semi-annually for the following 25 years. Ten survey monuments would be installed to serve as benchmarks to monitor cap settlement. A single lane gravel perimeter road would be constructed around the landfill to facilitate monitoring well access and discourage vehicle traffic from traveling across the landfill cap. Five year reviews would be performed to assess site conditions and provide recommendations for future actions. Inspection and maintenance would be implemented for a period of thirty years for the landfill access controls, groundwater and soil gas monitoring wells, stormwater control system, and landfill cap. Estimated costs for this alternative are presented in Tables J-3.

The cost analysis for Alternative 3d includes the tasks described above. These tasks and cost estimation assumptions are described below:

CAPITAL COSTS

State Prescriptive Landfill Cover System

This cost element is based on the following assumptions:

- The top two feet of the existing four-foot-thick soil cover would be removed and stockpiled for use as topsoil for the vegetative cover.
- After the top two feet of the existing soil cover are removed, the underlying two feet of soil would be scarified, and recompacted to a relative density of 90 percent in six-inch lifts to construct the foundation layer.
- A debris consolidation area would be excavated near the center of Anomaly Area 3.

APPENDIX J-4. ASSUMPTIONS AND COSTS FOR ALTERNATIVE 3b

- Approximately 12,000 cubic yards of debris would be excavated from the southwest and southeast portions of AA3 and relocated within the existing debris boundary to provide a 100-foot clearance from the edge of debris to the proposed buffer zone boundary.

- The areas excavated to relocate the debris would be backfilled with on-site fill material. The backfill would be placed in six-inch lifts and compacted to a relative density of 90-percent.

- The clay layer would be installed above the foundation layer. Geotextile fabric would be used on both sides of the clay barrier layer to improve shear force resistance at the soil/clay barrier layer interface.

- The barrier layer would be 1-foot-thick, and constructed of imported clay to achieve a hydraulic conductivity of 1×10^{-6} cm/sec as required by Title 27 of the CCR. The barrier layer would be constructed in 6-inch lifts.

- A two-foot-thick vegetative cover would be placed above the clay barrier layer.

- The landfill cover would incorporate a 3 percent maximum surface grade, as specified by Title 27 of the CCR. The side slopes of the landfill cover would be graded at 3:1.

- The area of the landfill cap would total approximately 5.75 acres, including the section directly above the debris disposal area and the side slopes.

- Approximately 9 acres of the site would be cleared and grubbed prior to construction of the landfill cap and other site improvements. The organic materials would be mulched and used as a topsoil amendment.

- Ten survey monuments would be installed to monitor potential settlement or subsidence as required by Title 27 of the CCR.

- The landfill cap would be vegetated with native grasses after construction.

- Approximately 350 feet long finger dike would be constructed and riprap would be placed to prevent erosion and control stormwater flow in the vicinity of AA 3.

- Approximately 1,800 linear feet of drainage channels would be constructed around the perimeter of the landfill cap to prevent run on and direct run off from the cap and adjacent areas towards Agua Chinon Wash. These channels would be four feet wide with an average depth of three feet. Approximately 500 cubic feet of shotcrete would be used to construct critical sections of the stormwater system.

- One pipe culvert would be constructed in conjunction with the gravel road at the landfill cap perimeter.

Monitoring Well Modifications and Abandonments

This cost element is based on the following assumptions:

- Five monitoring wells (four inside and one outside the debris limits) would be abandoned in conjunction with landfill cap construction.
- Casing extensions would be required for four monitoring wells to accommodate surface elevation changes associated with landfill cap construction and site grading. This task includes the demolition and replacement of surface completions (including concrete slabs, well monuments, and bollards).

Landfill Gas Collection System Construction

This cost element is based on the following assumptions:

- A passive landfill gas collection system would be installed. The system is assumed to include approximately 25 vertical vent wells spaced at 100 feet throughout the existing debris area cover.
- If necessary, the passive landfill gas collection system would be converted to an active one by connecting the wells with piping, and plumbing the system to a vacuum blower and associated equipment.
- The pad for the blower and associated equipment would be located to the northeast of existing monitoring wells MW-09A and MW-09B.

Access Road Construction

This cost element is based on the following assumptions:

- Approximately ½-mile of new access roads and existing access roads would be constructed or improved.
- The roads would be constructed as ten foot wide single lane, and would slope away from the landfill cap to promote runoff.
- A 6-inch-thick layer of ¾ minus aggregate would be placed and compacted over a compacted sub-base.

OPERATIONS AND MAINTENANCE COSTS

Land Use Controls

This cost element is based on the following assumptions:

- The Munitions and Explosives of Concern (MEC) Land Use Controls technology provided by RACER™ 2005 was used as a placeholder to estimate costs for the implementation of general land use controls.
- The capital costs for the potential addition of signs and locks to Anomaly Area 3 are minimal, therefore, it was assumed these costs are negligible for the cost estimate.

APPENDIX J-4. ASSUMPTIONS AND COSTS FOR ALTERNATIVE 3b

Long Term Monitoring

This cost element is based on the following assumptions:

- The five groundwater monitoring wells would be sampled for metals by EPA Method 6010B, volatile organic compounds (VOCs) by EPA Method 8260B, semi-volatile organic compounds (SVOCs) by EPA Method 8270, pesticides and herbicides by EPA Methods 8081/8151, and general chemistry semi-annually for five years, and annually for the following 25 years.
- The three soil gas monitoring wells would be sampled quarterly for fixed gases by American Society for Testing and Materials (ASTM) Method D1946 and VOCs by EPA Method TO-15 for five years, and semi-annually for the following 25 years.
- Ten percent of the landfill gas vent wells would be monitored quarterly for landfill gases with field instruments for five years, and semi-annually for the following 25 years.
- Groundwater samples would be collected using low-flow sampling pumps (already installed).
- Purge water would be collected in 55-gallon drums and disposed as investigation-derived waste.

Facility Inspection and Maintenance

This cost element is based on the following assumptions:

- Facility inspection, reporting, and maintenance would be conducted for a period of thirty years.
- Site inspections and reporting would be performed semi-annually.
- The monitoring technology was used to incorporate annual facility inspection, reporting, and maintenance costs into the cost estimate. The average annual cost for these elements was assumed to be approximately $8,000 for the site with a passive landfill gas collection system and $10,000 with an active landfill gas system.

PERIODIC COSTS

Monitoring Well Replacements

This cost element is based on the following assumptions:

- The five groundwater and three soil gas monitoring wells would be abandoned and replaced with new ones after ten and twenty years.

Five Year Reviews

This cost element is based on the following assumptions:

- Site specific documents, such as monitoring reports and decision documents would be reviewed after 5, 10, 15, 20, 25, and 30 years..
- An inspection would be conducted to assess site conditions as a part of each review.

- Each five year review would include a report providing conclusions and recommendations for future activities at the site.

Site Closeout

This cost element is based on the following assumptions:

- Site closeout activities would start in January 2038, after 30 years of groundwater and soil gas monitoring.
- Site closeout activities would include meetings, closure reports and decision documents, a monitoring well abandonment workplan, and abandonment of five groundwater and three soil gas monitoring wells.

APPENDIX J-5. ASSUMPTIONS AND COSTS FOR ALTERNATIVE 3c

SUMMARY DESCRIPTION

Alternative 3c includes the construction of a geosynthetic clay liner (GCL) landfill cover system, stormwater control system construction, the implementation of land use controls, existing access controls, monitoring well abandonments and installations, debris relocation, construction of a landfill gas collection system, long-term groundwater and soil gas monitoring, access road construction, five-year site reviews, facility inspection and maintenance, and site closeout.

The GCL cover system consists of a two-foot-thick foundation layer consisting of existing cover soils, the GCL (consisting of a bentonite powder bounded on both sides by a geotextile fabric), and a two-foot-thick vegetative cover. The landfill design also includes construction of stormwater control and drainage systems. Drainage improvements would be made to control flow from Agua Chinon Wash on to Anomaly Area 3 (AA 3). In addition, drainage channels would be constructed around the landfill cap to prevent erosion and stormwater run-on, and divert run off.

Land use controls include administrative controls such as deed restrictions and access controls such as existing fencing, and additional signs and locks (if necessary). Five monitoring wells (four inside and one outside the debris limits) would be abandoned in conjunction with landfill cap construction. In addition, four monitoring well casings and completions would be modified as a result of landfill cap construction. The five groundwater and three soil gas monitoring wells would be replaced after ten and twenty years. Approximately 12,000 cubic yards of debris would be relocated to provide a 100-foot clearance from the edge of debris to the proposed buffer zone boundary. A passive landfill gas collection system would be constructed and converted to an active system if necessary. Long-term groundwater monitoring includes sampling of five monitoring wells semi-annually for five years, and annually for the following 25 years. Long term soil gas monitoring includes sampling three wells and the landfill gas collection system quarterly for five years, and semi-annually for the following 25 years. Ten survey monuments would be installed to serve as benchmarks to monitor cap settlement. A single lane gravel perimeter road would be constructed around the landfill to facilitate monitoring well access and discourage vehicle traffic from traveling across the landfill cap. Five year reviews would be performed to assess site conditions and provide recommendations for future actions. Inspection and maintenance would be implemented for a period of thirty years for the landfill access controls, groundwater and soil gas monitoring wells, stormwater control system, and landfill cap. Estimated costs for this alternative are presented in Tables J-4.

The cost analysis for Alternative 3b includes the tasks described above. These tasks and cost estimation assumptions are described below:

CAPITAL COSTS

GCL Landfill Cover System

This cost element is based on the following assumptions:

- The top two feet of the existing four-foot-thick soil cover would be removed and stockpiled for use as topsoil for the vegetative cover.

APPENDIX J-5. ASSUMPTIONS AND COSTS FOR ALTERNATIVE 3c

- After the top two feet of the existing soil cover are removed, the underlying two feet of soil would be scarified, and recompacted to a relative density of 90 percent in six-inch lifts to construct the foundation layer.

- A debris consolidation area would be excavated near the center of Anomaly Area 3.

- Approximately 12,000 cubic yards of debris would be excavated from the southwest and southeast portions of AA3 and relocated within the existing debris boundary to provide a 100-foot clearance from the edge of debris to the proposed buffer zone boundary.

- The areas excavated to relocate the debris would be backfilled with on-site fill material. The backfill would be placed in six-inch lifts and compacted to a relative density of 90-percent.

- The GCL barrier layer would be installed above the foundation layer. Geotextile fabric would be used on both sides of the GCL to improve shear force resistance at the soil/GCL interface.

- A two-foot-thick vegetative cover would be placed above the GCL barrier layer.

- The landfill cover would incorporate a 3 percent maximum surface grade, as specified by Title 27 of the CCR. The side slopes of the landfill cover would be graded at 3:1.

- The area of the landfill cap would total approximately 5.75 acres, including the section directly above the debris disposal area and the side slopes.

- Approximately 9 acres of the site would be cleared and grubbed prior to construction of the landfill cap and other site improvements. The organic materials would be mulched and used as a topsoil amendment.

- Ten survey monuments would be installed to monitor potential settlement or subsidence as required by Title 27 of the CCR.

- The landfill cap would be vegetated with native grasses after construction.

- Approximately 350 feet long finger dike would be constructed and riprap would be placed to prevent erosion and control stormwater flow in the vicinity of AA 3.

- Approximately 1,800 linear feet of drainage channels would be constructed around the perimeter of the landfill cap to prevent run on and direct run off from the cap and adjacent areas towards Agua Chinon Wash. These channels would be four feet wide with an average depth of three feet. Approximately 500 cubic feet of shotcrete would be used to construct critical sections of the stormwater system.

- One pipe culvert would be constructed in conjunction with the gravel road at the landfill cap perimeter.

APPENDIX J-5. ASSUMPTIONS AND COSTS FOR ALTERNATIVE 3c

Monitoring Well Modifications and Abandonments

This cost element is based on the following assumptions:

- Five monitoring wells (four inside and one outside the debris limits) would be abandoned in conjunction with landfill cap construction.
- Casing extensions would be required for four monitoring wells to accommodate surface elevation changes associated with landfill cap construction and site grading. This task includes the demolition and replacement of surface completions (including concrete slabs, well monuments, and bollards).

Landfill Gas Collection System Construction

This cost element is based on the following assumptions:

- A passive landfill gas collection system would be installed. The system is assumed to include approximately 25 vertical vent wells spaced at 100 feet throughout the existing debris area cover.
- If necessary, the passive landfill gas collection system would be converted to an active one by connecting the wells with piping, and plumbing the system to a vacuum blower and associated equipment.
- The pad for the blower and associated equipment would be located to the northeast of existing monitoring wells MW-09A and MW-09B.

Access Road Construction

This cost element is based on the following assumptions:

- Approximately ½-mile of new access roads and existing access roads would be constructed or improved.
- The roads would be constructed as ten foot wide single lane, and would slope away from the landfill cap to promote runoff.
- A 6-inch-thick layer of ¾ minus aggregate would be placed and compacted over a compacted sub-base.

OPERATIONS AND MAINTENANCE COSTS

Land Use Controls

This cost element is based on the following assumptions:

- The Munitions and Explosives of Concern (MEC) Land Use Controls technology provided by RACER™ 2005 was used as a placeholder to estimate costs for the implementation of general land use controls.

- The capital costs for the potential addition of signs and locks to Anomaly Area 3 are minimal, therefore, it was assumed these costs are negligible for the cost estimate.

Long Term Monitoring

This cost element is based on the following assumptions:

- The five groundwater monitoring wells would be sampled for metals by EPA Method 6010B, volatile organic compounds (VOCs) by EPA Method 8260B, semi-volatile organic compounds (SVOCs) by EPA Method 8270, pesticides and herbicides by EPA Methods 8081/8151, and general chemistry semi-annually for five years, and annually for the following 25 years.

- The three soil gas monitoring wells would be sampled quarterly for fixed gases by American Society for Testing and Materials (ASTM) Method D1946 and VOCs by EPA Method TO-15 for five years, and semi-annually for the following 25 years.

- Ten percent of the landfill gas vent wells would be monitored quarterly for landfill gases with field instruments for five years, and semi-annually for the following 25 years.

- Groundwater samples would be collected using low-flow sampling pumps (already installed).

- Purge water would be collected in 55-gallon drums and disposed as investigation-derived waste.

Facility Inspection and Maintenance

This cost element is based on the following assumptions:

- Facility inspection, reporting, and maintenance would be conducted for a period of thirty years.

- Site inspections and reporting would be performed semi-annually.

- The monitoring technology was used to incorporate annual facility inspection, reporting, and maintenance costs into the cost estimate. The average annual cost for these elements was assumed to be approximately $8,000 for the site with a passive landfill gas collection system and $10,000 with an active landfill gas system.

PERIODIC COSTS

The cost analysis for Alternative 3b includes the tasks described above. These tasks and cost estimation assumptions are described below:

APPENDIX J-5. ASSUMPTIONS AND COSTS FOR ALTERNATIVE 3c

Monitoring Well Replacements

This cost element is based on the following assumptions:

- The five groundwater and three soil gas monitoring wells would be abandoned and replaced with new ones after ten and twenty years.

Five Year Reviews

This cost element is based on the following assumptions:

- Site specific documents, such as monitoring reports and decision documents would be reviewed after 5, 10, 15, 20, 25, and 30 years..
- An inspection would be conducted to assess site conditions as a part of each review.
- Each five year review would include a report providing conclusions and recommendations for future activities at the site.

Site Closeout

This cost element is based on the following assumptions:

- Site closeout activities would start in January 2038, after 30 years of groundwater and soil gas monitoring.
- Site closeout activities would include meetings, closure reports and decision documents, a monitoring well abandonment workplan, and abandonment of five groundwater and three soil gas monitoring wells.

APPENDIX J-6. ASSUMPTIONS AND COSTS FOR ALTERNATIVE 3d

SUMMARY DESCRIPTION

Alternative 3d includes the construction of a flexible membrane liner (FML) landfill cover system, stormwater control system construction, the implementation of land use controls, existing access controls, monitoring well modifications, abandonments and replacements, debris relocation, construction of a landfill gas collection system, long-term groundwater and soil gas monitoring, access road construction, five-year site reviews, facility inspection and maintenance, and site closeout.

The FML cover system consists of a two-foot-thick foundation layer consisting of existing cover soils, the FML (consisting of a 40 to 60 mil layer of either high or low density polyethylene), and a two-foot-thick vegetative cover. The landfill design also includes construction of stormwater control and drainage systems. Drainage improvements would be made to control the flow from Agua Chinon Wash on to Anomaly Area 3 (AA 3). In addition, drainage channels would be constructed around the landfill cap to prevent erosion and stormwater run-on, and divert run off.

Land use controls include administrative controls such as deed restrictions and access controls such as existing fencing, and additional signs and locks (if necessary). Five monitoring wells (four inside and one outside the debris limits) would be abandoned in conjunction with landfill cap construction. In addition, four monitoring well casings and completions would be modified as a result of landfill cap construction. The five groundwater and three soil gas monitoring wells would be replaced after ten and twenty years. Approximately 12,000 cubic yards of debris would be relocated to provide a 100-foot clearance from the edge of debris to the proposed buffer zone boundary. A passive landfill gas collection system would be constructed and converted to an active system if necessary. Long-term groundwater monitoring includes sampling of five monitoring wells semi-annually for five years, and annually for the following 25 years. Long term soil gas monitoring includes sampling three wells and the landfill gas collection system quarterly for five years, and semi-annually for the following 25 years. Ten survey monuments would be installed to serve as benchmarks to monitor cap settlement. A single lane gravel perimeter road would be constructed around the landfill to facilitate monitoring wells access and discourage vehicle traffic from traveling across the landfill cap. Five year reviews would be performed to assess site conditions and provide recommendations for future actions. Inspection and maintenance will be implemented for a period of thirty years for the landfill access controls, groundwater and soil gas monitoring wells, stormwater control system, and landfill cap. Estimated costs for this alternative are presented in Tables J-5.

The cost analysis for Alternative 3c includes the tasks described above. These tasks and cost estimation assumptions are described below:

CAPITAL COSTS

FML Landfill Cover System

This cost element is based on the following assumptions:

- The top two feet of the existing four-foot-thick soil cover would be removed and stockpiled for use as topsoil for the vegetative cover.

APPENDIX J-6. ASSUMPTIONS AND COSTS FOR ALTERNATIVE 3d

- After the top two feet of the existing soil cover are removed, the underlying two feet of soil would be scarified, and recompacted to a relative density of 90 percent in six-inch lifts to construct the foundation layer.

- A debris consolidation area would be excavated near the center of Anomaly Area 3.

- Approximately 12,000 cubic yards of debris would be excavated from the southwest and southeast portions of AA3 and relocated within the existing debris boundary to provide a 100-foot clearance from the edge of debris to the proposed buffer zone boundary.

- The areas excavated to relocate the debris would be backfilled with on-site fill material. The backfill would be placed in six-inch lifts and compacted to a relative density of 90-percent.

- The FML barrier layer would be installed above the foundation layer. Geotextile fabric would be used on both sides of the FML to improve shear force resistance at the soil/FML interface.

- A two-foot-thick vegetative cover would be placed above the FML barrier layer.

- The landfill cover would incorporate a 3 percent maximum surface grade, as specified by Title 27 of the CCR. The side slopes of the landfill cover would be graded at 3:1.

- The area of the landfill cap would total approximately 5.75 acres, including the section directly above the debris disposal area and the side slopes.

- Approximately 9 acres of the site would be cleared and grubbed prior to construction of the landfill cap and other site improvements. The organic materials would be mulched and used as a topsoil amendment.

- Ten survey monuments would be installed to monitor potential settlement or subsidence as required by Title 27 of the CCR.

- The landfill cap would be vegetated with native grasses after construction.

- Approximately 350 feet long finger dike would be constructed and riprap would be placed to prevent erosion and control stormwater flow in the vicinity of AA 3.

- Approximately 1,800 linear feet of drainage channels would be constructed around the perimeter of the landfill cap to prevent run on and direct run off from the cap and adjacent areas towards Agua Chinon Wash. These channels would be four feet wide with an average depth of three feet. Approximately 500 cubic feet of shotcrete would be used to construct critical sections of the stormwater system.

- One pipe culvert would be constructed in conjunction with the gravel road at the landfill cap perimeter.

APPENDIX J-6. ASSUMPTIONS AND COSTS FOR ALTERNATIVE 3d

Monitoring Well Modifications and Abandonments

This cost element is based on the following assumptions:

- Five monitoring wells (four inside and one outside the debris limits) would be abandoned in conjunction with landfill cap construction.
- Casing extensions would be required for four monitoring wells to accommodate surface elevation changes associated with landfill cap construction and site grading. This task includes the demolition and replacement of surface completions (including concrete slabs, well monuments, and bollards).

Landfill Gas Collection System Construction

This cost element is based on the following assumptions:

- A passive landfill gas collection system would be installed. The system is assumed to include approximately 25 vertical vent wells spaced at 100 feet throughout the existing debris area cover.
- If necessary, the passive landfill gas collection system would be converted to an active one by connecting the wells with piping, and plumbing the system to a vacuum blower and associated equipment.
- The pad for the blower and associated equipment would be located to the northeast of existing monitoring wells MW-09A and MW-09B.

Access Road Construction

This cost element is based on the following assumptions:

- Approximately ½-mile of new access roads and existing access roads would be constructed or improved.
- The roads would be constructed as ten foot wide single lane, and would slope away from the landfill cap to promote runoff.
- A 6-inch-thick layer of ¾ minus aggregate would be placed and compacted over a compacted sub-base.

OPERATIONS AND MAINTENANCE COSTS

Land Use Controls

This cost element is based on the following assumptions:

- The Munitions and Explosives of Concern (MEC) Land Use Controls technology provided by RACER™ 2005 was used as a placeholder to estimate costs for the implementation of general land use controls.

- The capital costs for the potential addition of signs and locks to Anomaly Area 3 are minimal, therefore, it was assumed these costs are negligible for the cost estimate.

Long Term Monitoring

This cost element is based on the following assumptions:

- The five groundwater monitoring wells would be sampled for metals by EPA Method 6010B, volatile organic compounds (VOCs) by EPA Method 8260B, semi-volatile organic compounds (SVOCs) by EPA Method 8270, pesticides and herbicides by EPA Methods 8081/8151, and general chemistry semi-annually for five years, and annually for the following 25 years.

- The three soil gas monitoring wells would be sampled quarterly for fixed gases by American Society for Testing and Materials (ASTM) Method D1946 and VOCs by EPA Method TO-15 for five years, and semi-annually for the following 25 years.

- Ten percent of the landfill gas vent wells would be monitored quarterly for landfill gases with field instruments for five years, and semi-annually for the following 25 years.

- Groundwater samples would be collected using low-flow sampling pumps (already installed).

- Purge water would be collected in 55-gallon drums and disposed as investigation-derived waste.

Facility Inspection and Maintenance

This cost element is based on the following assumptions:

- Facility inspection, reporting, and maintenance would be conducted for a period of thirty years.

- Site inspections and reporting would be performed semi-annually.

- The monitoring technology was used to incorporate annual facility inspection, reporting, and maintenance costs into the cost estimate. The average annual cost for these elements was assumed to be approximately $8,000 for the site with a passive landfill gas collection system and $10,000 with an active landfill gas system.

PERIODIC COSTS

Monitoring Well Replacements

This cost element is based on the following assumptions:

- The five groundwater and three soil gas monitoring wells would be abandoned and replaced with new ones after ten and twenty years.

Five Year Reviews

This cost element is based on the following assumptions:

- Site specific documents, such as monitoring reports and decision documents would be reviewed after 5, 10, 15, 20, 25, and 30 years..
- An inspection would be conducted to assess site conditions as a part of each review.
- Each five year review would include a report providing conclusions and recommendations for future activities at the site.

Site Closeout

This cost element is based on the following assumptions:

- Site closeout activities would start in January 2038, after 30 years of groundwater and soil gas monitoring.
- Site closeout activities would include meetings, closure reports and decision documents, a monitoring well abandonment workplan, and abandonment of five groundwater and three soil gas monitoring wells.

APPENDIX J-7. ASSUMPTIONS AND COSTS FOR ALTERNATIVE 4

SUMMARY DESCRIPTION

Alternative 4 (clean closure) includes excavation and removal of all buried construction debris at Anomaly Area 3, groundwater and soil gas monitoring well abandonments, site revegetation, long term groundwater monitoring for 5 years, a five year site review, and site closeout.

Clean closure consists of sample collection from the debris area for waste characterization purposes, sample collection from the backfill to ensure that the material is clean, excavation and off site disposal of all construction debris and associated soil, and backfilling the excavation area with imported fill material. The cost estimate for this alternative presents the following three clean closure scenarios:

1. 50-percent of the buried debris would be disposed of as RCRA hazardous waste requiring stabilization, and 50-percent of the buried debris would be disposed of as non-hazardous waste.

2. 25-percent of the buried debris would be disposed of as RCRA hazardous waste requiring stabilization, and 75-percent of the buried debris would be disposed of as non-hazardous waste.

3. 100-percent of the buried debris would be disposed of as non hazardous waste.

Five groundwater monitoring wells (four inside and one outside the debris limits) and three soil gas monitoring wells would be abandoned in conjunction with clean closure. After all debris was removed, the site would be revegetated with native grasses. Long-term groundwater monitoring includes sampling of five monitoring wells semi-annually for five years. The five year review would be performed to assess site conditions and provide recommendations for future actions. Estimated costs for the three scenarios considered for this alternative are provided in Tables J-6, J-7, and J-8.

The cost analysis for Alternative 4 includes the tasks described above. These tasks and cost estimation assumptions are described below:

CAPITAL COSTS

Clean Closure

This cost element is based on the following assumptions:

- Approximately 100 samples would be required to characterize the debris and soil for disposal purposes, and the backfill material prior to and during importation to the site. The samples would be analyzed for metals by EPA SW-846 Method 6010B, pesticides by EPA SW-846 Method 8081, herbicides by EPA SW-846 Method 8151, PCB's by EPA SW-846 Method 8082, and VOCs by EPA SW-846 Method 8260, and SVOCs by EPA SW-846 Method 8270.

- A total of approximately 140,000 cubic yards of construction debris and soil would be removed from the site.

- Trucking costs are based on transportation to the Kettleman Hills waste disposal facility for RCRA hazardous waste requiring stabilization, and to the Clean Harbors waste disposal facility for non-hazardous waste.

- After the construction debris and associated soil are removed from the site, the excavation would be backfilled with imported clean fill material. The material would be placed in 6 inch lifts and compacted to a relative density of 90 percent. The top one-foot of the excavation would be covered with topsoil to facilitate revegetation.

- Geotechnical testing would be performed in conjunction with backfilling activities.

Monitoring Well Abandonments

This cost element is based on the following assumptions:

- Five groundwater monitoring wells (four inside and one outside the debris limits) and three soil gas monitoring wells would be abandoned prior to clean closure activities.

Site Revegetation

This cost element is based on the following assumptions:

- A total of nine acres would be revegetated with native grasses after clean closure activities are completed.

- The revegetated area would be prepared, seeded, fertilized, and irrigated with a water truck weekly for two months.

OPERATIONS AND MAINTENANCE

Long Term Monitoring

This cost element is based on the following assumptions:

- The five groundwater monitoring wells would be sampled for metals by EPA Method 6010B, volatile organic compounds (VOCs) by EPA Method 8260B, semi-volatile organic compounds (SVOCs) by EPA Method 8270, pesticides and herbicides by EPA Methods 8081/8151, and general chemistry semi-annually for five years, and annually for the following 25 years.

- Groundwater samples would be collected using low-flow sampling pumps.

- Purge water would be collected in 55-gallon drums and disposed as investigation-derived waste.

APPENDIX J-7. ASSUMPTIONS AND COSTS FOR ALTERNATIVE 4

PERIODIC COSTS

Five Year Review

This cost element is based on the following assumptions:

- Site specific documents, such as monitoring reports and decision documents would be reviewed.
- An inspection would be conducted to assess site conditions.
- A report would be issued providing conclusions and recommendations for future activities at the site.

Site Closeout

This cost element is based on the following assumptions:

- Site closeout activities would start in January 2013, after 5 years of groundwater and soil gas monitoring.
- Site closeout activities would include meetings, closure reports and decision documents, a monitoring well abandonment workplan, and abandonment of five groundwater monitoring wells.

TABLE J-1. ESTIMATED COSTS FOR ALTERNATIVE 2 (ACTIVE LFG SYSTEM)

Phase Name	Calendar Year 1 2008	Calendar Year 2 2009	Calendar Year 3 2010	Calendar Year 4 2011	Calendar Year 5 2012	Calendar Year 6 2013	Calendar Year 7 2014	Calendar Year 8 2015
Design	$73,300							
Site Grading (Capital)	$71,604							
SG Well Installs/MW Abandonments (Capital)	$63,067							
Passive Landfill Gas Collection System (Capital)	$75,887							
Active Landfill Gas Collection System (Capital)	$217,667							
Drainage Improvements (Capital)	$99,945							
Land Use Controls (Capital)	$47,212							
Debris Relocation (Capital)	$499,282							
Long Term Monitoring (Years 1-5)	$95,031	$95,031	$95,031	$95,031	$95,031			
Long Term Monitoring (Years 6-30)						$53,125	$53,125	$53,125
Monitoring Well Replacements @10 yrs								
Monitoring Well Replacements @20 yrs								
Five Year Review						$28,149		
Site Closeout								
Sub-Total (2005 Costs)	$1,242,995	$95,031	$95,031	$95,031	$95,031	$81,274	$53,125	$53,125
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790
Sub-Total (2008 Costs)	$1,341,136	$102,534	$102,534	$102,534	$102,534	$87,691	$57,319	$57,319
Contingency (20 %)	$242,222	$20,507	$20,507	$20,507	$20,507	$17,538	$11,464	$11,464
Subtotal (2008 Costs) (with Contingency)	$1,583,357	$123,041	$123,041	$123,041	$123,041	$105,229	$68,783	$68,783
Discount Factor	1.0000	0.9728	0.9463	0.9205	0.8954	0.8710	0.8473	0.8242
Present Value	$1,583,357	$119,690	$116,430	$113,258	$110,174	$91,658	$58,281	$56,693

TABLE J-1. ESTIMATED COSTS FOR ALTERNATIVE 2 (ACTIVE LFG SYSTEM)

Phase Name	Calendar Year 9 2016	Calendar Year 10 2017	Calendar Year 11 2018	Calendar Year 12 2019	Calendar Year 13 2020	Calendar Year 14 2021	Calendar Year 15 2022	Calendar Year 16 2023
Design								
Site Grading (Capital)								
SG Well Installs/MW Abandonments (Capital)								
Passive Landfill Gas Collection System (Capital)								
Active Landfill Gas Collection System (Capital)								
Drainage Improvements (Capital)								
Land Use Controls (Capital)								
Debris Relocation (Capital)								
Long Term Monitoring (Years 1-5)								
Long Term Monitoring (Years 6-30)	$53,125	$53,125	$53,125	$53,125	$53,125	$53,125	$53,125	$53,125
Monitoring Well Replacements @10 yrs			$128,350					
Monitoring Well Replacements @20 yrs								
Five Year Review			$28,149					$28,149
Site Closeout								
Sub-Total (2005 Costs)	$53,125	$53,125	$209,624	$53,125	$53,125	$53,125	$53,125	$81,274
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790
Sub-Total (2008 Costs)	$57,319	$57,319	$226,175	$57,319	$57,319	$57,319	$57,319	$87,691
Contingency (20 %)	$11,464	$11,464	$45,235	$11,464	$11,464	$11,464	$11,464	$17,538
Subtotal (2008 Costs) (with Contingency)	$68,783	$68,783	$271,410	$68,783	$68,783	$68,783	$68,783	$105,229
Discount Factor	0.8018	0.7799	0.7587	0.7380	0.7179	0.6984	0.6794	0.6609
Present Value	$55,149	$53,647	$205,918	$50,764	$49,382	$48,037	$46,728	$69,541

TABLE J-1. ESTIMATED COSTS FOR ALTERNATIVE 2 (ACTIVE LFG SYSTEM)

Phase Name	Calendar Year 17 2024	Calendar Year 18 2025	Calendar Year 19 2026	Calendar Year 20 2027	Calendar Year 21 2028	Calendar Year 22 2029	Calendar Year 23 2030	Calendar Year 24 2031
Design								
Site Grading (Capital)								
SG Well Installs/MW Abandonments (Capital)								
Passive Landfill Gas Collection System (Capital)								
Active Landfill Gas Collection System (Capital)								
Drainage Improvements (Capital)								
Land Use Controls (Capital)								
Debris Relocation (Capital)								
Long Term Monitoring (Years 1-5)								
Long Term Monitoring (Years 6-30)	$53,125	$53,125	$53,125	$53,125	$53,125	$53,125	$53,125	$53,125
Monitoring Well Replacements @10 yrs								
Monitoring Well Replacements @20 yrs					$128,350			
Five Year Review					$28,149			
Site Closeout								
Sub-Total (2005 Costs)	$53,125	$53,125	$53,125	$53,125	$209,624	$53,125	$53,125	$53,125
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790
Sub-Total (2008 Costs)	$57,319	$57,319	$57,319	$57,319	$226,175	$57,319	$57,319	$57,319
Contingency (20 %)	$11,464	$11,464	$11,464	$11,464	$45,235	$11,464	$11,464	$11,464
Subtotal (2008 Costs) (with Contingency)	$68,783	$68,783	$68,783	$68,783	$271,410	$68,783	$68,783	$68,783
Discount Factor	0.6429	0.6253	0.6083	0.5917	0.5756	0.5599	0.5447	0.5299
Present Value	$44,217	$43,013	$41,842	$40,702	$156,230	$38,515	$37,466	$36,445

TABLE J-1. ESTIMATED COSTS FOR ALTERNATIVE 2 (ACTIVE LFG SYSTEM)

Phase Name	Calendar Year 25 2032	Calendar Year 26 2033	Calendar Year 27 2034	Calendar Year 28 2035	Calendar Year 29 2036	Calendar Year 30 2037	Calendar Year 31 2038	Row Total
Design								$73,300
Site Grading (Capital)								$71,604
SG Well Installs/MW Abandonments (Capital)								$63,067
Passive Landfill Gas Collection System (Capital)								$75,887
Active Landfill Gas Collection System (Capital)								$217,667
Drainage Improvements (Capital)								$99,945
Land Use Controls (Capital)								$47,212
Debris Relocation (Capital)								$499,282
Long Term Monitoring (Years 1-5)								$475,155
Long Term Monitoring (Years 6-30)	$53,125	$53,125	$53,125	$53,125	$53,125	$53,125		$1,328,125
Monitoring Well Replacements @10 yrs								$128,350
Monitoring Well Replacements @20 yrs								$128,350
Five Year Review		$28,149					$28,149	$168,894
Site Closeout							$69,683	$69,683
Sub-Total (2005 Costs)	$53,125	$81,274	$53,125	$53,125	$53,125	$53,125	$97,832	$3,446,521
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	
Sub-Total (2008 Costs)	$57,319	$87,691	$57,319	$57,319	$57,319	$57,319	$105,556	$3,718,641
Contingency (20 %)	$11,464	$17,538	$11,464	$11,464	$11,464	$11,464	$21,111	$717,723
Subtotal (2008 Costs) (with Contingency)	$68,783	$105,229	$68,783	$68,783	$68,783	$68,783	$126,668	$4,436,363
Discount Factor	0.5154	0.5014	0.4877	0.4744	0.4615	0.4490	0.4367	
Present Value	$35,453	$52,760	$33,548	$32,634	$31,745	$30,880	$55,319	$3,539,475

TABLE J-2. ESTIMATED COSTS FOR ALTERNATIVE 3a (ACTIVE LFG COLLECTION SYSTEM)

Phase Name	Calendar Year 1 2008	Calendar Year 2 2009	Calendar Year 3 2010	Calendar Year 4 2011	Calendar Year 5 2012	Calendar Year 6 2013	Calendar Year 7 2014	Calendar Year 8 2015
Design	$102,304							
ET Cover (Capital)	$1,452,305							
Abandon MWs/Install SGMWs/MW Casing Extensions (Capital)	$74,517							
Passive Landfill Gas Collection System (Capital)	$75,887							
Active Landfill Gas Collection System (Capital)	$217,667							
Land Use Controls (Capital)	$47,212							
Debris Relocation (Capital)	$499,282							
Long Term Monitoring (Years 1-5)	$99,039	$99,039	$99,039	$99,039	$99,039			
Long Term Monitoring (Years 6-30)						$57,132	$57,132	$57,132
Five Year Review						$45,251		
Monitoring Well Replacements @10 yrs								
Monitoring Well Replacements @20 yrs								
Site Closeout								
Sub-Total (2005 Costs)	$2,568,213	$99,039	$99,039	$99,039	$99,039	$102,383	$57,132	$57,132
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790
Sub-Total (2008 Costs)	$2,770,986	$106,859	$106,859	$106,859	$106,859	$110,467	$61,643	$61,643
Contingency (20 %)	$521,933	$21,372	$21,372	$21,372	$21,372	$22,093	$12,329	$12,329
Subtotal (2008 Costs) (with Contingency)	$3,292,919	$128,230	$128,230	$128,230	$128,230	$132,560	$73,971	$73,971
Discount Factor	1.0000	0.9728	0.9463	0.9205	0.8954	0.8710	0.8473	0.8242
Present Value	$3,292,919	$124,738	$121,340	$118,035	$114,820	$115,464	$62,677	$60,969

TABLE J-2. ESTIMATED COSTS FOR ALTERNATIVE 3a (ACTIVE LFG COLLECTION SYSTEM)

Phase Name	Calendar Year 9 2016	Calendar Year 10 2017	Calendar Year 11 2018	Calendar Year 12 2019	Calendar Year 13 2020	Calendar Year 14 2021	Calendar Year 15 2022	Calendar Year 16 2023
Design								
ET Cover (Capital)								
Abandon MWs/Install SGMWs/MW Casing Extensions (Capital)								
Passive Landfill Gas Collection System (Capital)								
Active Landfill Gas Collection System (Capital)								
Land Use Controls (Capital)								
Debris Relocation (Capital)								
Long Term Monitoring (Years 1-5)								
Long Term Monitoring (Years 6-30)	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132
Five Year Review			$45,251					$45,251
Monitoring Well Replacements @10 yrs			$128,350					
Monitoring Well Replacements @20 yrs								
Site Closeout								
Sub-Total (2005 Costs)	$57,132	$57,132	$230,733	$57,132	$57,132	$57,132	$57,132	$102,383
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790
Sub-Total (2008 Costs)	$61,643	$61,643	$248,951	$61,643	$61,643	$61,643	$61,643	$110,467
Contingency (20 %)	$12,329	$12,329	$49,790	$12,329	$12,329	$12,329	$12,329	$22,093
Subtotal (2008 Costs) (with Contingency)	$73,971	$73,971	$298,741	$73,971	$73,971	$73,971	$73,971	$132,560
Discount Factor	0.8018	0.7799	0.7587	0.7380	0.7179	0.6984	0.6794	0.6609
Present Value	$59,309	$57,693	$226,654	$54,593	$53,106	$51,660	$50,253	$87,602

TABLE J-2. ESTIMATED COSTS FOR ALTERNATIVE 3a (ACTIVE LFG COLLECTION SYSTEM)

Phase Name	Calendar Year 17 2024	Calendar Year 18 2025	Calendar Year 19 2026	Calendar Year 20 2027	Calendar Year 21 2028	Calendar Year 22 2029	Calendar Year 23 2030	Calendar Year 24 2031
Design								
ET Cover (Capital)								
Abandon MWs/Install SGMWs/MW Casing Extensions (Capital)								
Passive Landfill Gas Collection System (Capital)								
Active Landfill Gas Collection System (Capital)								
Land Use Controls (Capital)								
Debris Relocation (Capital)								
Long Term Monitoring (Years 1-5)								
Long Term Monitoring (Years 6-30)	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132
Five Year Review					$45,251			
Monitoring Well Replacements @10 yrs								
Monitoring Well Replacements @20 yrs					$128,350			
Site Closeout								
Sub-Total (2005 Costs)	$57,132	$57,132	$57,132	$57,132	$230,733	$57,132	$57,132	$57,132
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790
Sub-Total (2008 Costs)	$61,643	$61,643	$61,643	$61,643	$248,951	$61,643	$61,643	$61,643
Contingency (20 %)	$12,329	$12,329	$12,329	$12,329	$49,790	$12,329	$12,329	$12,329
Subtotal (2008 Costs) (with Contingency)	$73,971	$73,971	$73,971	$73,971	$298,741	$73,971	$73,971	$73,971
Discount Factor	0.6429	0.6253	0.6083	0.5917	0.5756	0.5599	0.5447	0.5299
Present Value	$47,553	$46,257	$44,997	$43,772	$171,962	$41,420	$40,292	$39,194

TABLE J-2. ESTIMATED COSTS FOR ALTERNATIVE 3a (ACTIVE LFG COLLECTION SYSTEM)

Phase Name	Calendar Year 25 2032	Calendar Year 26 2033	Calendar Year 27 2034	Calendar Year 28 2035	Calendar Year 29 2036	Calendar Year 30 2037	Calendar Year 31 2038	Row Total
Design								$102,304
ET Cover (Capital)								$1,452,305
Abandon MWs/Install SGMWs/MW Casing Extensions (Capital)								$74,517
Passive Landfill Gas Collection System (Capital)								$75,887
Active Landfill Gas Collection System (Capital)								$217,667
Land Use Controls (Capital)								$47,212
Debris Relocation (Capital)								$499,282
Long Term Monitoring (Years 1-5)								$495,195
Long Term Monitoring (Years 6-30)	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132		$1,428,300
Five Year Review		$45,251					$45,251	$271,506
Monitoring Well Replacements @10 yrs								$128,350
Monitoring Well Replacements @20 yrs								$128,350
Site Closeout							$93,173	$93,173
Sub-Total (2005 Costs)	$57,132	$102,383	$57,132	$57,132	$57,132	$57,132	$138,424	$5,014,048
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	
Sub-Total (2008 Costs)	$61,643	$110,467	$61,643	$61,643	$61,643	$61,643	$149,353	$5,409,932
Contingency (20 %)	$12,329	$22,093	$12,329	$12,329	$12,329	$12,329	$29,871	$1,049,722
Subtotal (2008 Costs) (with Contingency)	$73,971	$132,560	$73,971	$73,971	$73,971	$73,971	$179,224	$6,459,654
Discount Factor	0.5154	0.5014	0.4877	0.4744	0.4615	0.4490	0.4367	
Present Value	$38,127	$66,464	$36,078	$35,095	$34,139	$33,210	$78,271	$5,448,664

TABLE J-3. ESTIMATED COSTS FOR ALTERNATIVE 3d (ACTIVE LFG COLLECTION SYSTEM)

Phase Name	Calendar Year 1 2008	Calendar Year 2 2009	Calendar Year 3 2010	Calendar Year 4 2011	Calendar Year 5 2012	Calendar Year 6 2013	Calendar Year 7 2014	Calendar Year 8 2015
Design	$102,466							
Prescriptive Cover (Capital)	$1,615,533							
Passive Landfill Gas Collection System (Capital)	$75,887							
Active Landfill Gas Collection System (Capital)	$217,667							
Land Use Controls (Capital)	$47,212							
Abandon MWs/Install SGMWs/MW Casing Extensions (Capital)	$74,517							
Debris Relocation (Capital)	$499,282							
Long Term Monitoring (Years 1-5)	$99,039	$99,039	$99,039	$99,039	$99,039			
Long Term Monitoring (Years 6-30)						$57,132	$57,132	$57,132
Five Year Review						$45,251		
Monitoring Well Replacements @10 yrs								
Monitoring Well Replacements @20 yrs								
Site Closeout								
Sub-Total (2005 Costs)	$2,731,603	$99,039	$99,039	$99,039	$99,039	$102,383	$57,132	$57,132
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790
Sub-Total (2008 Costs)	$2,947,276	$106,859	$106,859	$106,859	$106,859	$110,467	$61,643	$61,643
Contingency (20 %)	$557,156	$21,372	$21,372	$21,372	$21,372	$22,093	$12,329	$12,329
Subtotal (2008 Costs) (with Contingency)	$3,504,433	$128,230	$128,230	$128,230	$128,230	$132,560	$73,971	$73,971
Discount Factor	1.0000	0.9728	0.9463	0.9205	0.8954	0.8710	0.8473	0.8242
Present Value	$3,504,433	$124,738	$121,340	$118,035	$114,820	$115,464	$62,677	$60,969

TABLE J-3. ESTIMATED COSTS FOR ALTERNATIVE 3d (ACTIVE LFG COLLECTION SYSTEM)

Phase Name	Calendar Year 9 2016	Calendar Year 10 2017	Calendar Year 11 2018	Calendar Year 12 2019	Calendar Year 13 2020	Calendar Year 14 2021	Calendar Year 15 2022	Calendar Year 16 2023
Design								
Prescriptive Cover (Capital)								
Passive Landfill Gas Collection System (Capital)								
Active Landfill Gas Collection System (Capital)								
Land Use Controls (Capital)								
Abandon MWs/Install SGMWs/MW Casing Extensions (Capital)								
Debris Relocation (Capital)								
Long Term Monitoring (Years 1-5)								
Long Term Monitoring (Years 6-30)	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132
Five Year Review			$45,251					$45,251
Monitoring Well Replacements @10 yrs			$128,350					
Monitoring Well Replacements @20 yrs								
Site Closeout								
Sub-Total (2005 Costs)	$57,132	$57,132	$230,733	$57,132	$57,132	$57,132	$57,132	$102,383
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790
Sub-Total (2008 Costs)	$61,643	$61,643	$248,951	$61,643	$61,643	$61,643	$61,643	$110,467
Contingency (20 %)	$12,329	$12,329	$49,790	$12,329	$12,329	$12,329	$12,329	$22,093
Subtotal (2008 Costs) (with Contingency)	$73,971	$73,971	$298,741	$73,971	$73,971	$73,971	$73,971	$132,560
Discount Factor	0.8018	0.7799	0.7587	0.7380	0.7179	0.6984	0.6794	0.6609
Present Value	$59,309	$57,693	$226,654	$54,593	$53,106	$51,660	$50,253	$87,602

TABLE J-3. ESTIMATED COSTS FOR ALTERNATIVE 3d (ACTIVE LFG COLLECTION SYSTEM)

Phase Name	Calendar Year 17 2024	Calendar Year 18 2025	Calendar Year 19 2026	Calendar Year 20 2027	Calendar Year 21 2028	Calendar Year 22 2029	Calendar Year 23 2030	Calendar Year 24 2031
Design								
Prescriptive Cover (Capital)								
Passive Landfill Gas Collection System (Capital)								
Active Landfill Gas Collection System (Capital)								
Land Use Controls (Capital)								
Abandon MWs/Install SGMWs/MW Casing Extensions (Capital)								
Debris Relocation (Capital)								
Long Term Monitoring (Years 1-5)								
Long Term Monitoring (Years 6-30)	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132
Five Year Review					$45,251			
Monitoring Well Replacements @10 yrs								
Monitoring Well Replacements @20 yrs					$128,350			
Site Closeout								
Sub-Total (2005 Costs)	$57,132	$57,132	$57,132	$57,132	$230,733	$57,132	$57,132	$57,132
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790
Sub-Total (2008 Costs)	$61,643	$61,643	$61,643	$61,643	$248,951	$61,643	$61,643	$61,643
Contingency (20 %)	$12,329	$12,329	$12,329	$12,329	$49,790	$12,329	$12,329	$12,329
Subtotal (2008 Costs) (with Contingency)	$73,971	$73,971	$73,971	$73,971	$298,741	$73,971	$73,971	$73,971
Discount Factor	0.6429	0.6253	0.6083	0.5917	0.5756	0.5599	0.5447	0.5299
Present Value	$47,553	$46,257	$44,997	$43,772	$171,962	$41,420	$40,292	$39,194

TABLE J-3. ESTIMATED COSTS FOR ALTERNATIVE 3d (ACTIVE LFG COLLECTION SYSTEM)

Phase Name	Calendar Year 25 2032	Calendar Year 26 2033	Calendar Year 27 2034	Calendar Year 28 2035	Calendar Year 29 2036	Calendar Year 30 2037	Calendar Year 31 2038	Row Total
Design								$102,466
Prescriptive Cover (Capital)								$1,615,533
Passive Landfill Gas Collection System (Capital)								$75,887
Active Landfill Gas Collection System (Capital)								$217,667
Land Use Controls (Capital)								$47,212
Abandon MWs/Install SGMWs/MW Casing Extensions (Capital)								$74,517
Debris Relocation (Capital)								$499,282
Long Term Monitoring (Years 1-5)								$495,195
Long Term Monitoring (Years 6-30)	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132		$1,428,300
Five Year Review		$45,251					$45,251	$271,506
Monitoring Well Replacements @10 yrs								$128,350
Monitoring Well Replacements @20 yrs								$128,350
Site Closeout							$93,173	$93,173
Sub-Total (2005 Costs)	$57,132	$102,383	$57,132	$57,132	$57,132	$57,132	$138,424	$5,177,438
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	
Sub-Total (2008 Costs)	$61,643	$110,467	$61,643	$61,643	$61,643	$61,643	$149,353	$5,586,222
Contingency (20 %)	$12,329	$22,093	$12,329	$12,329	$12,329	$12,329	$29,871	$1,084,945
Subtotal (2008 Costs) (with Contingency)	$73,971	$132,560	$73,971	$73,971	$73,971	$73,971	$179,224	$6,671,167
Discount Factor	0.5154	0.5014	0.4877	0.4744	0.4615	0.4490	0.4367	
Present Value	$38,127	$66,464	$36,078	$35,095	$34,139	$33,210	$78,271	$5,660,178

TABLE J-4. ESTIMATED COSTS FOR ALTERNATIVE 3b (ACTIVE LFG COLLECTION SYSTEM)

Phase Name	Calendar Year 1 2008	Calendar Year 2 2009	Calendar Year 3 2010	Calendar Year 4 2011	Calendar Year 5 2012	Calendar Year 6 2013	Calendar Year 7 2014	Calendar Year 8 2015
Design	$90,531							
GCL Cover (Capital)	$1,159,529							
Passive Landfill Gas Collection System (Capital)	$75,887							
Active Landfill Gas Collection System (Capital)	$217,667							
Land Use Controls (Capital)	$47,212							
Abandon MWs/Install SGMWs/MW Casing Extensions (Capital)	$74,517							
Debris Relocation (Capital)	$499,282							
Long Term Monitoring (Years 1-5)	$99,039	$99,039	$99,039	$99,039	$99,039			
Long Term Monitoring (Years 6-30)						$57,132	$57,132	$57,132
Five Year Review						$45,251		
Monitoring Well Replacements @10 yrs								
Monitoring Well Replacements @20 yrs								
Site Closeout								
Sub-Total (2005 Costs)	$2,263,664	$99,039	$99,039	$99,039	$99,039	$102,383	$57,132	$57,132
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790
Sub-Total (2008 Costs)	$2,442,391	$106,859	$106,859	$106,859	$106,859	$110,467	$61,643	$61,643
Contingency (20 %)	$458,755	$21,372	$21,372	$21,372	$21,372	$22,093	$12,329	$12,329
Subtotal (2008 Costs) (with Contingency)	$2,901,146	$128,230	$128,230	$128,230	$128,230	$132,560	$73,971	$73,971
Discount Factor	1.0000	0.9728	0.9463	0.9205	0.8954	0.8710	0.8473	0.8242
Present Value	$2,901,146	$124,738	$121,340	$118,035	$114,820	$115,464	$62,677	$60,969

TABLE J-4. ESTIMATED COSTS FOR ALTERNATIVE 3b (ACTIVE LFG COLLECTION SYSTEM)

Phase Name	Calendar Year 9 2016	Calendar Year 10 2017	Calendar Year 11 2018	Calendar Year 12 2019	Calendar Year 13 2020	Calendar Year 14 2021	Calendar Year 15 2022	Calendar Year 16 2023
Design								
GCL Cover (Capital)								
Passive Landfill Gas Collection System (Capital)								
Active Landfill Gas Collection System (Capital)								
Land Use Controls (Capital)								
Abandon MWs/Install SGMWs/MW Casing Extensions (Capital)								
Debris Relocation (Capital)								
Long Term Monitoring (Years 1-5)								
Long Term Monitoring (Years 6-30)	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132
Five Year Review			$45,251					$45,251
Monitoring Well Replacements @10 yrs			$128,350					
Monitoring Well Replacements @20 yrs								
Site Closeout								
Sub-Total (2005 Costs)	$57,132	$57,132	$230,733	$57,132	$57,132	$57,132	$57,132	$102,383
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790
Sub-Total (2008 Costs)	$61,643	$61,643	$248,951	$61,643	$61,643	$61,643	$61,643	$110,467
Contingency (20 %)	$12,329	$12,329	$49,790	$12,329	$12,329	$12,329	$12,329	$22,093
Subtotal (2008 Costs) (with Contingency)	$73,971	$73,971	$298,741	$73,971	$73,971	$73,971	$73,971	$132,560
Discount Factor	0.8018	0.7799	0.7587	0.7380	0.7179	0.6984	0.6794	0.6609
Present Value	$59,309	$57,693	$226,654	$54,593	$53,106	$51,660	$50,253	$87,602

TABLE J-4. ESTIMATED COSTS FOR ALTERNATIVE 3b (ACTIVE LFG COLLECTION SYSTEM)

Phase Name	Calendar Year 17 2024	Calendar Year 18 2025	Calendar Year 19 2026	Calendar Year 20 2027	Calendar Year 21 2028	Calendar Year 22 2029	Calendar Year 23 2030	Calendar Year 24 2031
Design								
GCL Cover (Capital)								
Passive Landfill Gas Collection System (Capital)								
Active Landfill Gas Collection System (Capital)								
Land Use Controls (Capital)								
Abandon MWs/Install SGMWs/MW Casing Extensions (Capital)								
Debris Relocation (Capital)								
Long Term Monitoring (Years 1-5)								
Long Term Monitoring (Years 6-30)	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132
Five Year Review					$45,251			
Monitoring Well Replacements @10 yrs								
Monitoring Well Replacements @20 yrs					$128,350			
Site Closeout								
Sub-Total (2005 Costs)	$57,132	$57,132	$57,132	$57,132	$230,733	$57,132	$57,132	$57,132
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790
Sub-Total (2008 Costs)	$61,643	$61,643	$61,643	$61,643	$248,951	$61,643	$61,643	$61,643
Contingency (20 %)	$12,329	$12,329	$12,329	$12,329	$49,790	$12,329	$12,329	$12,329
Subtotal (2008 Costs) (with Contingency)	$73,971	$73,971	$73,971	$73,971	$298,741	$73,971	$73,971	$73,971
Discount Factor	0.6429	0.6253	0.6083	0.5917	0.5756	0.5599	0.5447	0.5299
Present Value	$47,553	$46,257	$44,997	$43,772	$171,962	$41,420	$40,292	$39,194

TABLE J-4. ESTIMATED COSTS FOR ALTERNATIVE 3b (ACTIVE LFG COLLECTION SYSTEM)

Phase Name	Calendar Year 25 2032	Calendar Year 26 2033	Calendar Year 27 2034	Calendar Year 28 2035	Calendar Year 29 2036	Calendar Year 30 2037	Calendar Year 31 2038	Row Total
Design								$90,531
GCL Cover (Capital)								$1,159,529
Passive Landfill Gas Collection System (Capital)								$75,887
Active Landfill Gas Collection System (Capital)								$217,667
Land Use Controls (Capital)								$47,212
Abandon MWs/Install SGMWs/MW Casing Extensions (Capital)								$74,517
Debris Relocation (Capital)								$499,282
Long Term Monitoring (Years 1-5)								$495,195
Long Term Monitoring (Years 6-30)	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132		$1,428,300
Five Year Review		$45,251					$45,251	$271,506
Monitoring Well Replacements @10 yrs								$128,350
Monitoring Well Replacements @20 yrs								$128,350
Site Closeout							$93,173	$93,173
Sub-Total (2005 Costs)	$57,132	$102,383	$57,132	$57,132	$57,132	$57,132	$138,424	$4,709,499
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	
Sub-Total (2008 Costs)	$61,643	$110,467	$61,643	$61,643	$61,643	$61,643	$149,353	$5,081,337
Contingency (20 %)	$12,329	$22,093	$12,329	$12,329	$12,329	$12,329	$29,871	$986,544
Subtotal (2008 Costs) (with Contingency)	$73,971	$132,560	$73,971	$73,971	$73,971	$73,971	$179,224	$6,067,881
Discount Factor	0.5154	0.5014	0.4877	0.4744	0.4615	0.4490	0.4367	
Present Value	$38,127	$66,464	$36,078	$35,095	$34,139	$33,210	$78,271	$5,056,891

TABLE J-5. ESTIMATED COSTS FOR ALTERNATIVE 3c (ACTIVE LFG SYSTEM)

Phase Name	Calendar Year 1 2008	Calendar Year 2 2009	Calendar Year 3 2010	Calendar Year 4 2011	Calendar Year 5 2012	Calendar Year 6 2013	Calendar Year 7 2014	Calendar Year 8 2015
Design	$98,563							
FML Cover (Capital)	$1,507,374							
Passive Landfill Gas Collection System (Capital)	$75,887							
Active Landfill Gas Collection System (Capital)	$217,667							
Land Use Controls (Capital)	$47,212							
Abandon MWs/Install SGMWs/MW Casing Extensions (Capital)	$74,517							
Debris Relocation (Capital)	$499,282							
Long Term Monitoring (Years 1-5)	$99,039	$99,039	$99,039	$99,039	$99,039			
Long Term Monitoring (Years 6-30)						$57,132	$57,132	$57,132
Five Year Review						$45,251		
Monitoring Well Replacements @10 yrs								
Monitoring Well Replacements @20 yrs								
Site Closeout								
Sub-Total (2005 Costs)	$2,619,541	$99,039	$99,039	$99,039	$99,039	$102,383	$57,132	$57,132
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790
Sub-Total (2008 Costs)	$2,826,367	$106,859	$106,859	$106,859	$106,859	$110,467	$61,643	$61,643
Contingency (20 %)	$533,816	$21,372	$21,372	$21,372	$21,372	$22,093	$12,329	$12,329
Subtotal (2008 Costs) (with Contingency)	$3,360,183	$128,230	$128,230	$128,230	$128,230	$132,560	$73,971	$73,971
Discount Factor	1.0000	0.9728	0.9463	0.9205	0.8954	0.8710	0.8473	0.8242
Present Value	$3,360,183	$124,738	$121,340	$118,035	$114,820	$115,464	$62,677	$60,969

TABLE J-5. ESTIMATED COSTS FOR ALTERNATIVE 3c (ACTIVE LFG SYSTEM)

Phase Name	Calendar Year 9 2016	Calendar Year 10 2017	Calendar Year 11 2018	Calendar Year 12 2019	Calendar Year 13 2020	Calendar Year 14 2021	Calendar Year 15 2022	Calendar Year 16 2023
Design								
FML Cover (Capital)								
Passive Landfill Gas Collection System (Capital)								
Active Landfill Gas Collection System (Capital)								
Land Use Controls (Capital)								
Abandon MWs/Install SGMWs/MW Casing Extensions (Capital)								
Debris Relocation (Capital)								
Long Term Monitoring (Years 1-5)								
Long Term Monitoring (Years 6-30)	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132
Five Year Review			$45,251					$45,251
Monitoring Well Replacements @10 yrs			$128,350					
Monitoring Well Replacements @20 yrs								
Site Closeout								
Sub-Total (2005 Costs)	$57,132	$57,132	$230,733	$57,132	$57,132	$57,132	$57,132	$102,383
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790
Sub-Total (2008 Costs)	$61,643	$61,643	$248,951	$61,643	$61,643	$61,643	$61,643	$110,467
Contingency (20 %)	$12,329	$12,329	$49,790	$12,329	$12,329	$12,329	$12,329	$22,093
Subtotal (2008 Costs) (with Contingency)	$73,971	$73,971	$298,741	$73,971	$73,971	$73,971	$73,971	$132,560
Discount Factor	0.8018	0.7799	0.7587	0.7380	0.7179	0.6984	0.6794	0.6609
Present Value	$59,309	$57,693	$226,654	$54,593	$53,106	$51,660	$50,253	$87,602

TABLE J-5. ESTIMATED COSTS FOR ALTERNATIVE 3c (ACTIVE LFG SYSTEM)

Phase Name	Calendar Year 17 2024	Calendar Year 18 2025	Calendar Year 19 2026	Calendar Year 20 2027	Calendar Year 21 2028	Calendar Year 22 2029	Calendar Year 23 2030	Calendar Year 24 2031
Design								
FML Cover (Capital)								
Passive Landfill Gas Collection System (Capital)								
Active Landfill Gas Collection System (Capital)								
Land Use Controls (Capital)								
Abandon MWs/Install SGMWs/MW Casing Extensions (Capital)								
Debris Relocation (Capital)								
Long Term Monitoring (Years 1-5)								
Long Term Monitoring (Years 6-30)	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132
Five Year Review					$45,251			
Monitoring Well Replacements @10 yrs								
Monitoring Well Replacements @20 yrs					$128,350			
Site Closeout								
Sub-Total (2005 Costs)	$57,132	$57,132	$57,132	$57,132	$230,733	$57,132	$57,132	$57,132
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790
Sub-Total (2008 Costs)	$61,643	$61,643	$61,643	$61,643	$248,951	$61,643	$61,643	$61,643
Contingency (20 %)	$12,329	$12,329	$12,329	$12,329	$49,790	$12,329	$12,329	$12,329
Subtotal (2008 Costs) (with Contingency)	$73,971	$73,971	$73,971	$73,971	$298,741	$73,971	$73,971	$73,971
Discount Factor	0.6429	0.6253	0.6083	0.5917	0.5756	0.5599	0.5447	0.5299
Present Value	$47,553	$46,257	$44,997	$43,772	$171,962	$41,420	$40,292	$39,194

TABLE J-5. ESTIMATED COSTS FOR ALTERNATIVE 3c (ACTIVE LFG SYSTEM)

Phase Name	Calendar Year 25 2032	Calendar Year 26 2033	Calendar Year 27 2034	Calendar Year 28 2035	Calendar Year 29 2036	Calendar Year 30 2037	Calendar Year 31 2038	Row Total
Design								$98,563
FML Cover (Capital)								$1,507,374
Passive Landfill Gas Collection System (Capital)								$75,887
Active Landfill Gas Collection System (Capital)								$217,667
Land Use Controls (Capital)								$47,212
Abandon MWs/Install SGMWs/MW Casing Extensions (Capital)								$74,517
Debris Relocation (Capital)								$499,282
Long Term Monitoring (Years 1-5)								$495,195
Long Term Monitoring (Years 6-30)	$57,132	$57,132	$57,132	$57,132	$57,132	$57,132		$1,428,300
Five Year Review		$45,251					$45,251	$271,506
Monitoring Well Replacements @10 yrs								$128,350
Monitoring Well Replacements @20 yrs								$128,350
Site Closeout							$93,173	$93,173
Sub-Total (2005 Costs)	$57,132	$102,383	$57,132	$57,132	$57,132	$57,132	$138,424	$5,065,376
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	
Sub-Total (2008 Costs)	$61,643	$110,467	$61,643	$61,643	$61,643	$61,643	$149,353	$5,465,312
Contingency (20 %)	$12,329	$22,093	$12,329	$12,329	$12,329	$12,329	$29,871	$1,061,606
Subtotal (2008 Costs) (with Contingency)	$73,971	$132,560	$73,971	$73,971	$73,971	$73,971	$179,224	$6,526,918
Discount Factor	0.5154	0.5014	0.4877	0.4744	0.4615	0.4490	0.4367	
Present Value	$38,127	$66,464	$36,078	$35,095	$34,139	$33,210	$78,271	$5,515,928

TABLE J-6. ESTIMATED COSTS FOR ALTERNATIVE 4 (50/50 CLEAN CLOSURE)

Phase Name	Calendar Year 1 2008	Calendar Year 2 2009	Calendar Year 3 2010	Calendar Year 4 2011	Calendar Year 5 2012	Calendar Year 6 2013	Row Total
Design	$96,141						$96,141
Dig and Haul (Capital)	$28,257,477						$28,257,477
Revegetation (Capital)	$31,728						$31,728
Monitoring Well Abandonments/Casing Extensions (Capital)	$56,560						$56,560
Long Term Monitoring (5 Years)	$62,380	$62,380	$62,380	$62,380	$62,380		$311,900
Five Year Review						$24,514	$24,514
Site Closeout						$69,683	$69,683
Sub-Total (2005 Costs)	$28,504,286	$62,380	$62,380	$62,380	$62,380	$94,197	$28,848,003
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	
Sub-Total (2008 Costs)	$30,754,839	$67,305	$67,305	$67,305	$67,305	$101,634	$31,125,694
Contingency (20 %)	$6,130,221	$13,461	$13,461	$13,461	$13,461	$20,327	$6,204,392
Subtotal (2008 Costs) (with Contingency)	$36,885,061	$80,766	$80,766	$80,766	$80,766	$121,961	$37,330,087
Discount Factor	1.0000	0.9728	0.9463	0.9205	0.8954	0.8710	
Present Value	$36,885,061	$78,566	$76,426	$74,345	$72,320	$106,232	$37,292,950

TABLE J-7. ESTIMATED COSTS FOR ALTERNATIVE 4 (75/25 CLEAN CLOSURE)

Phase Name	Calendar Year 1 2008	Calendar Year 2 2009	Calendar Year 3 2010	Calendar Year 4 2011	Calendar Year 5 2012	Calendar Year 6 2013	Row Total
Design	$96,924						$96,924
Dig and Haul (Capital)	$23,504,480						$23,504,480
Monitoring Well Abandonments/Casing Extensions (Capital)	$56,560						$56,560
Revegetation (Capital)	$31,728						$31,728
Long Term Monitoring (5 Years)	$62,380	$62,380	$62,380	$62,380	$62,380		$311,900
Five Year Review						$24,514	$24,514
Site Closeout						$69,683	$69,683
Sub-Total (2005 Costs)	$23,752,072	$62,380	$62,380	$62,380	$62,380	$94,197	$24,095,789
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	
Sub-Total (2008 Costs)	$25,627,415	$67,305	$67,305	$67,305	$67,305	$101,634	$25,998,270
Contingency (20 %)	$5,104,568	$13,461	$13,461	$13,461	$13,461	$20,327	$5,178,739
Subtotal (2008 Costs) (with Contingency)	$30,731,982	$80,766	$80,766	$80,766	$80,766	$121,961	$31,177,008
Discount Factor	1.0000	0.9728	0.9463	0.9205	0.8954	0.8710	
Present Value	$30,731,982	$78,566	$76,426	$74,345	$72,320	$106,232	$31,139,872

TABLE J-8. ESTIMATED COSTS FOR ALTERNATIVE 4 (100/0 CLEAN CLOSURE)

Phase Name	Calendar Year 1 2008	Calendar Year 2 2009	Calendar Year 3 2010	Calendar Year 4 2011	Calendar Year 5 2012	Calendar Year 6 2013	Row Total
Design	$92,313						$92,313
Dig and Haul (Capital)	$18,987,121						$18,987,121
Monitoring Well Abandonments/Casing Extensions (Capital)	$56,560						$56,560
Revegetation (Capital)	$31,728						$31,728
Long Term Monitoring (5 Years)	$62,380	$62,380	$62,380	$62,380	$62,380		$311,900
Five Year Review						$24,514	$24,514
Site Closeout						$69,683	$69,683
Sub-Total (2005 Costs)	$19,230,102	$62,380	$62,380	$62,380	$62,380	$94,197	$19,573,819
Escalation Factor	1.0790	1.0790	1.0790	1.0790	1.0790	1.0790	
Sub-Total (2008 Costs)	$20,748,413	$67,305	$67,305	$67,305	$67,305	$101,634	$21,119,268
Contingency (20 %)	$4,129,762	$13,461	$13,461	$13,461	$13,461	$20,327	$4,203,933
Subtotal (2008 Costs) (with Contingency)	$24,878,175	$80,766	$80,766	$80,766	$80,766	$121,961	$25,323,201
Discount Factor	1.0000	0.9728	0.9463	0.9205	0.8954	0.8710	
Present Value	$24,878,175	$78,566	$76,426	$74,345	$72,320	$106,232	$25,286,065

Appendix K
UNSAT-H Model

Technical Memorandum

Remedial Investigation and Feasibility Study, Anomaly Area 3 Appendix K– UNSAT-H Modeling Results

FORMER MARINE CORPS AIR STATION EL TORO, CALIFORNIA

May 2008

Base Realignment and Closure
Program Management Office West
1230 Columbia Street, Suite 1100
San Diego, CA 92101

Comprehensive Long-Term Environmental Action Navy
Contract Number N62742-94-D-0048, CTO 0068

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ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
AA3	Anomaly Area 3
APHO	Aerial Photograph
ASTM	American Society for Testing and Materials
bgs	below ground surface
BNI	Bechtel National, Inc.
BRAC	Base Realignment and Closure Act
CH	fat clay
cm	centimeters
cm/sec	centimeters per second
Earth Tech	Earth Tech, Inc.
EPA	Environmental Protection Agency
ET	evapotranspiration
FI	fines
FS	feasibility study
ft	feet
GR	gravel
HELP	hydraulic evaluation of landfill evaluation performance
hr	hour
in	inches
IRP	Installation Restoration Program
IT/OHM	International Technology/OHM Remediation Services
LAI	leaf area index
LL	liquid limit
MCAS	Marine Corps Air Station
mph	miles per hour
NCDC	National Climatic Data Center
NP	non-plastic
pcf	pounds per cubic foot
PET	potential evapotranspiration
PI	plasticity index
PL	plastic limit
RI	Remedial Investigation
RLD	root length density
ROD	Record of Decision
RSE	removal site evaluation
SA	sand
SC	clayey sand
SM	silty sand
UNSAT-H	Unsaturated Soil Water and Heat Flow Model
U.S.	United States
USCS	Unified Soil Classification System
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service

1. INTRODUCTION

1.1 OVERVIEW

This technical memorandum presents the characterization of the soil cover material and water balance simulations using UNSAT-H to assess the performance of three covers scenarios; (the existing soil cover, a constructed evapotranspiration (ET) cover, and a state prescriptive cover) at Anomaly Area 3 (AA3), former Marine Corps Air Station (MCAS) El Toro (Figure 2-1).

This technical memorandum was prepared as a component of the RI/FS and describes the characteristics of the existing soil, the model simulations that were conducted to assess the performance of the existing soil cover, the constructed ET cover and state prescriptive cover, and the model prediction results.

1.2 PROJECT SUMMARY

1.2.1 Site Description

Former MCAS El Toro is located in Orange County, California, approximately 8 miles southeast of Santa Ana and 12 miles northeast of Laguna Beach. Former MCAS El Toro covers approximately 4,738 acres. Land use around MCAS El Toro includes agricultural, commercial, light industrial, and residential. MCAS El Toro closed on 2 July 1999, as part of the BRAC Act.

AA3 encompasses an area of approximately 9 acres and is located in the northwestern section of the former MCAS El Toro facility near Pusan Way, adjacent to the Agua Chinon Wash. AA3 refers to seven aerial photograph (APHO) anomaly areas (APHO 59, APHO 60, APHO 61, APHO 62, APHO 63, APHO 64, and APHO 65) identified by Science Applications International Corporation (SAIC) during a review of historical aerial photographs taken during the period from 1946 through 1992 (SAIC 1993). Historically, the site was used as a source of borrow material. Records indicate that some of the borrow pits and trenches were backfilled with construction debris and later covered with 5 feet or more of fill soil (IT/OHM 2000). The removal site evaluation (RSE) field investigation determined that the site was actually covered with approximately 2 to 5 feet of fill soil with an average thickness of approximately 4 feet. A review of historical aerial photographs and topographic maps suggests that placement of construction debris occurred between 1972 and 1988. Interviews with former Station personnel indicate that construction debris generated during the construction of the investigation-derived waste management area at IRP Site 3 were placed at AA3.

1.2.2 Landfill Cover Alternative Description

The existing AA3 soil cover and a constructed ET cover consisting of existing and imported soil materials were evaluated in the FS as alternative 2 and alternative 3a. A state prescriptive cover was also evaluated as alternative 3b. The existing soil cover (fill soil) at AA3 is composed of silty sand (SM) based on the Unified Soil Classification System (USCS), and would be graded to a thickness of 4 feet. The configuration of the constructed ET cover includes a 2-ft-thick foundation layer consisting of existing cover soils, and a 4-ft-thick ET layer consisting of existing cover soils blended with imported borrow soil. The constructed ET cover would be compacted to a minimum of 90 percent of the maximum dry density per American Society for Testing and Materials (ASTM) Method D1557. Further characterization of the ET cover is provided with the description of the conceptual model in Section 12.2.2, as shown in Figure 12-1. The state prescriptive cover consists of a 2-ft vegetative soil layer above a 1-ft clay layer with a maximum hydraulic conductivity of 1×10^{-6} cm/sec and a 2-ft-thick foundation layer.

2. CHARACTERIZATION OF EXISTING SOIL COVER

Near surface soil data were collected as a part of the RSE Investigation primarily for landfill cover design and construction considerations, including possible use of existing soils as a foundation layer and for an actual monolithic soil cover. The soil samples used for geotechnical analysis were collected from the surface to 5 feet below ground surface (bgs). Nine soil samples from the exploratory trenches, twelve soil samples from the direct push sampling locations, and six soil samples from the monitoring well boreholes were submitted for geotechnical analysis.

The average moisture content of the cover soils was 5.3 percent, with values ranging from 1.5 to 20.9 percent. The average in situ dry density of the samples was 97.4 pounds per cubic foot (pcf), with values ranging from 93.1 to 100.3 pcf. The average particle size percentages for gravel, sand, and fines were 3, 72, and 26 percent, respectively. The values of gravel, sand, and fine particle sizes ranged from 0 to 9, 58 to 94, and 3 to 40 percent, respectively. The average maximum dry density based on ASTM 1557 was 121.8 pcf, with values ranging from 118.5 to 125 pcf. These in-situ density values represent relative compaction values between 78 to 80 percent. The soils used in the analysis were predominantly classified as SM. The soil samples used in the analysis were representative of existing conditions at the site. Geotechnical results of the RSE Investigation are summarized in Table 2-1 below.

Table 2-1: Existing Cover Soils Geotechnical Summary

	Moisture Content (ASTM Method D2216)	Dry Density (ASTM Method D2937	Particle Size Distribution GR:SA:FI (ASTM Method D422/D1140)	Maximum Dry Density (ASTM Method D1557)
Units	%	pcf	%	pcf
Average	5.3	97.4	3:72:26	121.8
Range	1.5 - 20.9	93.1 – 100.3	0-9:58-94:3-40	118.5-125

Notes:
ASTM - American Society of Testing Materials
FI – fines
GR - gravel
pcf – pounds per cubic foot
SA - sand

To specifically evaluate the hydraulic properties of the existing cover soils for UNSAT-H analysis, five soil samples collected from exploratory trenches between depths of 0 and 5 feet bgs were composited into one sample. The soil samples and sample depths used in the composite sample included TR03 (0 – 4 feet bgs), TR04 (0 – 3 feet bgs), TR07 (2 – 3 feet bgs), TR08 (4 – 5 feet bgs), and TR11 (0 – 4 feet bgs). The composited sample was thoroughly mixed and split into two samples. Sample LK537 was submitted to TeraTest Laboratories for particle size analysis by ASTM Method D422, compaction characteristics by ASTM Method D1557, and hydraulic conductivity by ASTM Method D5084 (flexible wall method). Sample LK538 was submitted to Daniel B. Stephens Laboratories for saturated hydraulic conductivity (rigid wall method) by ASTM Method D2434, volumetric and gravimetric moisture content by ASTM Methods D2216 and D4643 respectively, dry bulk density by ASTM Method D2937, calculated total porosity per Methods of Soil Analysis Chapter 18, the soil-water moisture characteristic curve (7 points), calculated unsaturated hydraulic conductivity per Soil Science Society of America J 1980, and van Genuchten parameters. The results of the tests performed on the composited soil sample are summarized in Table 2-2 below.

Table 2-2: Composite Sample Geotechnical Results

EPA ID	Grain Size Distribution GR:SA:FI	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Soil Classification	Hydraulic Conductivity Results			
	ASTM D422	ASTM D1557	ASTM D1557	ASTM D2487/D2488	Relative Compaction (%)	Initial Moisture (%)	Dry Density (pcf)	Hydraulic Conductivity (cm/sec)
LK537	3:70:27	125	10.5	SM	80	12.49	100.3	1.4E-04[1]
					90	12.49	112.5	2.2E-05[1]
LK538	-	-	-	-	80	10.0	99.9	2.0E-03[2]
	-	-	-	-	90	10.1	111.7	8.0E-05[2]

Notes:
- – Not tested
[1] – ASTM D5084
ASTM – American Society of Testing Materials
cm/sec – centimeters per second
EPA – Environmental Protection Agency
FI – fines
[2] – ASTM D2434
GR – gravel
pcf – pounds per cubic foot
SA – sand
SM – silty sand

3. UNSATURATED FLOW-WATER BALANCE MODEL

3.1 OBJECTIVE

An unsaturated flow-water balance model was used to assess the potential hydrologic performance of an ET cover based on the cover thickness, soil and vegetation characteristics, and climatic conditions.

3.2 MODEL SELECTION

The water balance model UNSAT-H, Version 3.01 (Fayer 2000) was selected to model water percolation through the ET cover. UNSAT-H has the features to simulate the unsaturated vertical flow through a final soil cover. The model includes input parameters to define the cover's vertical profile, soil characteristics, vegetation characteristics, and climatic conditions. The UNSAT-H code is based on theories for one-dimensional unsaturated moisture and heat flow.

3.3 DESCRIPTION OF UNSAT-H

A complete description of the UNSAT-H model is presented in *Unsaturated Soil Water and Heat Flow Model, Version 3.0* (Fayer 2000). The following subsections describe the general model methodology, model assumptions, boundary conditions, input parameters, and model verification.

3.3.1 General Methodology

The hydrologic water balance is expressed in the UNSAT-H model according to the general soil-water budget formula given below:

$$\Delta S_w = P - O_f - L_f - E_t - P_i \qquad (1)$$

where

ΔS_w	=	Change in soil-water storage
P	=	Precipitation
O_f	=	Overland flow
L_f	=	Lateral subsurface flow
E_t	=	Evapotranspiration, and
P_i	=	Percolation

Because of the one-dimensional character of UNSAT-H, the lateral subsurface flow term (L_f) is disregarded.

The flow of water is calculated using Richard's equation for liquid water flow in response to gravitational suction-head gradients and Fick's law for diffusive vapor flow (Richards 1931):

where

$$C(h)\frac{\partial h}{\partial t} = -\frac{\partial}{\partial z}[K_T(h)\frac{\partial h}{\partial z} + K_L(h) + q_{vT}] - S(z,t) \qquad (2)$$

C(h)	=	Specific soil-moisture capacity (L^3/L)
h	=	Suction head, the negative of the soil water pressure head (L)
t	=	Time (T)
z	=	Depth below the soil surface (L)
K_T	=	$K_L + K_{vh}$
K_L	=	liquid water conductivity (L/T)
K_{vh}	=	vapor conductivity relative to a suction head (L/T)
q_{vT}	=	vapor flux induced by a thermal gradient (L/T)
S	=	sink term for water uptake by plants (1/T)

To solve Richard's equation, UNSAT-H must be supplied with relationships for both the hydraulic conductivity and the water content as functions of suction head. The specific soil-moisture capacity term can be calculated by UNSAT-H from the soil water-retention curve.

The UNSAT-H code contains several options for describing the moisture content of unsaturated soils as a function of the suction head. The van Genuchten function (van Genuchten 1978 and 1980) was selected for El Toro model simulations. The van Genuchten equation for water content (θ) versus suction head (h) is:

$$\theta = \theta_r + (\theta_s - \theta_r)[1 + (\alpha h)^n]^{-m} \text{ ..... } (3)$$

where

θ_s	=	Saturation moisture content (L^3/L^3),
θ_r	=	Residual moisture content (L^3/L^3), and
α, n	=	curve-fitting parameters.
m	=	1-(1/n)

The hydraulic conductivity function is based on the Mualem model (Mualem 1976), and is given by (van Genuchten 1978 and 1980):

$$K_L(h) = K_s \frac{[1 - (\alpha h)^{nm}[1 + (\alpha h)^n]^{-m}]^2}{[1 + (\alpha h)^n]^{lm}} \text{ .....} (4)$$

in which K_s is the saturated hydraulic conductivity.

3.3.2 UNSAT-H Model Assumptions

The solution methodology in UNSAT-H model is based on the following set of assumptions:

- Flow is one-dimensional;
- Hysteresis of the soil water characteristic curve is not considered for the El Toro simulations;

- Runoff is calculated from the water budget equation by subtracting ET, moisture retention, and infiltration from precipitation. The effects of slope and slope-length are not considered in computing overland flow;
- Absorption and interception of water by the plant canopy are not considered;
- When the upper boundary is selected as a flux boundary, infiltration and evaporation from the surface can be used as the specified fluxes;
- Evaporation and transpiration are computed using the potential evapotranspiration (PET) concept which is based on the partitioning of PET between potential evaporation and potential transpiration;
- Soil water storage is computed by integrating the water content profile; and,
- Flux from the lower boundary is drainage.

3.3.3 Selection of UNSAT-H Boundary Conditions

In UNSAT-H, the upper boundary condition for liquid water flow can be either a flux or constant head (Fayer 2000). The variable flux boundary was used for El Toro model simulations. The flux rate of the surface boundary is dependent on the precipitation rate, the predicted suction head at the soil surface, and the model calculated PET based on a form of the Penman equation (Doorenbos and Pruitt 1977) and daily meteorological data (maximum/minimum air temperature, dewpoint temperature, solar radiation, average wind speed, and cloud cover). The lower boundary may be defined using five options to include unit gradient, constant head, specified flux, impermeable boundary, and specified head. The unit gradient boundary condition was defined for the El Toro model simulations and is a characteristic of a vertical downward gravitational flow condition.

3.3.4 UNSAT-H Input Parameters

In the following sections, the required soil, ET, and climatic input data for UNSAT-H simulations are presented.

3.3.4.1 Soil Data

This group includes parameters related to both the soil matrix and the moisture flow through the soil.

Initial Suction Head. Initial suction head is required to initialize the moisture condition within the soil profile prior to starting the simulations. The initial soil suction head can be determined from direct measurements or estimates that are based on soil and climatic conditions. For long simulation periods the effect of initial suction heads becomes less important since the soil suction heads over time are influenced by the imposed climatic conditions (precipitation and ET). The initial soil suction heads for El Toro simulations are estimates based on the soil and climatic condition.

Soil Moisture Retention and Hydraulic Conductivity. Soil moisture retention and hydraulic conductivity characteristics within the simulated profile typically have significant influence on the predicted water balance. In UNSAT-H, the soil-moisture hydraulic-conductivity relationships may be developed through functions including those defined by Haverkamp et al. (1977), Brooks and Corey (1964), and van Genuchten et al. (1991). For simulations discussed in this report, the

van Genuchten functions were used to develop soil-moisture hydraulic-conductivity relationships. The van Genuchten parameters include the saturated volumetric water content (θ_s), the residual volumetric water content (θ_r), fitting parameters (n, α), and saturated hydraulic conductivity (K_s).

The van Genuchten parameters (with the exception of the state prescriptive cover) used as model input were developed from saturated hydraulic conductivity and soil moisture retention analyses that were conducted by TeraTest Laboratories in Irvine, California and Daniel B. Stephens Laboratory in Albuquerque, New Mexico.

3.3.4.2 ET DATA

ET includes soil water that is lost to the atmosphere through surface evaporation or plant transpiration.

Evaporation. Evaporation is predicted using the potential evaporation concept. The daily potential evaporation is predicted based on Fick's law of diffusion and derived from daily meteorological parameters and the model predicted water suction head at the soil surface.

Transpiration. Transpiration is based on the PET concept where the PET is first partitioned into potential evaporation and potential transpiration, and then the potential transpiration is distributed over the root zone in proportion to the relative root density at each depth. One of two methods is available in the UNSAT-H code to partition the PET. One method is based on the plant leaf area index data (Ritchie and Burnett 1971) and the other method is based on cheatgrass biomass data that was developed for the Department of Energy site located in Handford, Washington (Hinds 1975). The plant leaf area index method was used to partition PET for El Toro model simulations.

The following plant data is required as input for UNSAT-H:

Root Biomass Distribution. The predicted transpiration rates are dependent on many variables including the plant root biomass. The root biomass distribution is based on the root length density (RLD) function, which is defined as follows:

$$RLD = a\exp(-bz) + c \quad (5)$$

The RLD equation provides a means to define the root biomass as a function of depth from the surface. The equation coefficients a, -b, and c optimize the fit to normalized root biomass data and are used as input for the UNSAT-H model to define the root biomass distribution. A more detailed discussion regarding the relationship between predicted transpiration rate and root biomass is provided in the UNSAT-H documentation (Fayer 2000).

Leaf Area Index. The leaf area index (LAI) defines the ratio of plant canopy area to bare ground area for a plant with a high LAI representative of a more dense plant canopy. The UNSAT-H model predicted transpiration rate is determined from either plant LAI or plant biomass production.

Biomass. This is the organic matter produced by plants per unit surface during the growing season. The UNSAT-H model predicted transpiration rate is determined from either plant LAI or plant biomass production.

Growing Season. The growing season defines the period of plant biological activity from date of planting to date of harvest. There is a direct relationship between the duration of the growing season and the predicted transpiration.

Percent Bare Area. The percent bare area varies with the type of vegetation and the level at which it is established on the cover. There is an inverse relationship between the percent bare area and the predicted plant transpiration.

3.3.4.3 Climatic Data

The UNSAT-H model requires daily meteorological data in order to perform calculations for moisture movement within the cover soils as well as to calculate the other components of the daily moisture budget, such as PET. The daily meteorological data includes the day of the year (Julian day), maximum air temperature (degrees Fahrenheit [°F]), minimum air temperature (°F), dew point temperature (°F), solar radiation (Langleys), average wind speed (miles per hour [mph]), average cloud cover (tenths), and precipitation (in).

UNSAT-H has two options for applying precipitation. The precipitation options consist of formatting either daily precipitation data or hourly precipitation data. The El Toro model simulations were conducted using daily precipitation data. Using this option, starting at 00:00 hr, the total daily precipitation is applied at a fixed hourly application rate. Use of an hourly application rate may result in a lower drainage rate, particularly in low permeability soils, since hourly precipitation may predict more water lost as runoff when precipitation rate exceeds the soil surface infiltration rate.

3.3.4.4 Verification of UNSAT-H Model

Two examples are provided in the UNSAT-H manual (Fayer 2000) to verify the accuracy of the infiltration and drainage modeling. The first example compares the UNSAT-H infiltration results for sand and clay with an analytic solution of Philip (1969) and a numerical solution by Haverkamp et al. (1977). There was very good agreement between UNSAT-H predictions and the model example results. The second example compares the measured drainage rates observed by Kool et al. (1985) from an undisturbed core of silty loam soil with UNSAT-H simulation results. There was very close agreement between the measured cumulative drainage and the model predicted values.

4. MODEL SIMULATIONS

4.1 CONCEPTUAL MODEL

The conceptual model represents the cover configuration (Figures 12-1 through 12-2) for AA3. Slender wheatgrass was used as a surrogate for the vegetation present at AA3.

The water balance of the cover will be based on a one-dimensional analysis of a vertical soil column for a ten-year period. The water input for model simulations is through precipitation. Water from precipitation enters the soil surface as infiltration. Soil water is removed from the cover surface as ET, which is a combination of evaporation and plant transpiration. Soil water is maintained in the soil water pores throughout the vertical profile as soil water storage. Soil water discharges from the base of the soil column as drainage.

4.2 CLIMATIC ANALYSIS AND MODEL INPUT PARAMETERS

Daily meteorological data that was used as input for UNSAT-H simulations included maximum and minimum air temperature, dew point temperature, average wind speed, average cloud cover, average solar radiation, and total precipitation. All meteorological data for model simulations, except solar radiation, was obtained from EarthInfo, Inc., located in Boulder, Colorado. EarthInfo provides electronic data that is obtained from the National Climatic Data Center (NCDC) databases. The EarthInfo data includes the historical meteorological record for California weather stations. Solar radiation data was obtained from the National Solar Radiation Data Base, which includes NCDC data that is available through the National Renewal Energy Laboratory Internet site at http://rredc.nrel.gov/solar.

Precipitation is the climatic parameter that typically has the most influence on water balance. An evaluation of the historical annual precipitation data from weather stations located near El Toro was conducted to select a 10-year climatic period for the model simulations. The stations with near complete data records that were located in the vicinity of El Toro included Laguna Beach, Santa Ana (Fire Station), and Tustin (MCAS and Irvine Ranch). Laguna Beach is about 10 miles south of the site, Santa Ana is about 8 miles northwest of the site, and Tustin is about 6 miles northwest of the site. The objective was to obtain precipitation data for a ten-year period that included one or more years with near maximum annual precipitation, one or more years with below normal annual precipitation, and several years of near average annual precipitation.

A summary of the historical precipitation data for the Laguna Beach, Santa Ana, and Tustin weather stations near the El Toro site is provided in Table 4-1. The data shows that the maximum annual precipitation ranges from about 28 inches to 31 inches, the minimum annual precipitation ranges from about 3 inches to 4 inches, and the average annual precipitation is about 12 inches.

The 10-year climatic period from 1980 through 1989 was selected to represent model simulations. Daily precipitation data from the Laguna Beach weather station was used to represent the ten-year period. The annual precipitation for Laguna Beach from 1980 through 1989 is provided in Table 4-2. There are two relatively wet years (1980 and 1983), a dry year (1989), and many years with near average precipitation (1981, 1982, 1986, and 1987).

There was no single weather station that included all the meteorological data for the ten-year period. To obtain the required meteorological files for model simulations, all data, except solar radiation, was obtained from the Laguna Beach, Santa Ana, or the Tustin weather stations, which are located near El Toro. The nearest NCDC solar radiation data was from a Los Angeles weather station, therefore all the average solar radiation data for the ten-year period was from Los

Angeles. The meteorological data that was used from each weather station is provided in Table 4-2.

Table 4-1: Summary of Weather Station Precipitation Data

Precipitation Data[1]	Weather Station		
	Laguna Beach	Santa Ana Fire Station	Tustin Irvine Ranch
Years of Record	1929-1993	1949-1993	1927-1993
Maximum Annual Precipitation (in)	28.24	31.02	28.56
Minimum Annual Precipitation (in)	3.45	3.55	4.16
Average Annual Precipitation (in)	12.25	12.64	12.61

Notes:
[1] Based on EarthInfo disc files that include National Climatic Data Center Data through 1993.

Table 4-2: Summary of Annual Precipitation for Model Simulation Period and NCDC Weather Station Data Source

Year	Weather Station- Daily Meteorological Data				
	Laguna Beach Annual Precipitation (in)	Laguna Beach	Santa Ana Station	Tustin MCAF	Los Angeles
1980	21.86	prp	mxt, mnt	wnd, dpt, cld	sor
1981	10.85	prp ,mxt, mnt		wnd, dpt, cld	sor
1982	15.53	prp ,mxt, mnt		wnd, dpt, cld	sor
1983	27.21	prp ,mxt, mnt		wnd, dpt, cld	sor
1984	8.29	prp ,mxt, mnt		wnd, dpt, cld	sor
1985	6.78	prp ,mxt, mnt		wnd, dpt, cld	sor
1986	11.15	prp ,mxt, mnt		wnd, dpt, cld	sor
1987	11.84	prp ,mxt, mnt		wnd, dpt, cld	sor
1988	9.45	prp ,mxt, mnt		wnd, dpt, cld	sor
1989	4.01[1]	prp ,mxt, mnt		wnd, dpt, cld	sor

Notes:
[1]There was no precipitation data for Laguna Beach for the months of October, November and December in 1989 therefore precipitation data for final three months were obtained from Santa Ana (0.88 in)
prp=Precipitation mxt=maximum temperature mnt=minimum temperature
wnd= wind dpt = dew point temperature cld = average cloud cover
sor=average solar radiation

4.3 Model Scenarios

Three UNSAT-H model simulations were conducted to assess the performance of the existing soil cover graded to a thickness of four feet, a constructed 4-ft-thick ET cover, and a state prescriptive cover using climatic, soil, and vegetation inputs that represent regional conditions.

A 4-ft ET cover assuming a relative compaction value of 80 percent was modeled as the existing soil cover. For the constructed ET cover, blend of imported soil and existing cover compacted to 90% relative compaction was used. It should be noted that the assumed compaction value of 80 percent used for modeling purposes, represents the natural condition of the existing soil cover, and is not intended to be the design criteria for the cover. The design criteria for the cover will be developed in the remedial design phase.The State of California prescriptive cover consists of a 2-ft vegetative soil layer overlying a 1-ft clay layer with a maximum hydraulic conductivity of $1x10^{-6}$ cm/sec and a 2-ft-thick foundation layer. The five scenarios are listed below:

- Scenario I: Existing Soil Cover assuming 80% relative compaction with hydraulic conductivity of 1.4×10^{-4} cm/sec
- Scenario II: Constructed ET Cover assuming 90% relative compaction with hydraulic conductivity of 2.2×10^{-5} cm/sec
- Scenario III: State Prescriptive Cover

The following subsections provide descriptions of model design and input parameter values.

4.3.1 Node Spacing

UNSAT-H is a one-dimensional finite difference model. Model development requires the establishment of nodes throughout the profile domain. The first and last nodes are at the surface and bottom of the model domain, respectively. The nodes are separated by 0.1 centimeters (cm) to enhance model resolution near boundaries such as the surface and bottom of the model domain. The distances between nodes are gradually increased away from boundaries.

4.3.2 Initial Conditions

The initial conditions define the soil water tension (hydraulic potential) at each node at the beginning of the model simulation. The soil water initial condition represents the soil water condition for the initial model simulation and has the most influence over the annual water balance of the first simulation. Over time, as the annual simulations progress, the soil water tensions are determined by the model inputs that characterize climatic, soil, and vegetation conditions.

Soils in semi-arid and arid climates typically have soil tensions that may range from 0 cm of water near the soil surface following precipitation to 20,000 cm of water at depth during dry periods. For El Toro model simulations, the initial soil water tensions at nodes were defined as 1,000 cm of water. The initial soil water tension of 1,000 cm represents a soil water condition that is wetter than normal based on an evaluation of soil water tensions following several years of model simulations.

4.3.3 Boundary Conditions

A discussion of the UNSAT-H model options for boundary conditions is provided in Section 3.3.3. The one-dimensional model has upper and lower boundaries. The upper boundary represents the ground surface and is defined as a variable flux boundary that is influenced by precipitation input data and model predicted ET rates. The lower boundary, at the bottom of the ET cover, is defined as a unit gradient boundary, which represents a vertical downward gravitational flow condition.

4.3.4 Input Parameters

Climate.

The UNSAT-H model climatic input parameters and the climatic analysis that was conducted to select the climatic period that was used for model simulations are provided in Section 4.2. Model simulations were conducted for a 10-yr period to represent the climatic conditions near the site using historical climatic data for the years from 1980 through 1989.

Soil Characteristics.

Descriptions of the input parameters that define soil characteristics are provided in Section 3.3.4.1. The van Genuchten soil input parameters that were used to characterize the soils were obtained from laboratory analysis that were conducted on samples that were compacted to 80 percent and 90 percent of the maximum dry density per ASTM Method D1557. The van Genuchten soil input parameters for the state prescriptive cover were obtained from the previous technical memorandum (BNI 1998), which is consistent with Sites 2 & 17 landfill cover evaluation. The van Genuchten soil input parameters that were used for the models are provided in Table 4-3.

Both rigid wall method (ASTM D2434) and flexible wall method (ASTM D5084) were used to obtain the saturated hydraulic conductivity value. In order to limit consolidation influences during testing, the rigid wall procedure is limited to disturbed granular soils containing not more than 10% soil passing No. 200 sieve. Therefore, the flexible wall method is more appropriate to analyze soil samples at AA3, which has an average of 29.8% passing No.200 sieve. For comparison purpose, both saturated hydraulic conductivity values were used for the existing soil cover and the constructed ET cover.

Table 4-3: Summary of van Genuchten Soil Characterization Values

Soil Sample	Soil Type	van Genuchten Soil Parameters					
		θ_s=saturated volumetric water content	θ_r=residual volumetric water content	n=curve fitting parameter (slope)	α= inverse of soil air entry pressure	K_s (cm/sec)	
						ASTM D2434	ASTM D5084
80% compaction	SM	0.44	0.00	1.30	0.03	2.0×10^{-3}	1.4×10^{-4}
90% compaction	SM	0.35	0.00	1.34	0.01	8.0×10^{-5}	2.2×10^{-5}
State Prescriptive	Vegetative soil cover (SM)	0.47	0.07	1.80	0.06	5.2×10^{-5}	
State Prescriptive	Barrier layer (clay)	0.45	0.09	1.23	0.01	1.0×10^{-6}	

Notes:
- = not tested
cm/sec = centimeters per second

Vegetation.

UNSAT-H model simulation of plant transpiration requires data that describes plant growth characteristics for vegetation that is common to the site. Descriptions of the required input parameters are provided in Section 3.3.4.2. The availability of such data is limited and this information is typically obtained from existing studies that are reported in the literature. The characteristics of slender wheatgrass, as reported by Sims and Singh (1978), were used to input the required plant parameters. A 107-day growing season was defined. The root depth was defined as 4 ft within ET covers and in the top 2 ft of the state prescriptive (i.e., vegetative soil cover). The root length density coefficients that characterize the root density as a function of depth are defined as a=0.94, b=0.12, and c=0.06. The leaf area index values for the base model range from 0 to 1.0 over the growing season. The percent bare area for the base model is defined as 50 percent.

5. MODEL PREDICTIONS

The UNSAT-H water balance predictions for the various simulations are provided in Table 5-1. The predicted water balance is provided for each year of the 10-yr simulation period, which is based on climatic conditions for the site from 1980 through 1989.

The predicted annual drainage ranges from the model simulations are listed below:

- Scenario I Existing Soil Cover 80 percent compaction: ranges from 0.002 in to 8.702 in (0.005 cm to 22.103 cm);
- Scenario II ET Soil Cover: ranges from 0.001 in to 1.685 in (0.002 cm to 4.282 cm);
- Scenario III State Prescriptive: less than 0.606 in to 6.031 in (1.540 cm to 15.319 cm).

Relatively high annual drainage rates, exceeding 20 cm in the wet years, were predicted for scenarios I. The predicted high drainage rates are attributed to the limited soil water retention properties of this coarse grained soil. The soil water loss from transpiration, although less than that from evaporation, provides a means to remove water that has infiltrated into the soil and is not influenced by surface evaporation. For Scenario II, the predicted annual drainage ranged from less than 1 cm to 4 cm, indicating that compaction of the existing cover soil to 90 percent significantly improves the predicted performance of the cover over the existing condition. The predicted annual drainage for the state prescriptive cover exceeded 1 cm for all ten years presumably because the capability of the compacted soil to restrict downward drainage is limited. Overall low annual predicted drainage rate for scenario II is also in part due to a larger amount of surface runoff.

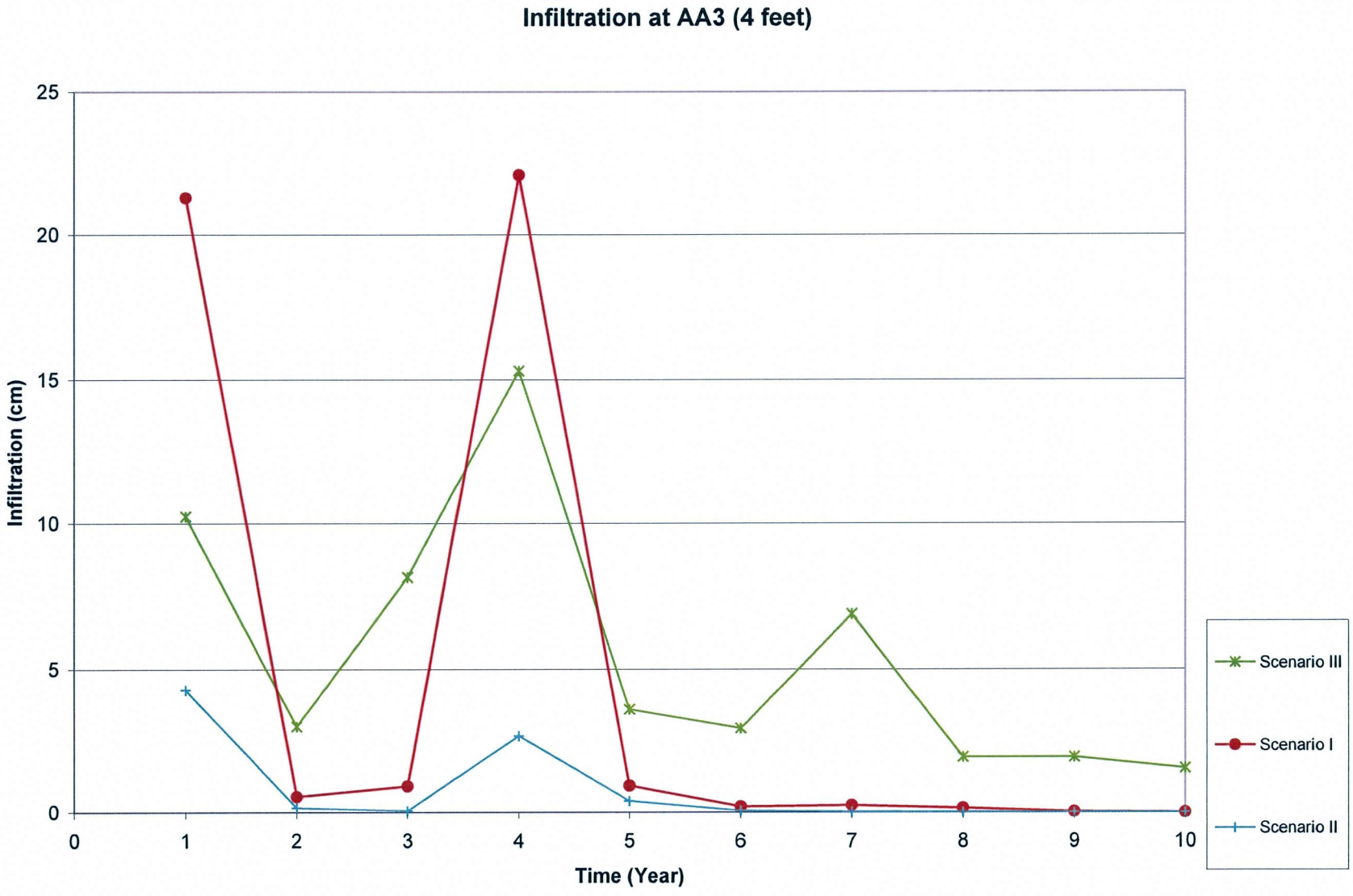
A plot of predicted annual drainage for the three cover types over the ten-year period is provided in Figure 5-1. The predicted annual drainage for the state prescriptive cover is typically greater as compared to other cover types for most years. A plot of predicted cumulative drainage for the three cover scenarios over the ten-year period is provided in Figure 5-2. The state prescriptive cover (Scenario III) had the highest predicted cumulative drainage at the end of the 10-year period at about 55 cm. Scenario II had the lowest predicted cumulative drainage at the end of the 10-year period at less than 10 cm, which mostly is due to runoff. Accounting for model uncertainties, it can be concluded that there is no discernable difference in the performance of scenarios I, II, and the state prescriptive cover.

Table 5-1: UNSAT-H Model Predictions

Year	Annual Water Balance (cm)					
	Precipitation	Runoff	Transpiration	Evaporation	Storage	Drainage
Scenario I: Existing Soil Cover assuming 80% relative compaction* with hydraulic conductivity of 1.4 x 10^{-4} cm/sec						
1980	55.52	0	8.48	20.51	23.68	21.31
1981	27.56	0	8.08	15.84	26.66	0.56
1982	39.45	0	6.94	29.57	28.58	0.93
1983	69.11	0	8.13	34.65	32.71	22.10
1984	21.06	0	7.16	15.35	30.22	0.95
1985	17.22	0	7.20	16.78	23.18	0.21
1986	28.32	0	7.53	19.95	23.68	0.26
1987	30.07	0	7.19	22.28	24.02	0.16
1988	24.00	0	6.84	16.77	24.31	0.03
1989	10.19	0	6.22	12.30	15.92	0.01

Year	Annual Water Balance (cm)					
	Precipitation	Runoff	Transpiration	Evaporation	Storage	Drainage
Scenario II: Constructed ET Cover assuming 90% relative compaction* with hydraulic conductivity of 2.2 x 10^{-5} cm/sec						
1980	55.52	21.34	8.11	21.90	20.86	4.28
1981	27.56	4.29	7.12	15.50	21.26	0.17
1982	39.45	3.60	6.10	28.72	22.14	0.06
1983	69.11	17.24	7.73	35.67	28.17	2.67
1984	21.06	1.61	6.43	15.32	25.37	0.41
1985	17.22	0.30	6.14	16.66	19.36	0.07
1986	28.32	2.81	6.53	19.77	18.48	0.03
1987	30.07	1.39	5.64	21.92	19.49	0.02
1988	24.00	1.45	5.20	16.54	20.24	0.01
1989	10.19	0	4.45	12.04	13.88	0.00
Scenario III: State Prescriptive Cover						
1980	55.52	13.14	7.60	15.88	21.70	10.25
1981	27.56	2.01	7.66	10.74	25.76	3.00
1982	39.45	0.59	6.58	20.96	28.84	8.16
1983	69.11	16.02	7.30	26.96	32.29	15.32
1984	21.06	0.15	6.92	12.37	30.21	3.60
1985	17.22	1.19	6.91	12.52	23.79	2.94
1986	28.32	1.08	6.84	13.98	23.30	6.90
1987	30.07	0.33	7.19	17.75	26.06	1.93
1988	24.00	0.10	6.91	13.15	27.88	1.93
1989	10.19	0.31	6.57	10.20	19.41	1.54

Notes:
Predictions based on 10-year simulations using historical climatic data from weather stations near the site
Soil hydraulic characteristics for generic loam obtained from Carsel and Parrish, 1988
* It should be noted that the assumed compaction value of 80 percent used for modeling purposes, represents the natural condition of the existing soil cover, and is not intended to be the design criteria for the cover. The design criteria for the cover will be developed in the remedial design phase


Infiltration at AA3 (4 feet)
Infiltration (cm)
25
20
15
10
5
0
0
1
2
3
4
5
6
7
8
9
10
Time (Year)
Scenario III
Scenario I
Scenario II

PAGE NO. 5-4

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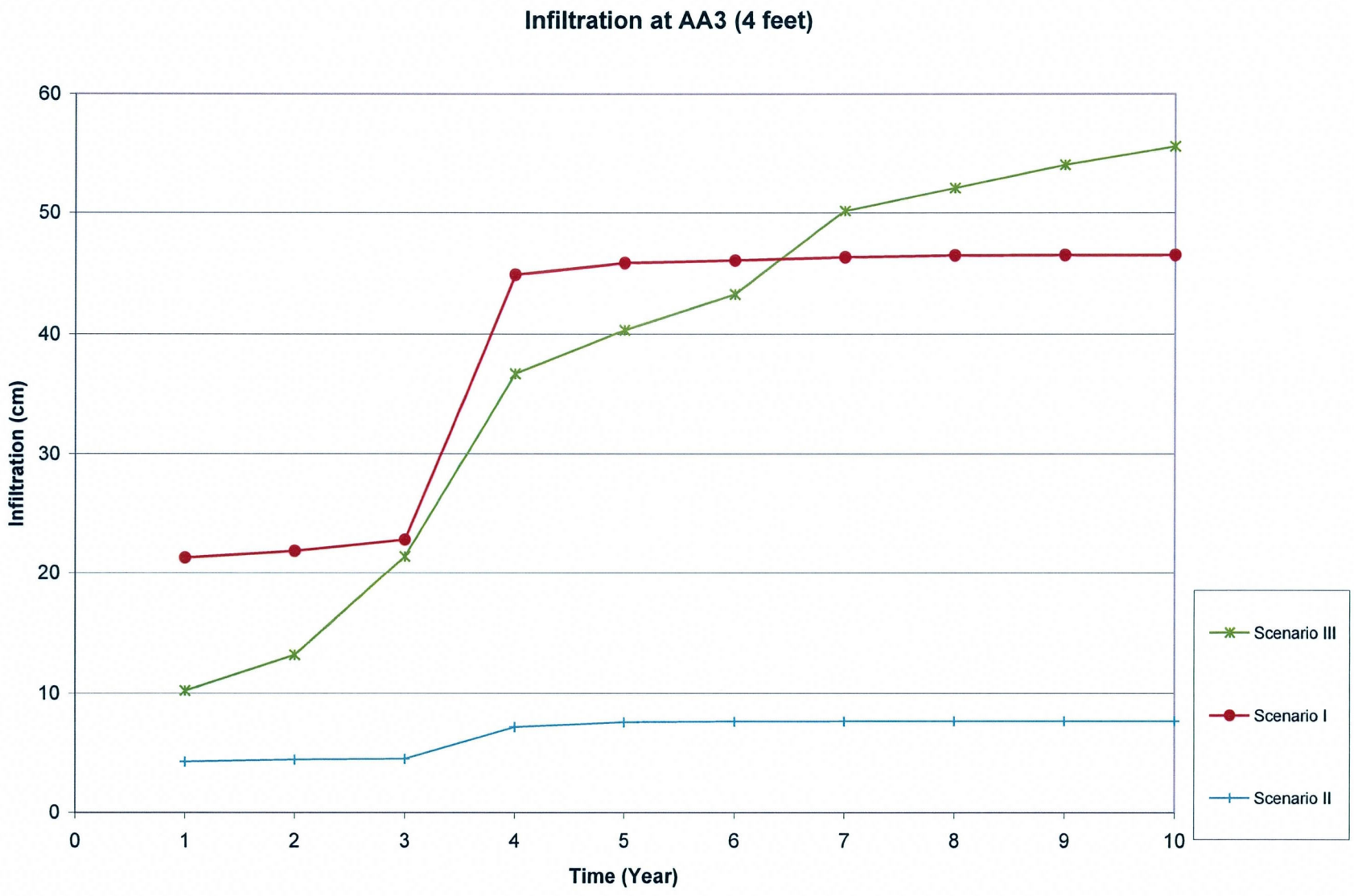
Infiltration at AA3 (4 feet)
Infiltration (cm)
60
50
40
30
20
10
0
0
1
2
3
4
5
6
7
8
9
10
Time (Year)
Scenario III
Scenario I
Scenario II

6. DISCUSSION

Based on the UNSAT-H water balance predictions the hydrologic performance of landfill cover configurations based on cumulative drainage over a ten-year period from best to worst is: the constructed ET cover (scenario II), existing soil cover (scenario I), and the state prescriptive cover (scenario III). The cumulative drainage for both existing soil cover and the constructed cover was less than that predicted for the state prescriptive cover over a 10-year simulation period. The predicted annual drainage for all scenarios is less than state prescriptive cover in eight out of total ten years.

The modeling results indicate that both the existing soil cover and the constructed ET cover will perform equivalent to the state prescriptive cover based on the accumulated drainage considering the model uncertainties during the selected 10-year simulation, despite of the higher drainage during the wet years. The results indicated that soil with a saturated hydraulic conductivity near or less than 1.4×10^{-4} cm/sec and with suitable soil water retention properties will perform equivalent to the state prescriptive cover. Both existing soil cover and the constructed ET cover would meet the substantive requirement for the engineered alternative to the state prescriptive specified in the California Code of Regulations Title 27 Section 20080.

7. REFERENCES

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Attachment 1
Geotechnical Laboratory Results

Geotechnical Laboratory Results
Daniel B. Stephens & Associates, Inc.

Laboratory Report for

Earth Tech, Inc

Anomaly Area 3; CTO 0078; Job # 37380

September 9, 2005

Daniel B. Stephens & Associates, Inc.

6020 Academy NE, Suite 100 • Albuquerque, New Mexico 87109

September 8, 2005

Crispin Wanyoike
Earth Tech, Inc.
21064 Bake Parkway, Suite 100
Lake Forest, CA 92630
(562) 951-2057

Re: DBS&A Laboratory Report for the Earth Tech, Inc. Anomaly Area 3 sample

Dear Mr. Wanyoike:

Enclosed is the final report for the Earth Tech, Inc. Anomaly Area 3 sample. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed final report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the final report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Earth Tech, Inc. and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.
LABORATORY / TESTING FACILITY

Joleen Hines
Laboratory Supervising Manager

Enclosure

Daniel B. Stephens & Associates, Inc.
6020 Academy NE, Suite 100 505-822-9400
Albuquerque, NM 87109 FAX 505-822-8877

Summaries

Sample Prep Summary

	Proctor Data*		Target Remold Density at 80% and 90% of Maximum Dry Bulk Density, Dry of Optimum	Actual Remold Values		
Sample Number	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm^3)	Dry Bulk Density (g/cm^3)	Moisture Content (%, g/g)	Dry Bulk Density (g/cm^3)	% of Max. Dry Bulk Density (%)
Anomally Area (80%)	10.5	2.00	1.60	10.0	1.60	80%
Anomally Area (90%)	10.5	2.00	1.80	10.1	1.79	90%

*Provided by Client

Daniel B. Stephens & Associates, Inc.

Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties[1] (θ, ρ_d, ϕ)	Saturated Hydraulic Conductivity[2]		Moisture Characteristics[3]					Unsaturated Hydraulic Conductivity	Particle Size[4]			Effective Porosity	Particle Density	Air Permeability	1/3, 15 Bar Points and Water Holding Capacity	Atterberg Limits	Proctor Compaction
		CH	FH	HC	PP	TH	WP	RH		DS	WS	H						
Anomally Area (80%)	X	X		X	X		X	X	X									
Anomally Area (90%)	X	X		X	X		X	X	X									

[1] θ = Initial moisture content, ρ_d = Dry bulk density, ϕ = Calculated porosity
[2] CH = Constant head, FH = falling head
[3] HC = Hanging column, PP = Pressure plate, TH = Thermocouple psychrometer, WP = Water activity meter, RH = Relative humidity box
[4] DS = Dry sieve, WS = Wet sieve, H = Hydrometer

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Initial Moisture Content Gravimetric (%, g/g)	Initial Moisture Content Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
Anomally Area (80%)	10.0	16.0	1.60	1.76	39.5
Anomally Area (90%)	10.1	18.1	1.79	1.98	32.3

NA = Not analyzed

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Method of Analysis	
		Constant Head	Falling Head
Anomally Area (80%)	2.0E-03	X	
Anomally Area (90%)	8.0E-05	X	

Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
Anomally Area (80%)	0	43.2
	9	41.4
	37	38.5
	75	28.8
	510	18.1
	8566	9.3
	851293	1.7
Anomally Area (90%)	0	35.9
	11	34.3
	41	33.7
	78	30.8
	510	20.6
	7037	9.0
	851293	1.1

Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	α (cm^{-1})	N (dimensionless)	θ_r	θ_s
Anomally Area (80%)	0.0333	1.3048	0.0041	0.4356
Anomally Area (90%)	0.0092	1.3352	0.0000	0.3536

Summary of Calculated Unsaturated Hydraulic Properties with Gravel Corrections

Sample Number	Ksat	α (cm^{-1})	N (dimensionless)	θ_i	θ_r	θ_s
Anomally Area (80%)	2.0E-03	0.0333	1.3048	0.1567	0.0040	0.4267
Anomally Area (90%)	7.8E-05	0.0092	1.3352	0.1769	0.0000	0.3455

Laboratory Data and Graphical Plots

Initial Properties

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Initial Moisture Content Gravimetric (%, g/g)	Initial Moisture Content Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
Anomally Area (80%)	10.0	16.0	1.60	1.76	39.5
Anomally Area (90%)	10.1	18.1	1.79	1.98	32.3

NA = Not analyzed

Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Earth Tech (6-05)
Job Number: LB05.0143.00
Sample Number: Anomally Area (80%)
Ring Number: NA
Depth: NA

Test Date: 30-Jun-05

Field weight of sample* (g): 409.88
Tare weight, ring (g): 82.45
Tare weight, cap/plate/epoxy (g): 0.00

Dry weight of sample (g): 297.74
Sample volume (cm^3): 185.73
Assumed particle density: 2.65

Initial Volumetric Moisture Content (% vol): 16.0
Initial Gravimetric Moisture Content (% g/g): 10.0
Dry bulk density (g/cm^3): 1.60
Wet bulk density (g/cm^3): 1.76
Calculated Porosity (% vol): 39.5
Percent Saturation: 40.5

Comments:

* Weight including tares
NA = Not analyzed

Laboratory analysis by: T. Sciacca
Data entered by: R. Gurule
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Earth Tech (6-05)
Job Number: LB05.0143.00
Sample Number: Anomally Area (90%)
Ring Number: NA
Depth: NA

Test Date: 30-Jun-05

Field weight of sample* (g): 444.82
Tare weight, ring (g): 81.23
Tare weight, cap/plate/epoxy (g): 0.00

Dry weight of sample (g): 330.25
Sample volume (cm^3): 184.07
Assumed particle density: 2.65

Initial Volumetric Moisture Content (% vol): 18.1
Initial Gravimetric Moisture Content (% g/g): 10.1
Dry bulk density (g/cm^3): 1.79
Wet bulk density (g/cm^3): 1.98
Calculated Porosity (% vol): 32.3
Percent Saturation: 56.1

Comments:

* Weight including tares
NA = Not analyzed

Laboratory analysis by: T. Sciacca
Data entered by: R. Gurule
Checked by: J. Hines

Saturated Hydraulic Conductivity

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Method of Analysis	
		Constant Head	Falling Head
Anomally Area (80%)	2.0E-03	X	
Anomally Area (90%)	8.0E-05	X	

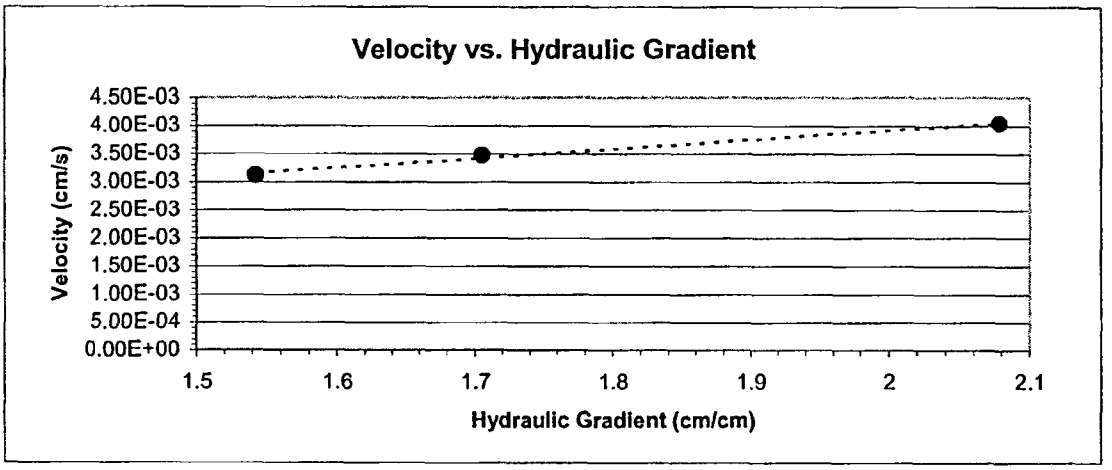
Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Earth Tech (6-05)	*Type of water used:*	TAP
Job number:	LB05.0143.00	*Collection vessel tare* (g):	6.36
Sample number:	Anomally Area (80%)	*Sample length* (cm):	6.16
Ring Number:	NA	*Sample diameter* (cm):	6.20
Depth:	NA	*Sample x-sectional area* (cm^2):	30.15

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
11-Jul-05	10:13:52	21.0	12.8	12.8	6.5	53	1.9E-03	1.9E-03
11-Jul-05	10:14:45							
Test # 2:								
12-Jul-05	08:24:30	21.0	10.5	25.2	18.9	180	2.0E-03	2.0E-03
12-Jul-05	08:27:30							
Test # 3:								
12-Jul-05	16:19:42	21.0	9.5	14.6	8.3	88	2.0E-03	2.0E-03
12-Jul-05	16:21:10							

***Average Ksat* (cm/sec):** **2.0E-03**



Comments:

Laboratory analysis by: M. Carrillo
Data entered by: M. Carrillo
Checked by: J. Hines

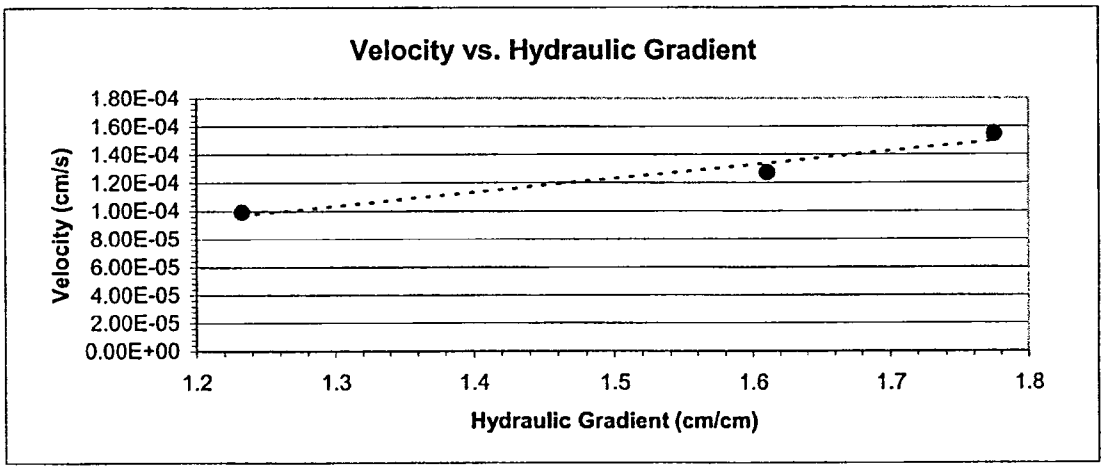
Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Earth Tech (6-05)	*Type of water used:*	TAP
Job number:	LB05.0143.00	*Collection vessel tare* (g):	11.80
Sample number:	Anomally Area (90%)	*Sample length* (cm):	6.09
Ring Number:	NA	*Sample diameter* (cm):	6.21
Depth:	NA	*Sample x-sectional area* (cm^2):	30.25

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
11-Jul-05	12:36:15	21.0	10.8	18.9	7.1	1522	8.7E-05	8.5E-05
11-Jul-05	13:01:37							
Test # 2:								
12-Jul-05	09:01:46	21.0	9.8	24.1	12.3	3195	7.9E-05	7.7E-05
12-Jul-05	09:55:01							
Test # 3:								
13-Jul-05	07:55:42	21.0	7.5	21.3	9.5	3187	8.0E-05	7.8E-05
13-Jul-05	08:48:49							

***Average Ksat* (cm/sec):** **8.0E-05**



Comments:

Laboratory analysis by: T. Bowekatey
Data entered by: M. Carrillo
Checked by: J. Hines

Unsaturated Hydraulic Conductivity

Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
Anomally Area (80%)	0	43.2
	9	41.4
	37	38.5
	75	28.8
	510	18.1
	8566	9.3
	851293	1.7
Anomally Area (90%)	0	35.9
	11	34.3
	41	33.7
	78	30.8
	510	20.6
	7037	9.0
	851293	1.1

Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	α (cm^{-1})	N (dimensionless)	θ_r	θ_s
Anomally Area (80%)	0.0333	1.3048	0.0041	0.4356
Anomally Area (90%)	0.0092	1.3352	0.0000	0.3536

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name: Earth Tech (6-05)
Job Number: LB05.0143.00
Sample Number: Anomally Area (80%)
Ring Number: NA
Depth: NA

Dry wt. of sample (g): 297.74
Tare wt., screen & clamp (g): 27.79
Tare wt., ring (g): 82.45
Tare wt., epoxy (g): 0.00
Sample volume (cm^3): 185.73

Saturated weight at 0 cm tension* (g): 488.26
Volume of water[T] in saturated sample (cm^3): 80.28
Saturated moisture content (% vol): 43.22
Sample bulk density (g/cm^3): 1.60

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content[T] (% vol)
Hanging column:	13-Jul-05 / 15:00	488.26	0.00	43.22
	20-Jul-05 / 12:20	484.90	8.50	41.41
	26-Jul-05 / 14:00	479.57	37.00	38.54
	05-Aug-05 / 15:10	461.49	75.00	28.81
Pressure plate:	15-Aug-05 / 10:45	441.69	509.90	18.15

Comments:

* Weight including tares
[T] Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: M. Carrillo
Data entered by: R. Gurule
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Water Activity Meter/Relative Humidity Box

(Main Drainage Curve)

Job Name: Earth Tech (6-05)
Job Number: LB05.0143.00
Sample Number: Anomally Area (80%)
Ring Number: NA
Depth: NA

Dry weight of water activity meter sample* (g): 132.50
Tare weight, jar (g): 112.93
Sample bulk density (g/cm^3): 1.60

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Water Activity Meter:	24-Aug-05 / 13:31	133.64	8566.3	9.34

Dry weight of relative humidity box sample* (g): 67.48
Tare weight (g): 40.00
Sample bulk density (g/cm^3): 1.60

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Relative humidity box:	22-Jul-05 / 09:00	67.77	851293	1.67

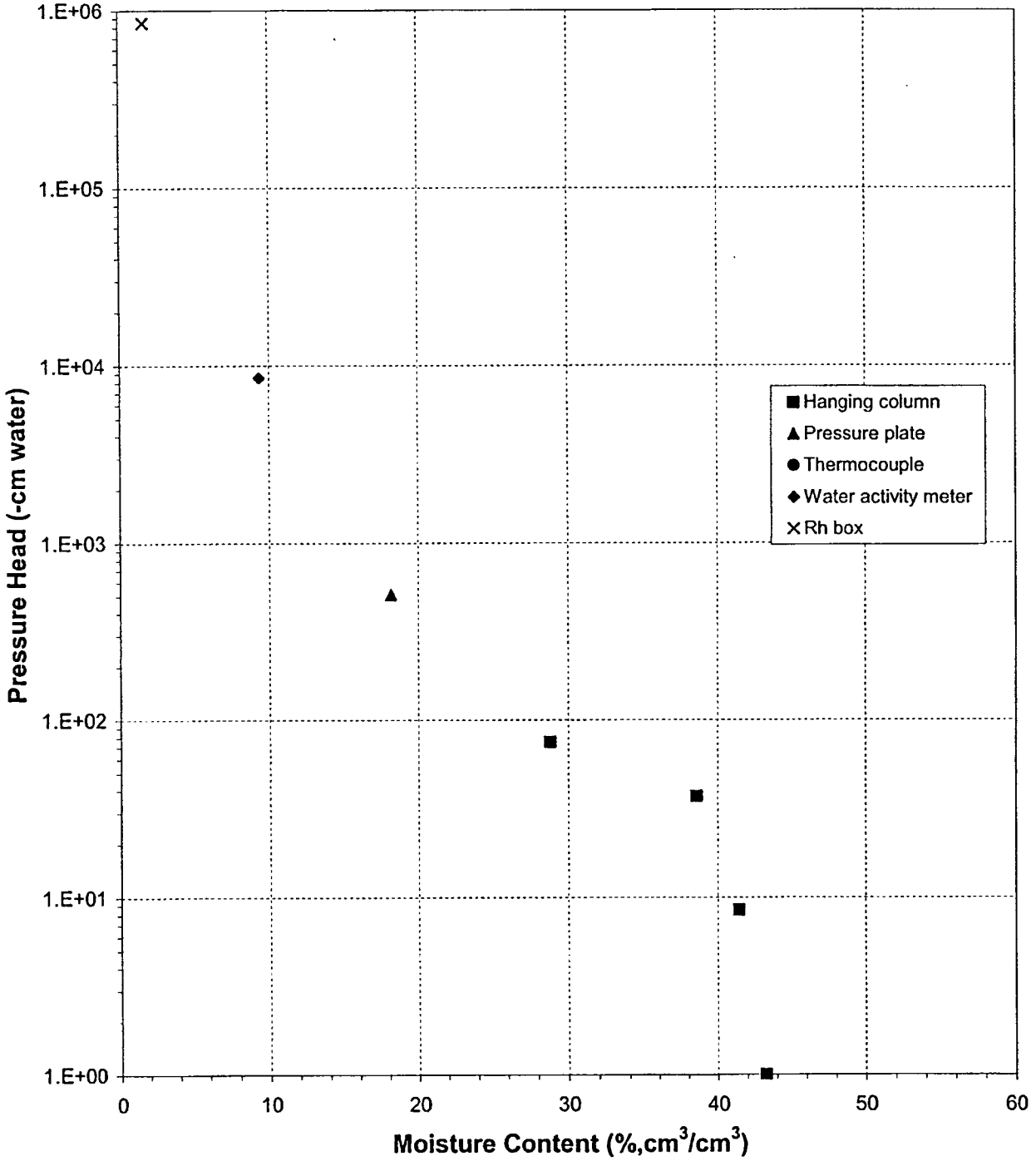
Comments:

* Weight including tares
† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: M. Carrillo/T. Sciacca
Data entered by: R. Gurule
Checked by: J. Hines

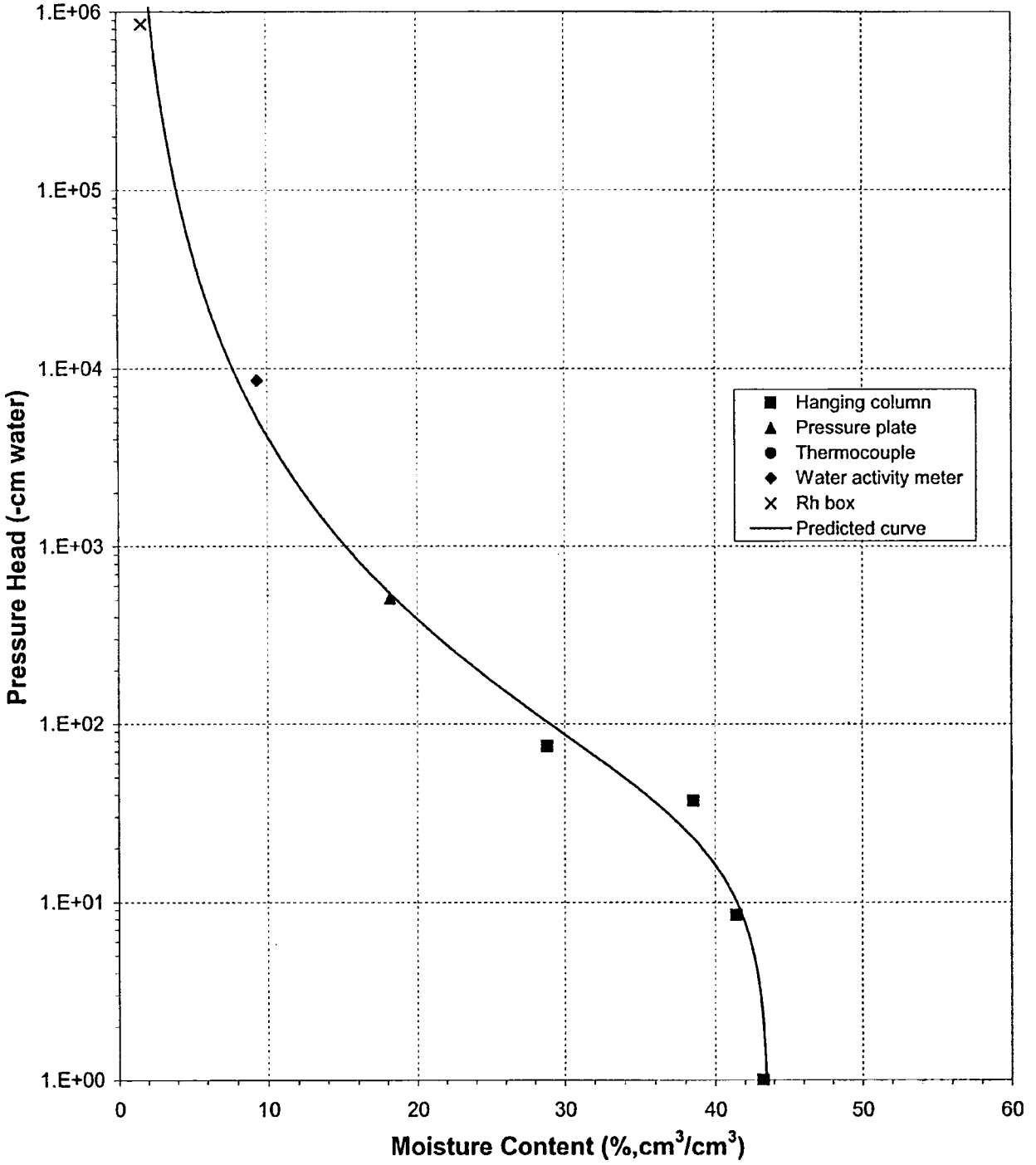
Water Retention Data Points

Sample Number: Anomally Area (80%)



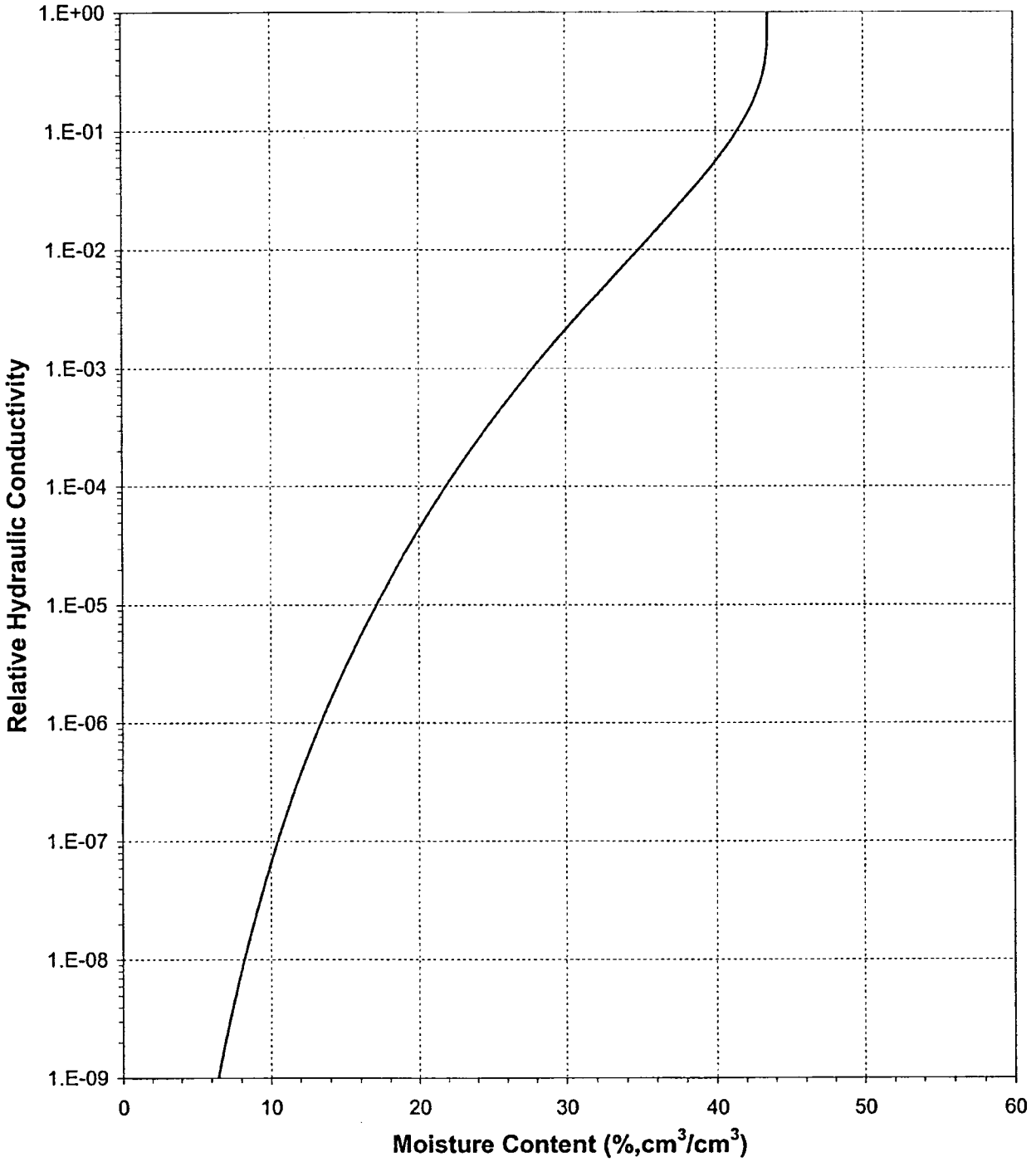
Predicted Water Retention Curve and Data Points

Sample Number: Anomally Area (80%)



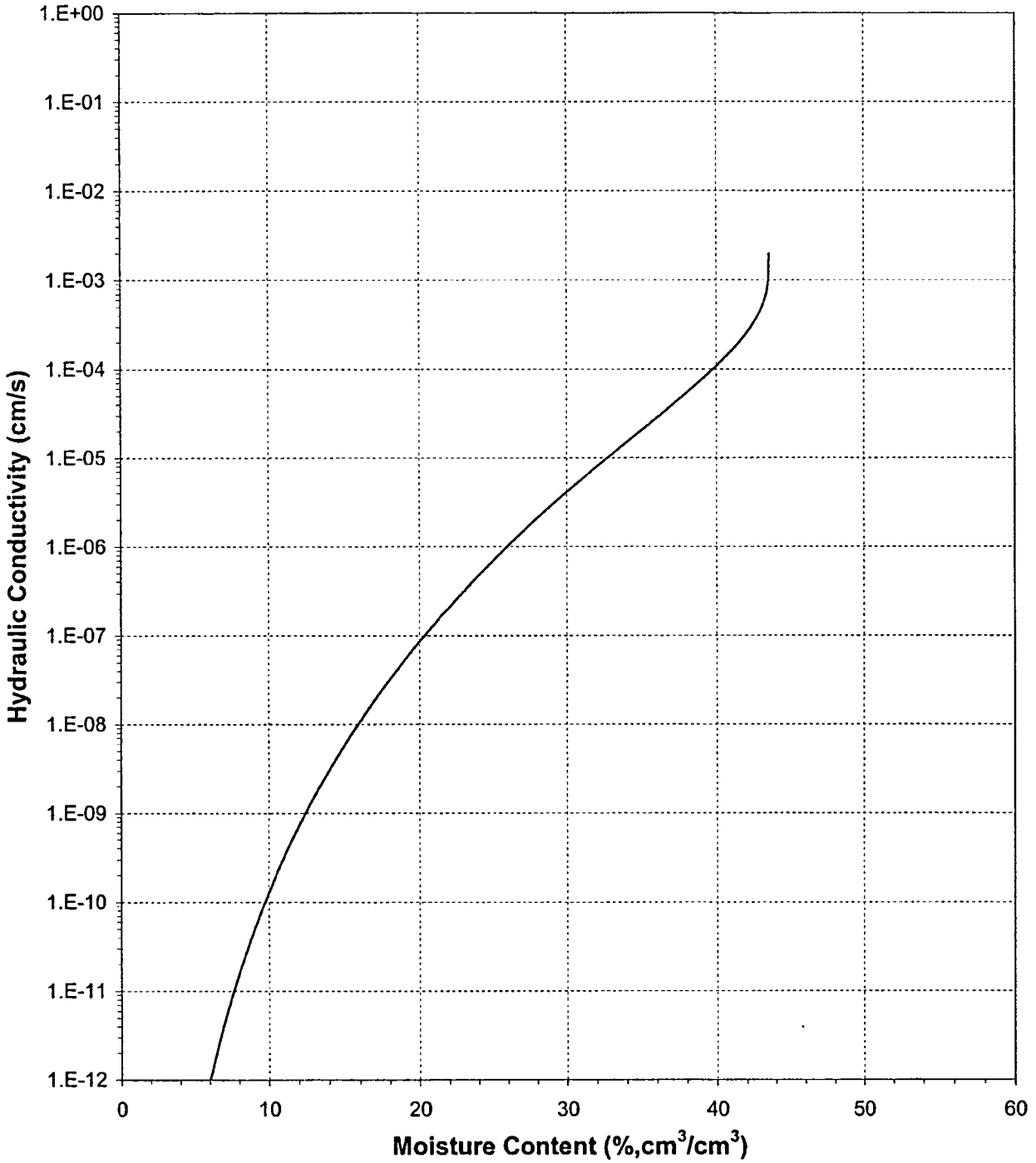
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: Anomally Area (80%)



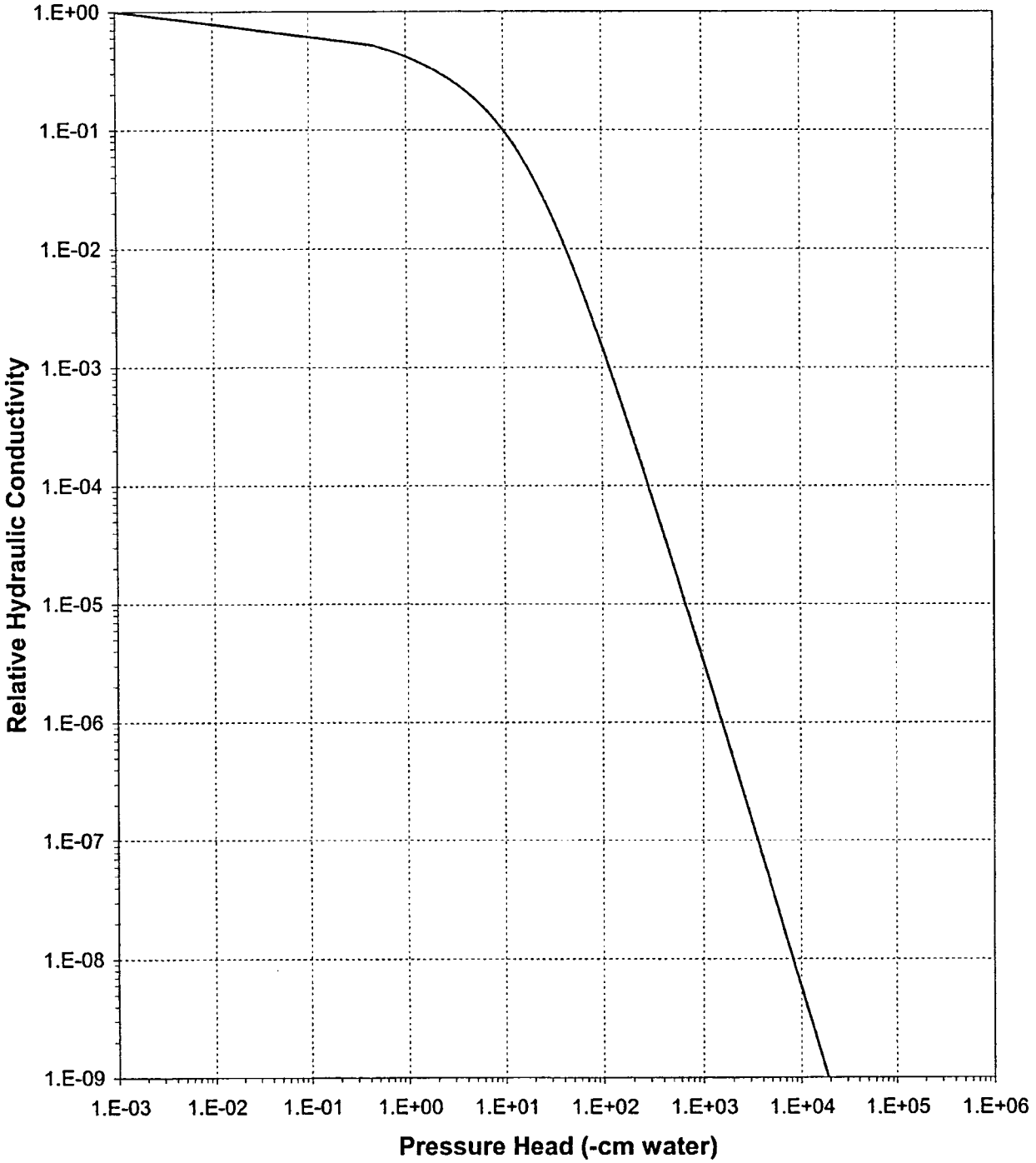
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: Anomally Area (80%)



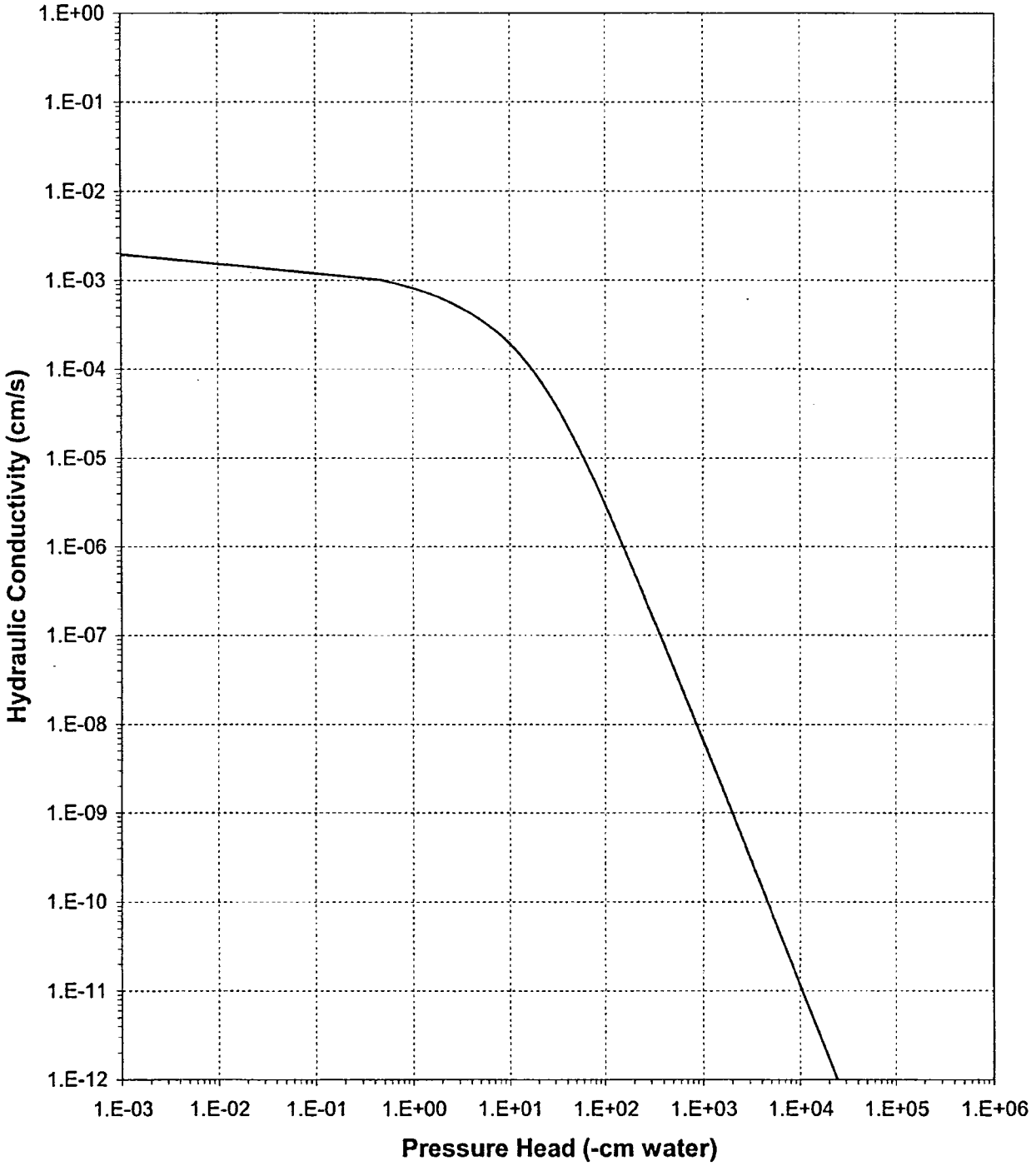
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: Anomally Area (80%)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: Anomally Area (80%)



Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name: Earth Tech (6-05)
Job Number: LB05.0143.00
Sample Number: Anomally Area (90%)
Ring Number: NA
Depth: NA

Dry wt. of sample (g): 330.25
Tare wt., screen & clamp (g): 27.47
Tare wt., ring (g): 81.23
Tare wt., epoxy (g): 0.00
Sample volume (cm^3): 184.07

Saturated weight at 0 cm tension* (g): 506.06
Volume of water[T] in saturated sample (cm^3): 67.11
Saturated moisture content (% vol): 35.92
Sample bulk density (g/cm^3): 1.79

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content[T] (% vol)
Hanging column:	13-Jul-05 / 16:20	505.06	0.00	35.92
	20-Jul-05 / 12:20	502.08	10.70	34.30
	26-Jul-05 / 14:05	500.89	41.00	33.65
	15-Aug-05 / 15:10	495.71	78.00	30.84
Pressure plate:	15-Aug-05 / 10:45	476.84	509.90	20.58

Comments:

* Weight including tares
[T] Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: M. Carrillo
Data entered by: R. Gurule
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Water Activity Meter/Relative Humidity Box

(Main Drainage Curve)

Job Name: Earth Tech (6-05)
Job Number: LB05.0143.00
Sample Number: Anomally Area (90%)
Ring Number: NA
Depth: NA

Dry weight of water activity meter sample* (g): 159.46
Tare weight, jar (g): 112.85
Sample bulk density (g/cm^3): 1.79

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Water Activity Meter:	29-Aug-05 / 10:00	161.79	7036.6	8.97

Dry weight of relative humidity box sample* (g): 77.58
Tare weight (g): 38.81
Sample bulk density (g/cm^3): 1.79

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Relative humidity box:	03-Aug-05 / 10:15	77.81	851293	1.06

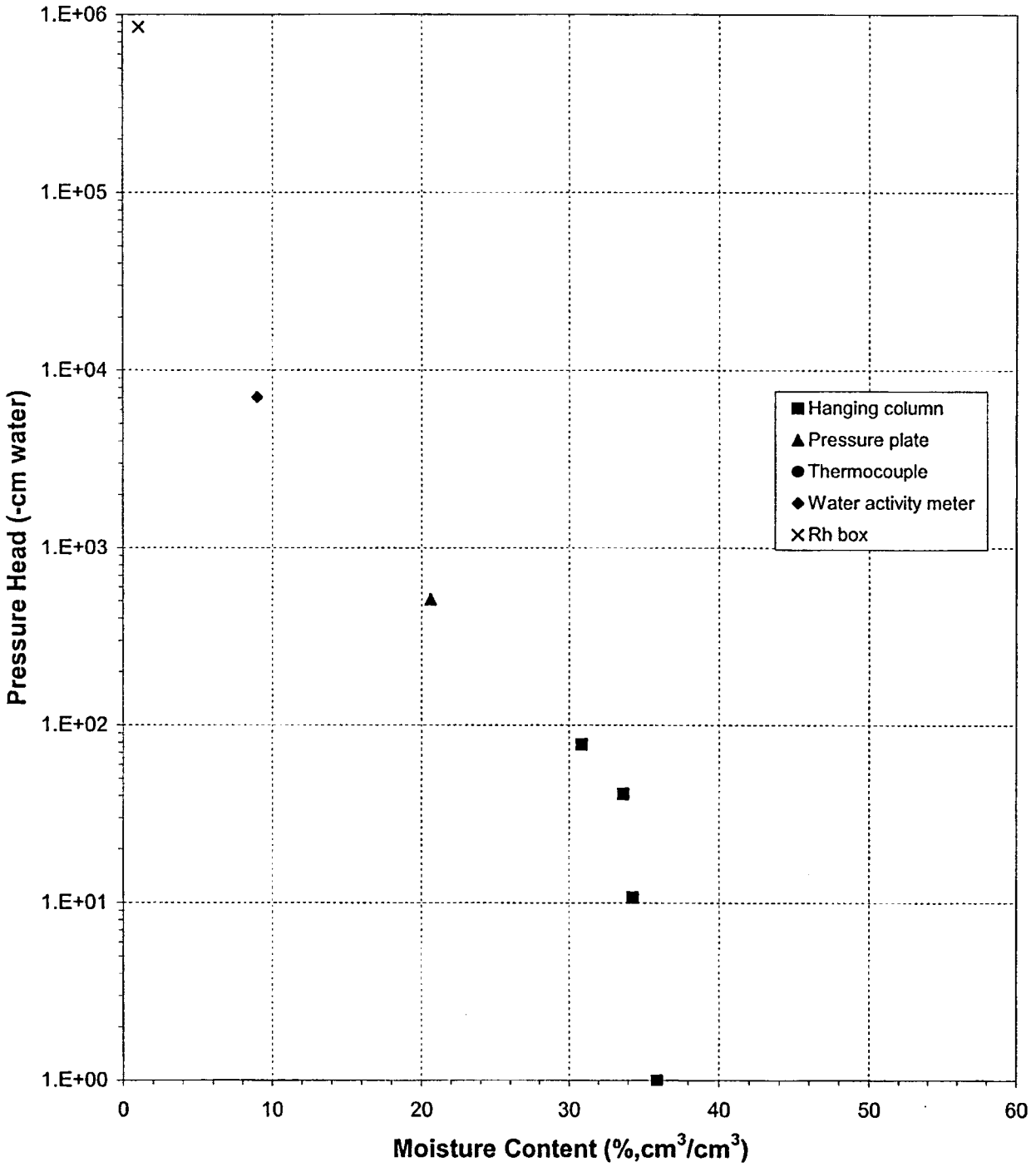
Comments:

* Weight including tares
† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: M. Carrillo
Data entered by: R. Gurule
Checked by: J. Hines

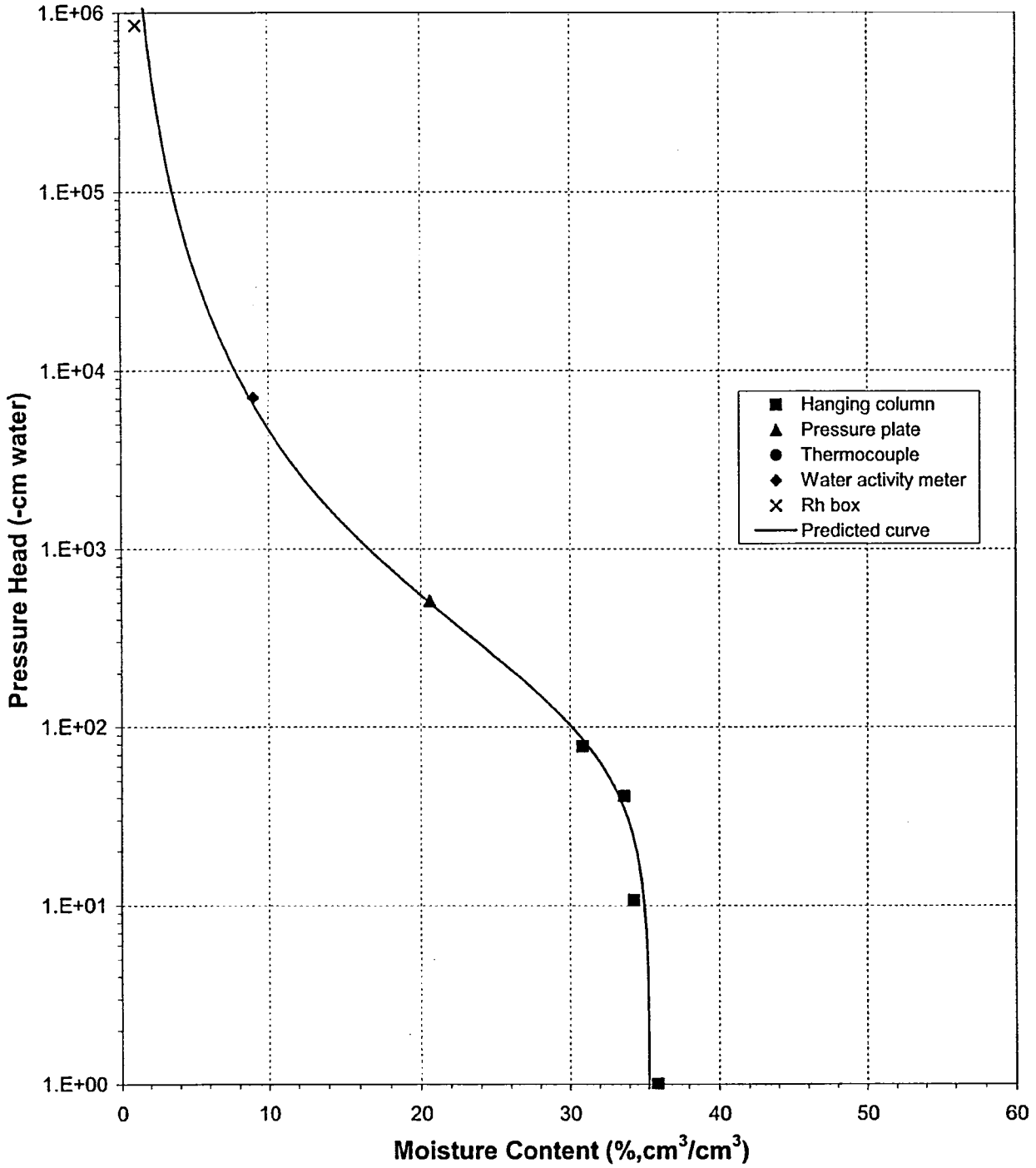
Water Retention Data Points

Sample Number: Anomally Area (90%)



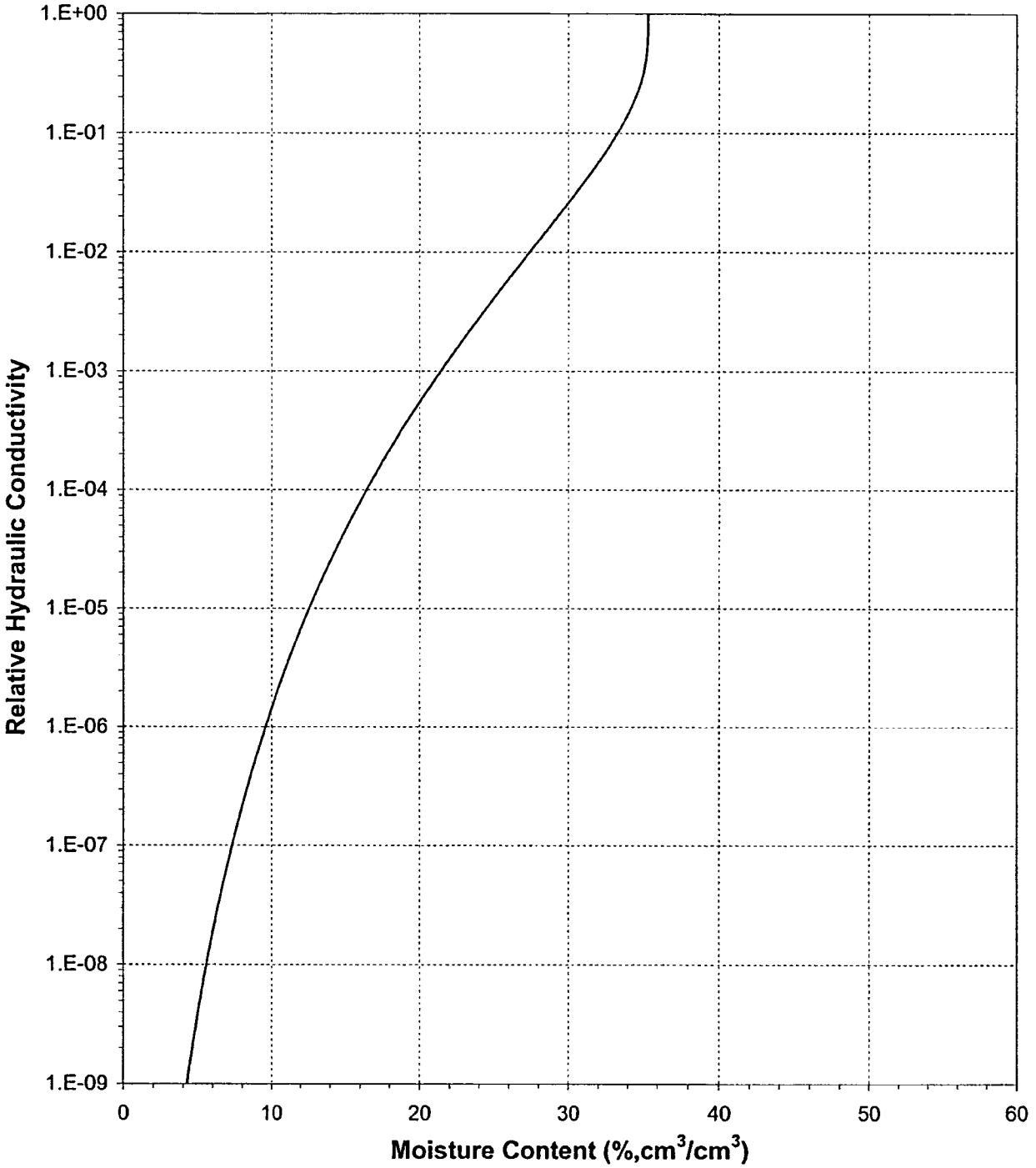
Predicted Water Retention Curve and Data Points

Sample Number: Anomally Area (90%)



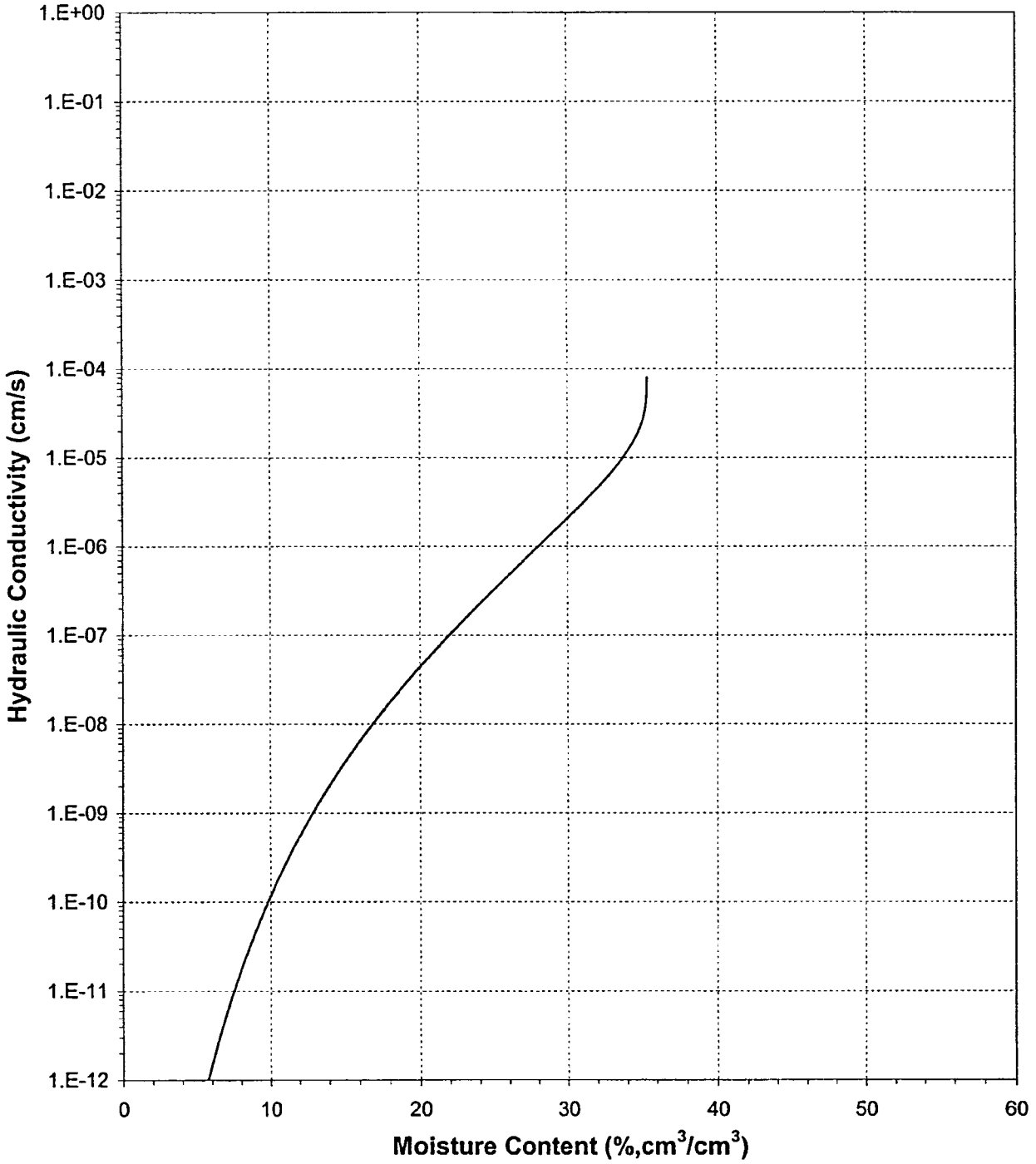
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: Anomally Area (90%)



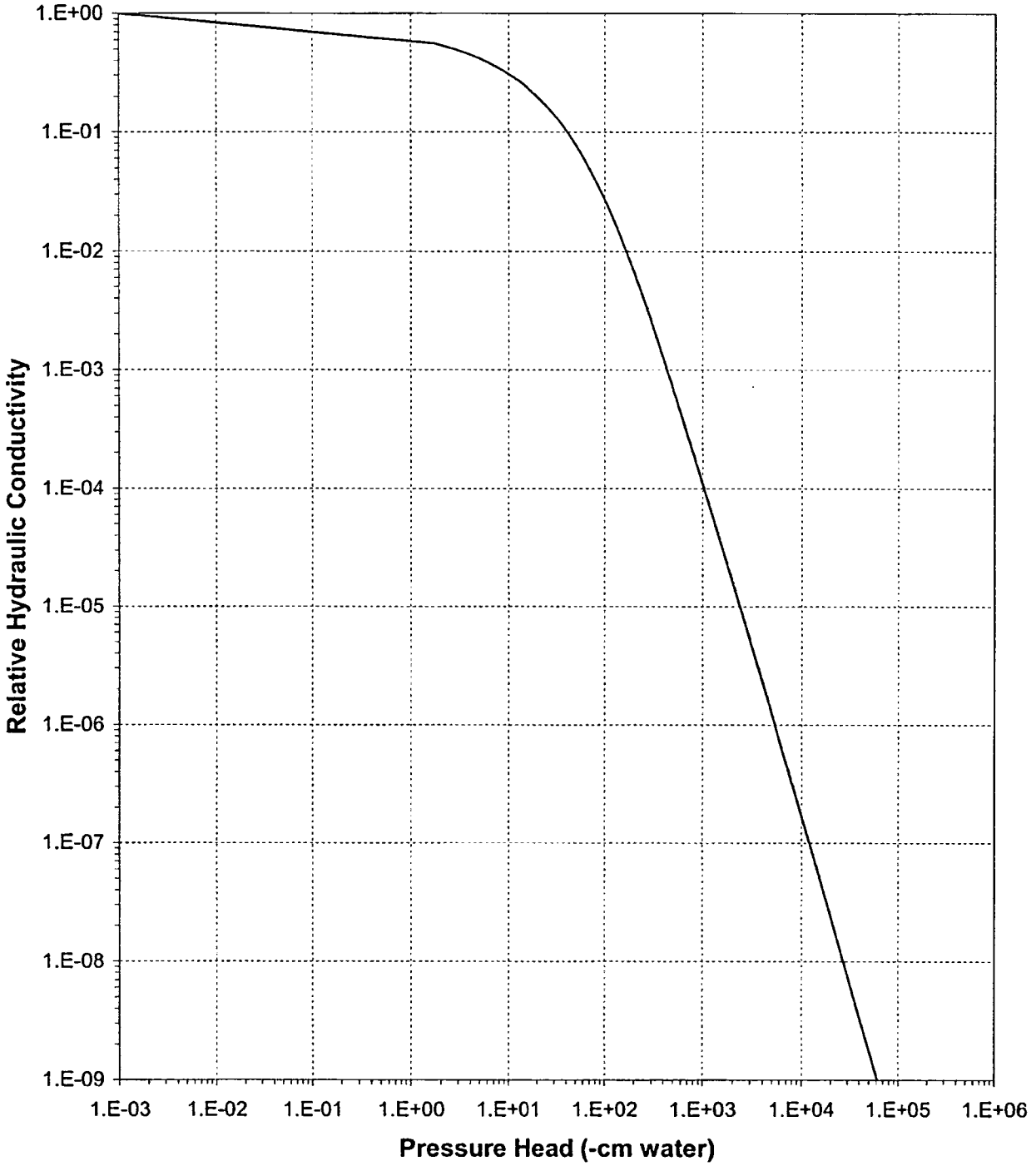
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: Anomally Area (90%)



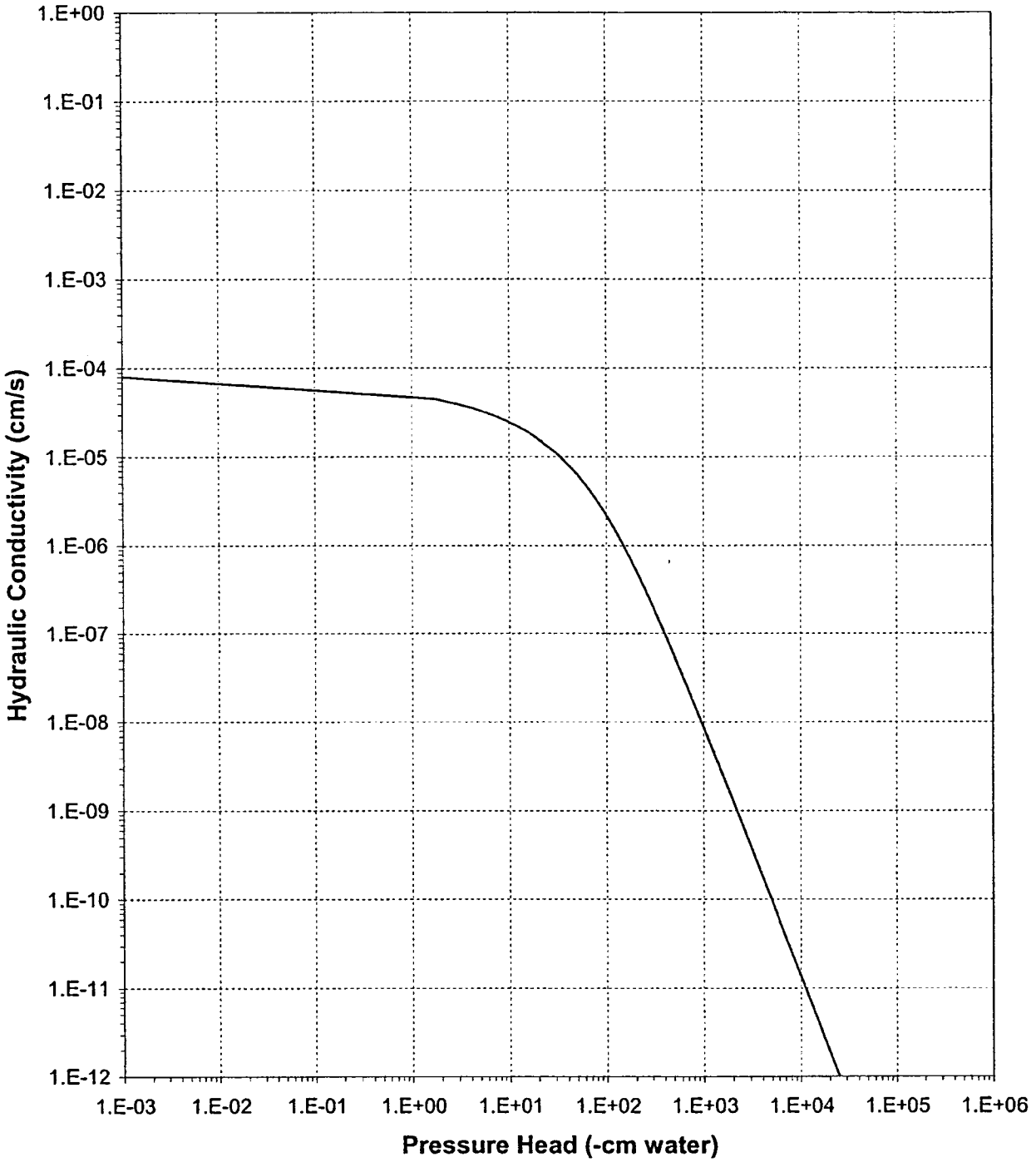
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: Anomally Area (90%)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: Anomally Area (90%)



Unsaturated Hydraulic Conductivity With Gravel Corrections

Summary of Calculated Unsaturated Hydraulic Properties with Gravel Corrections

Sample Number	Ksat	α (cm^{-1})	N (dimensionless)	θ_i	θ_r	θ_s
Anomally Area (80%)	2.0E-03	0.0333	1.3048	0.1567	0.0040	0.4267
Anomally Area (90%)	7.8E-05	0.0092	1.3352	0.1769	0.0000	0.3455

Daniel B. Stephens & Associates, Inc.

Gravel Correction Data Sheet

Job name: Earth Tech, Inc.
Job number: LB05.0143.00
Sample Name/Number: Anomally Area (80%)
Split: #4

Uncorrected input values		Corrected Values	
Mass (coarse)(g):	84.64		
Mass (fines)(g):	2450		
Dry bulk density (fines)(g/cm^3):	1.6	Density (composite)(g/cm^3):	1.62
Density (coarse)(g/cm^3):	2.65		
Ksat value (fines)(cm/sec):	2.0E-03	Ksat composite(cm/sec):	2.0E-03
Theta initial (fines):	0.1600	Theta initial composite:	0.1567
Theta saturated (fines):	0.4356	Theta saturated composite:	0.4267
Theta residual (fines):	0.0041	Theta residual composite:	0.0040
*Theta initial (coarse):	0		
*Theta saturated (coarse):	0		
*Theta residual (coarse):	0		
*Volume (coarse voids)(cm^3):	0		

Volumetric fraction of fines in composite: 0.980
Volumetric fraction of coarse in composite: 0.020
Volumetric fraction of voids in composite: 0.000
Volume (fines)(cm^3): 1531.25
Volume (coarse)(cm^3): 31.94
Volume (composite)(cm^3): 1563.19

*Comments: *Values will be zero if the coarse fraction is assumed to hold no water in pores.*

Date: 9/1/05
Data entered by: D. O'Dowd
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name: Earth Tech (6-05)
Job Number: LB05.0143.00
Sample Number: Anomally Area (80%)(Gravel Corrected)
Ring Number: NA
Depth: NA

Dry wt. of sample (g): 297.74
Tare wt., screen & clamp (g): 27.79
Tare wt., ring (g): 82.45
Tare wt., epoxy (g): 0.00
Sample volume (cm^3): 185.73

Saturated weight at 0 cm tension* (g): 488.26
Volume of water[T] in saturated sample (cm^3): 80.28
Saturated moisture content (% vol): 43.22
Sample bulk density (g/cm^3): 1.60

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content[T] (% vol)
Hanging column:	13-Jul-05 / 15:00	488.26	0.00	43.22
	20-Jul-05 / 12:20	484.90	8.50	41.41
	26-Jul-05 / 14:00	479.57	37.00	38.54
	05-Aug-05 / 15:10	461.49	75.00	28.81
Pressure plate:	15-Aug-05 / 10:45	441.69	509.90	18.15

Comments:

* Weight including tares
[T] Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: M. Carrillo
Data entered by: R. Gurule
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Water Activity Meter/Relative Humidity Box

(Main Drainage Curve)

Job Name: Earth Tech (6-05)
Job Number: LB05.0143.00
Sample Number: Anomally Area (80%)(Gravel Corrected)
Ring Number: NA
Depth: NA

Dry weight of water activity meter sample* (g): 132.50
Tare weight, jar (g): 112.93
Sample bulk density (g/cm^3): 1.60

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Water Activity Meter:	24-Aug-05 / 13:31	133.64	8566.3	9.34

Dry weight of relative humidity box sample* (g): 67.48
Tare weight (g): 40.00
Sample bulk density (g/cm^3): 1.60

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Relative humidity box:	22-Jul-05 / 09:00	67.77	851293	1.67

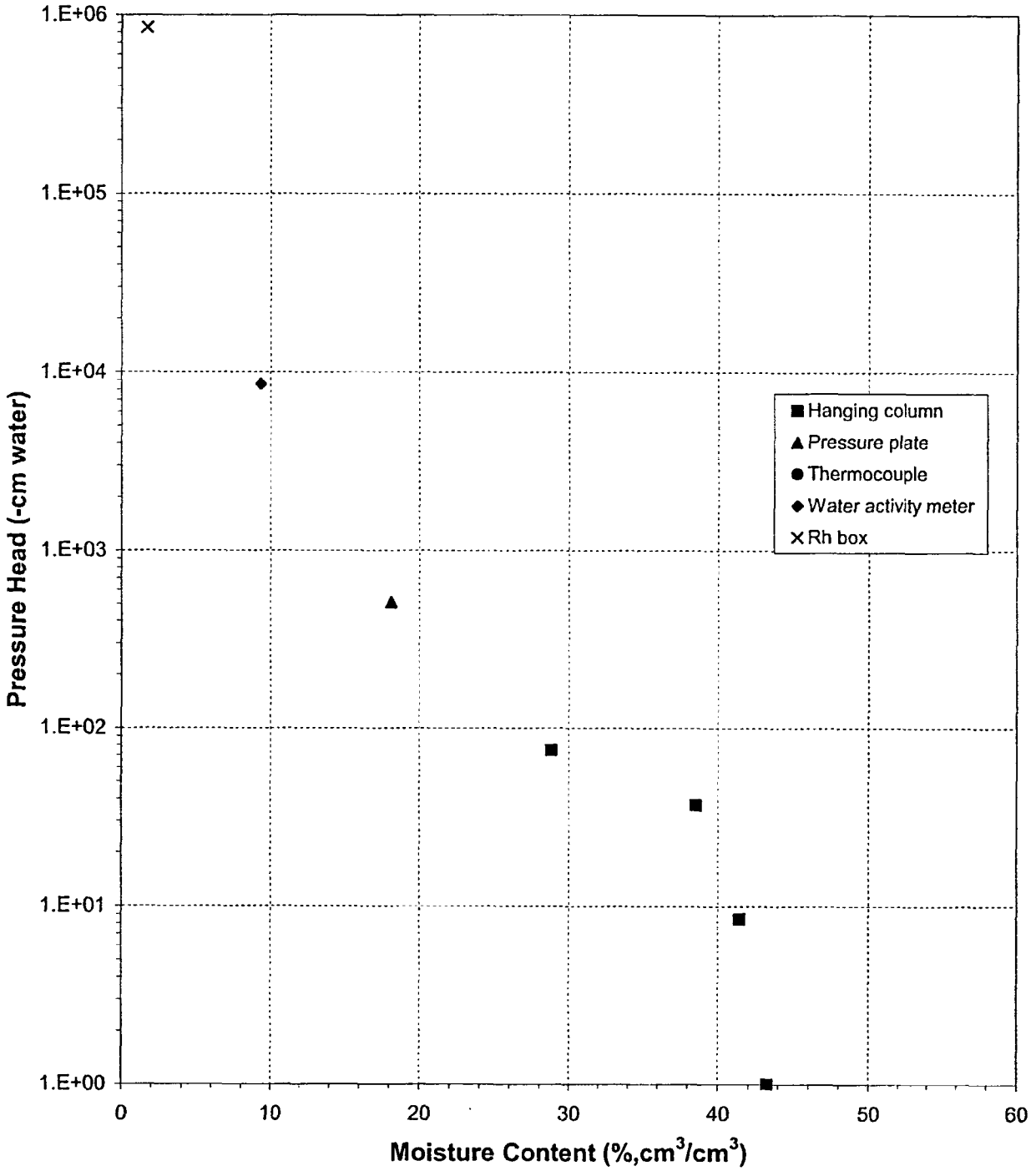
Comments:

* Weight including tares
† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: M. Carrillo/T. Sciacca
Data entered by: R. Gurule
Checked by: J. Hines

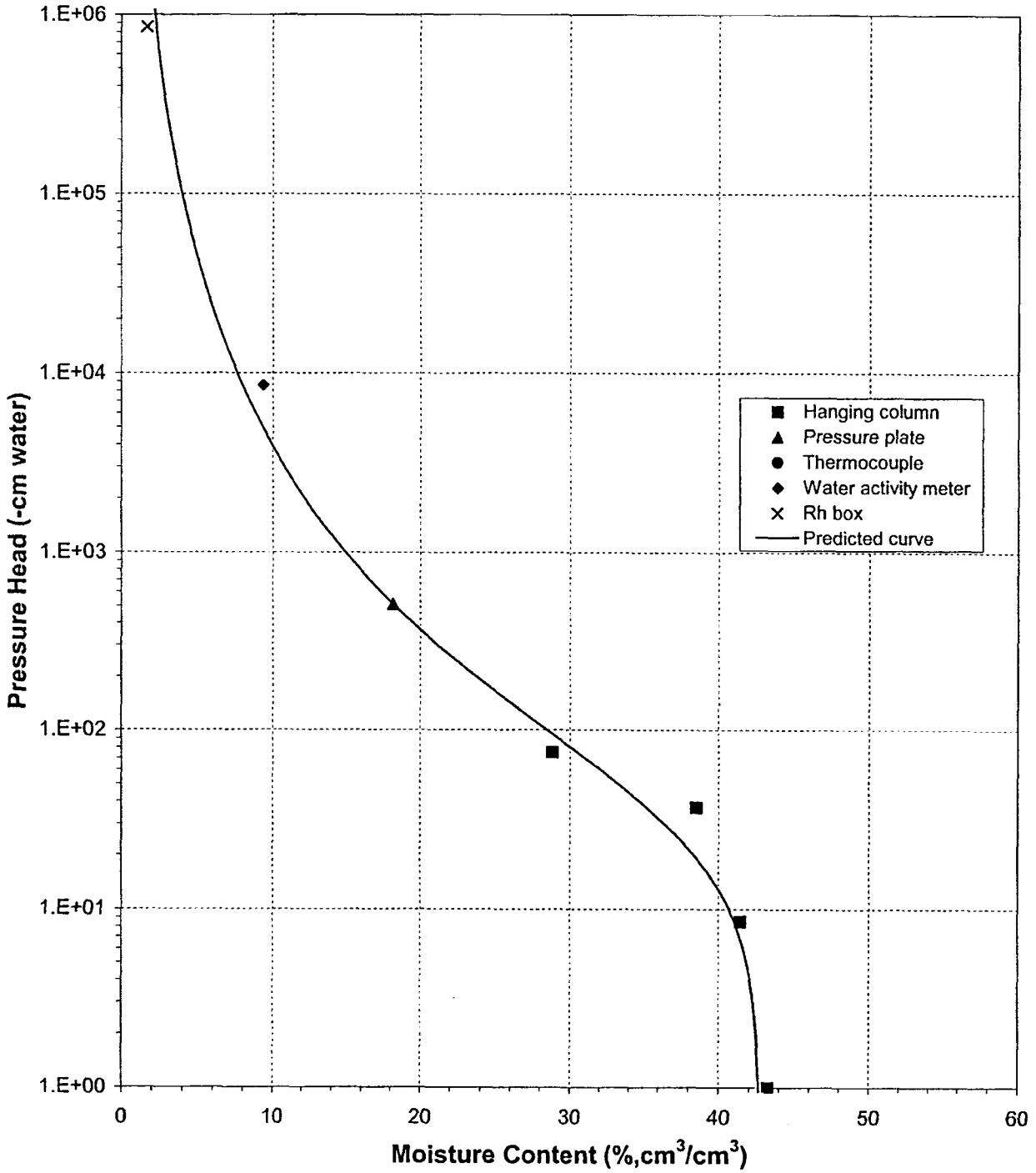
Water Retention Data Points

Sample Number: Anomally Area (80%)(Gravel Corrected)



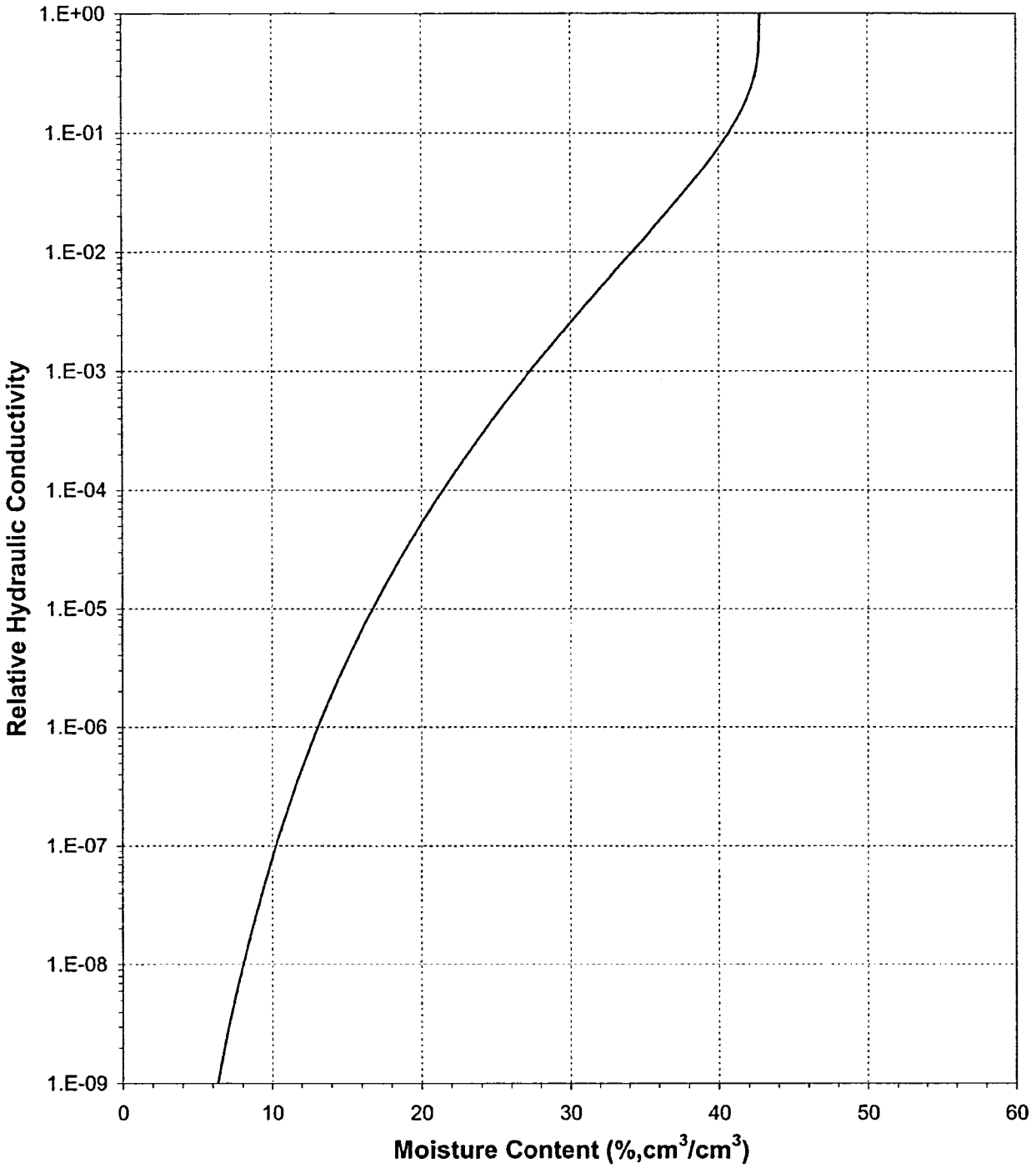
Predicted Water Retention Curve and Data Points

Sample Number: Anomally Area (80%)(Gravel Corrected)



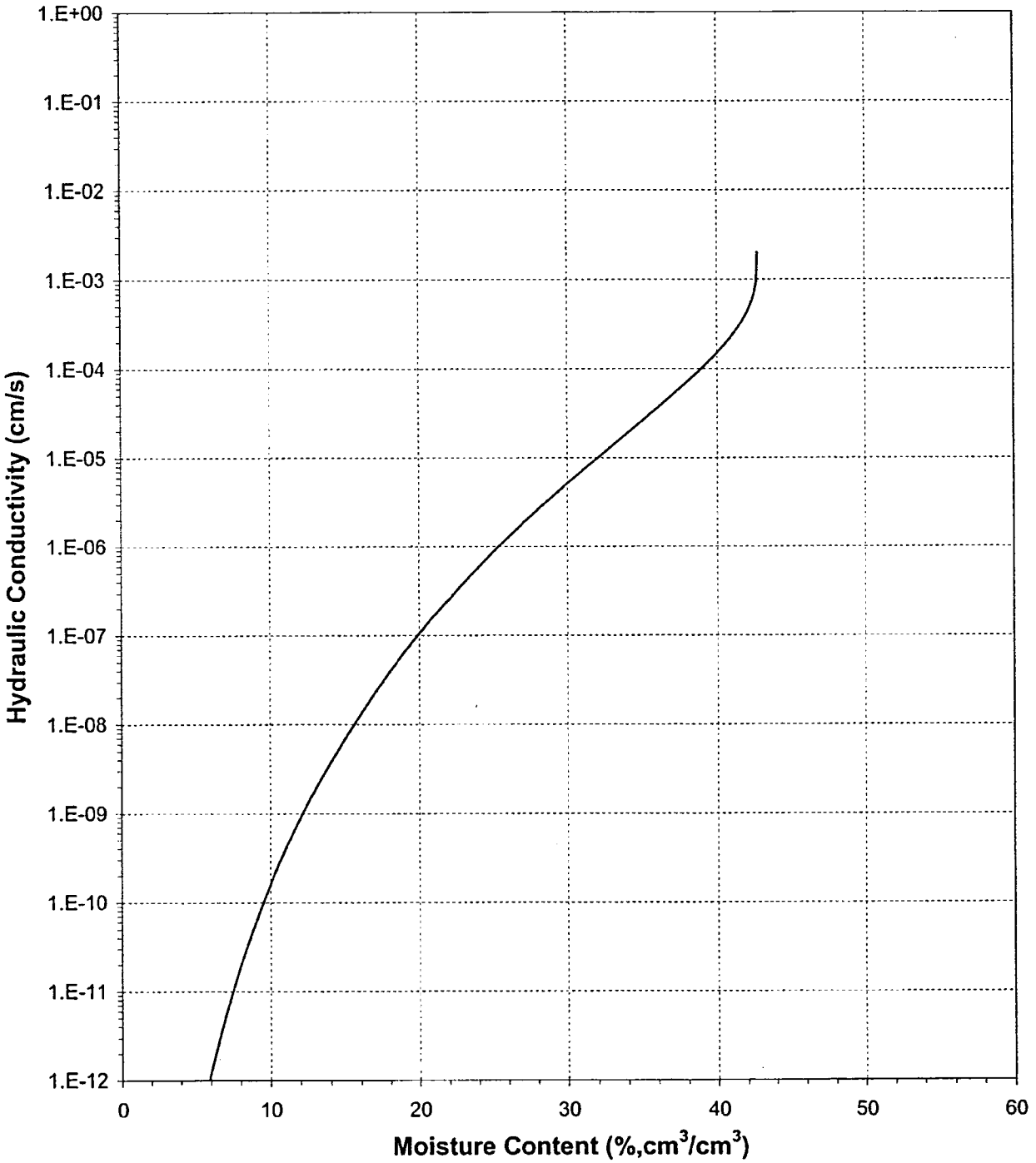
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: Anomally Area (80%)(Gravel Corrected)



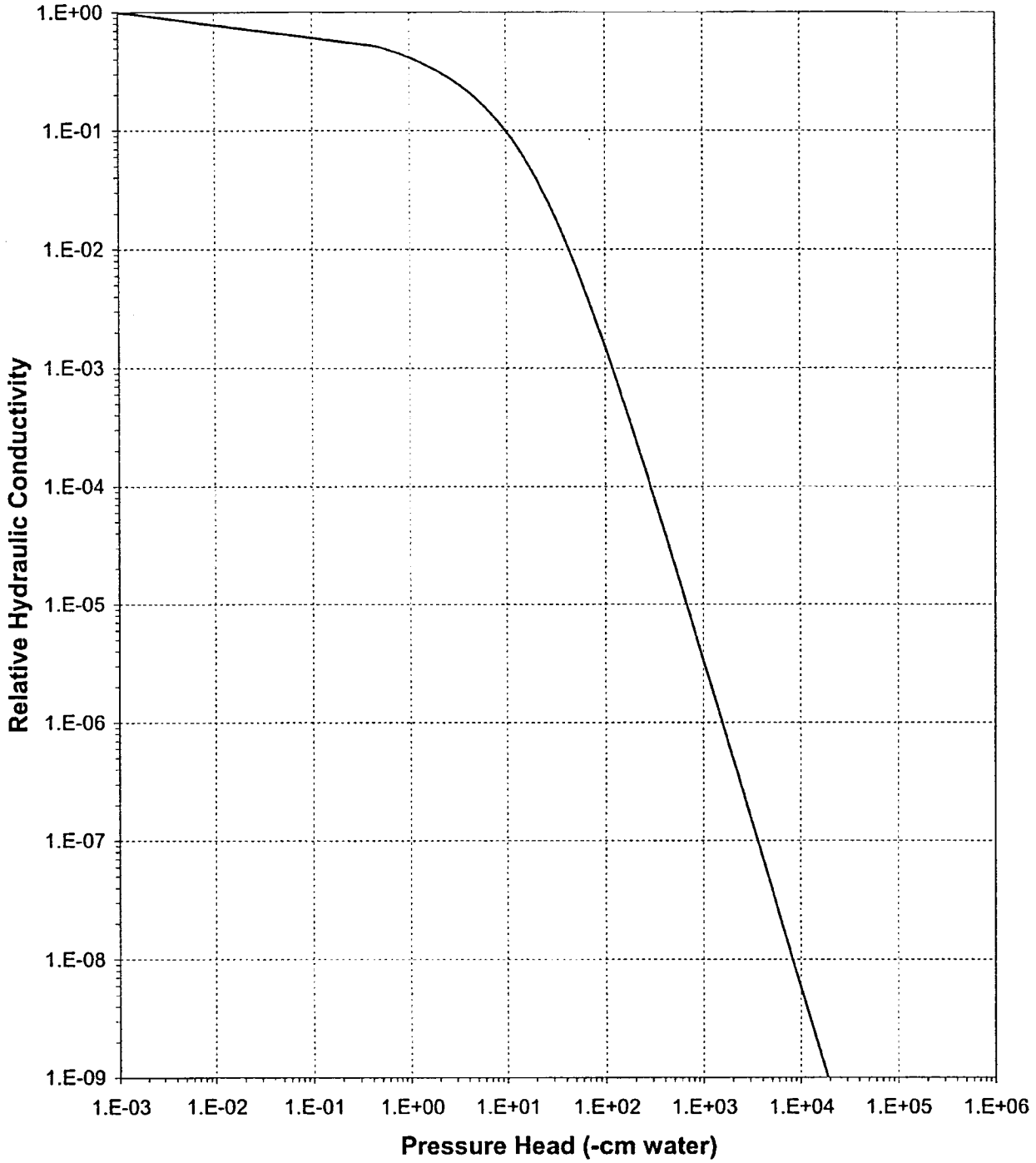
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: Anomally Area (80%)(Gravel Corrected)



Plot of Relative Hydraulic Conductivity vs Pressure Head

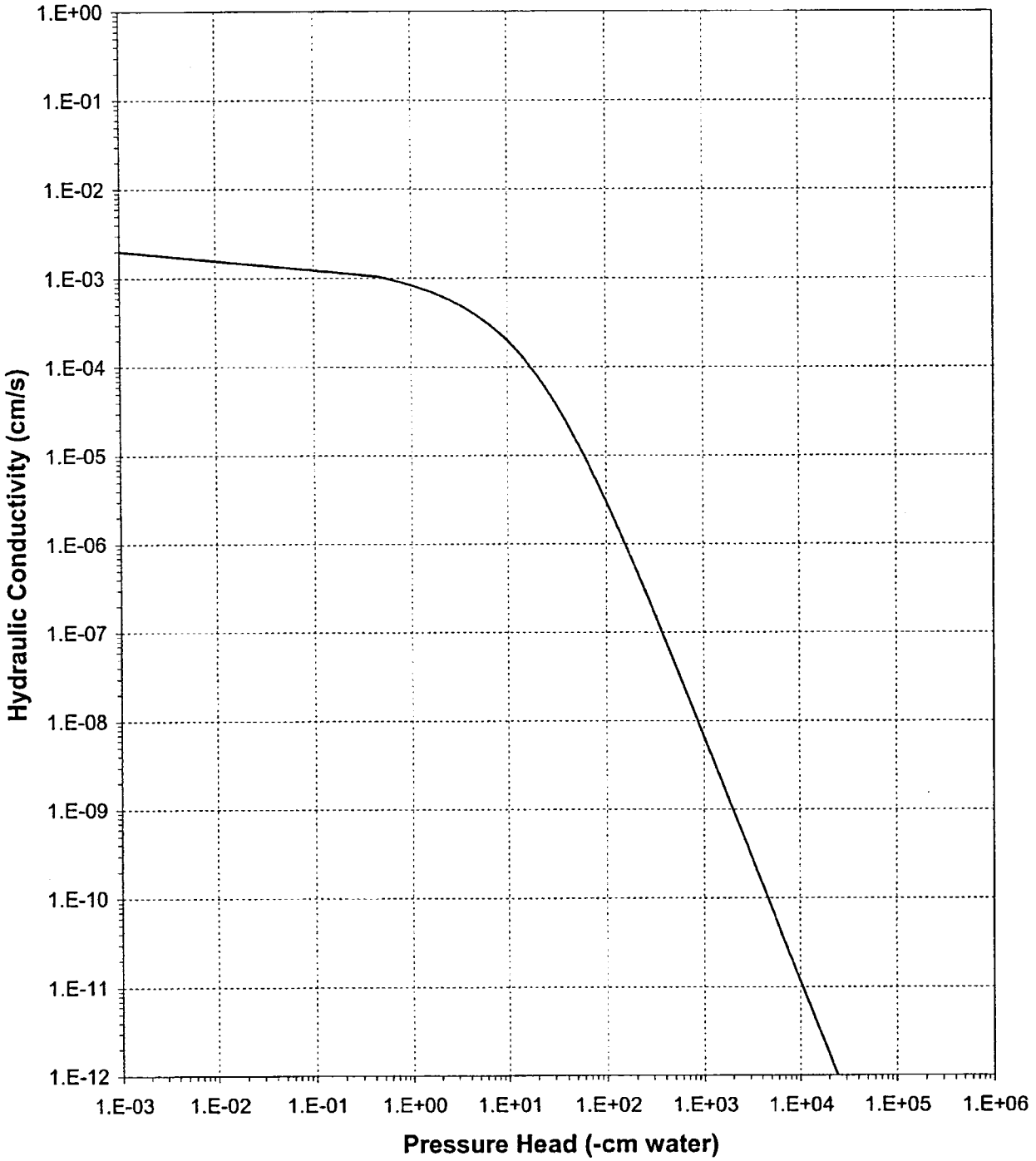
Sample Number: Anomally Area (80%)(Gravel Corrected)



Daniel B. Stephens & Associates, Inc.

Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: Anomally Area (80%)(Gravel Corrected)



Daniel B. Stephens & Associates, Inc.

Gravel Correction Data Sheet

Job name: Earth Tech, Inc.
Job number: LB05.0143.00
Sample Name/Number: Anomally Area (90%)
Split: #4

Uncorrected input values		Corrected Values	
Mass (coarse)(g):	84.64		
Mass (fines)(g):	2450		
Dry bulk density (fines)(g/cm^3):	1.79	Density (composite)(g/cm^3):	1.81
Density (coarse)(g/cm^3):	2.65		
Ksat value (fines)(cm/sec):	8.0E-05	Ksat composite(cm/sec):	7.8E-05
Theta initial (fines):	0.1810	Theta initial composite:	0.1769
Theta saturated (fines):	0.3536	Theta saturated composite:	0.3455
Theta residual (fines):	0.0000	Theta residual composite:	0.0000
*Theta initial (coarse):	0		
*Theta saturated (coarse):	0		
*Theta residual (coarse):	0		
*Volume (coarse voids)(cm^3):	0		

Volumetric fraction of fines in composite: 0.977
Volumetric fraction of coarse in composite: 0.023
Volumetric fraction of voids in composite: 0.000
Volume (fines)(cm^3): 1368.72
Volume (coarse)(cm^3): 31.94
Volume (composite)(cm^3): 1400.65

*Comments: *Values will be zero if the coarse fraction is assumed to hold no water in pores.*

Date: 9/1/05
Data entered by: D. O'Dowd
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name: Earth Tech (6-05)
Job Number: LB05.0143.00
Sample Number: Anomally Area (90%)(Gravel Corrected)
Ring Number: NA
Depth: NA

Dry wt. of sample (g): 330.25
Tare wt., screen & clamp (g): 27.47
Tare wt., ring (g): 81.23
Tare wt., epoxy (g): 0.00
Sample volume (cm^3): 184.07

Saturated weight at 0 cm tension* (g): 506.06
Volume of water[T] in saturated sample (cm^3): 67.11
Saturated moisture content (% vol): 35.92
Sample bulk density (g/cm^3): 1.79

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content[T] (% vol)
Hanging column:	13-Jul-05 / 16:20	505.06	0.00	35.92
	20-Jul-05 / 12:20	502.08	10.70	34.30
	26-Jul-05 / 14:05	500.89	41.00	33.65
	15-Aug-05 / 15:10	495.71	78.00	30.84
Pressure plate:	15-Aug-05 / 10:45	476.84	509.90	20.58

Comments:

* Weight including tares
[T] Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: M. Carrillo
Data entered by: R. Gurule
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Water Activity Meter/Relative Humidity Box

(Main Drainage Curve)

Job Name: Earth Tech (6-05)
Job Number: LB05.0143.00
Sample Number: Anomally Area (90%)(Gravel Corrected)
Ring Number: NA
Depth: NA

Dry weight of water activity meter sample* (g): 159.46
Tare weight, jar (g): 112.85
Sample bulk density (g/cm^3): 1.79

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Water Activity Meter:	29-Aug-05 / 10:00	161.79	7036.6	8.97

Dry weight of relative humidity box sample* (g): 77.58
Tare weight (g): 38.81
Sample bulk density (g/cm^3): 1.79

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Relative humidity box:	03-Aug-05 / 10:15	77.81	851293	1.06

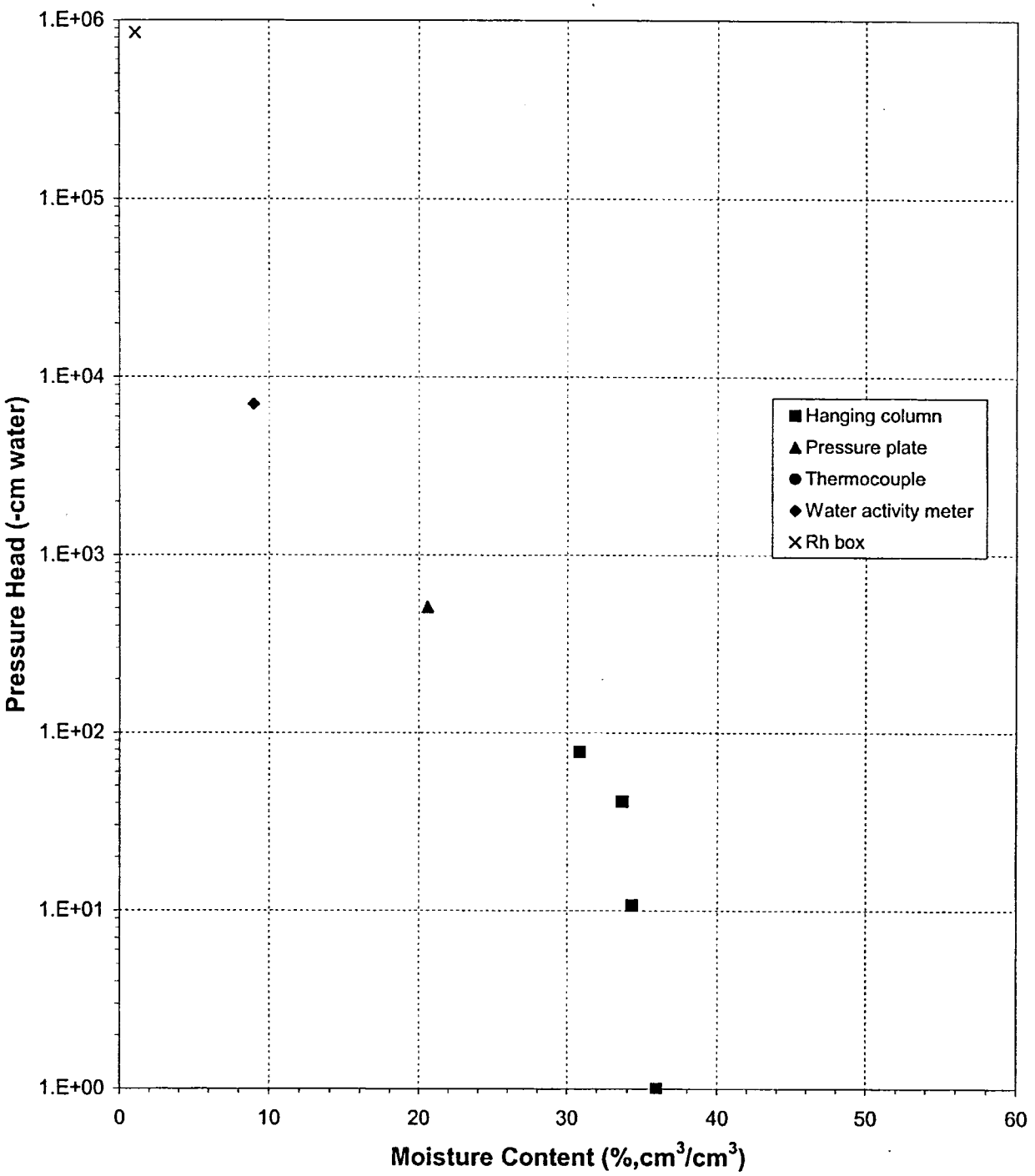
Comments:

* Weight including tares
† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: M. Carrillo
Data entered by: R. Gurule
Checked by: J. Hines

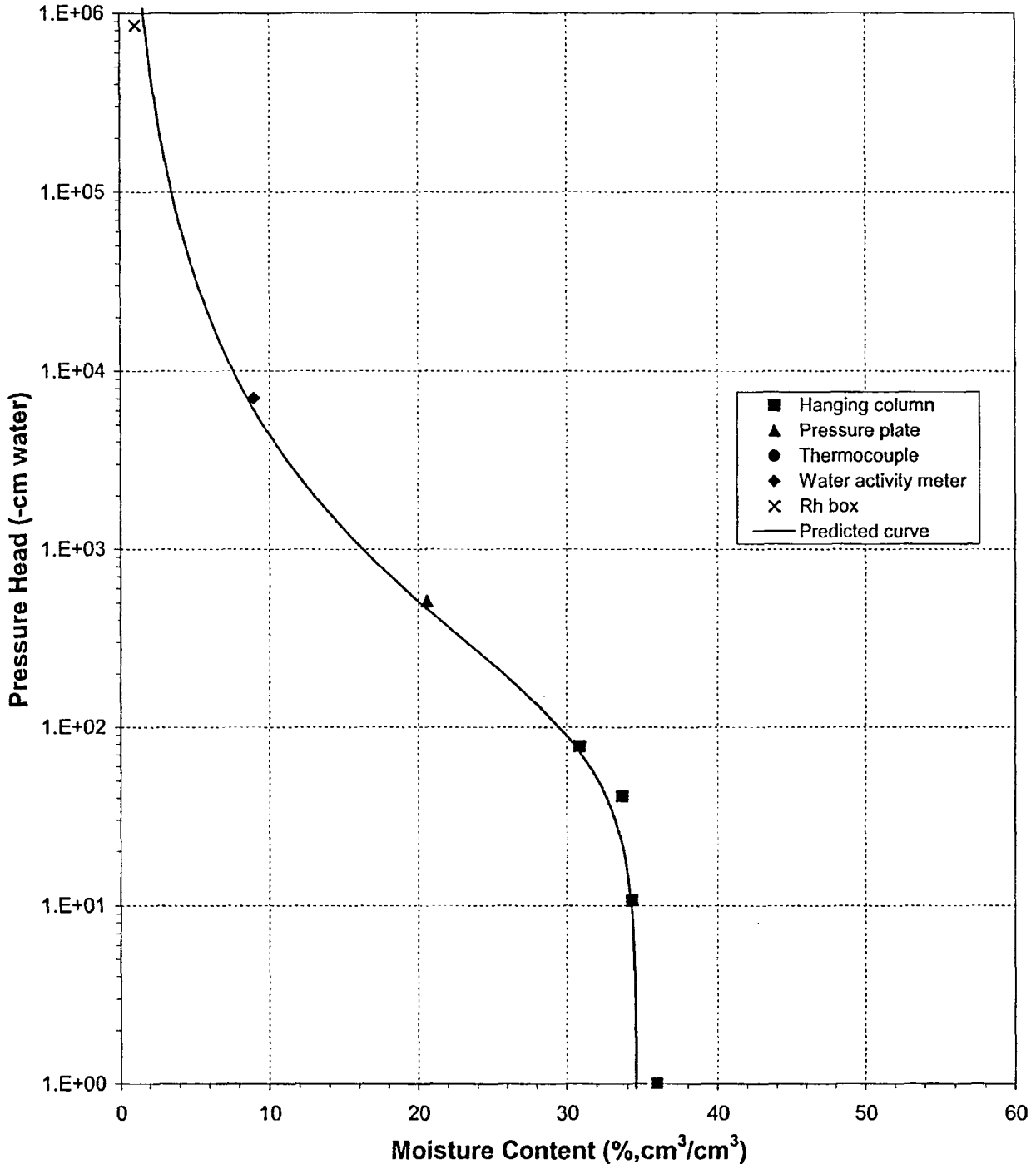
Water Retention Data Points

Sample Number: Anomally Area (90%)(Gravel Corrected)



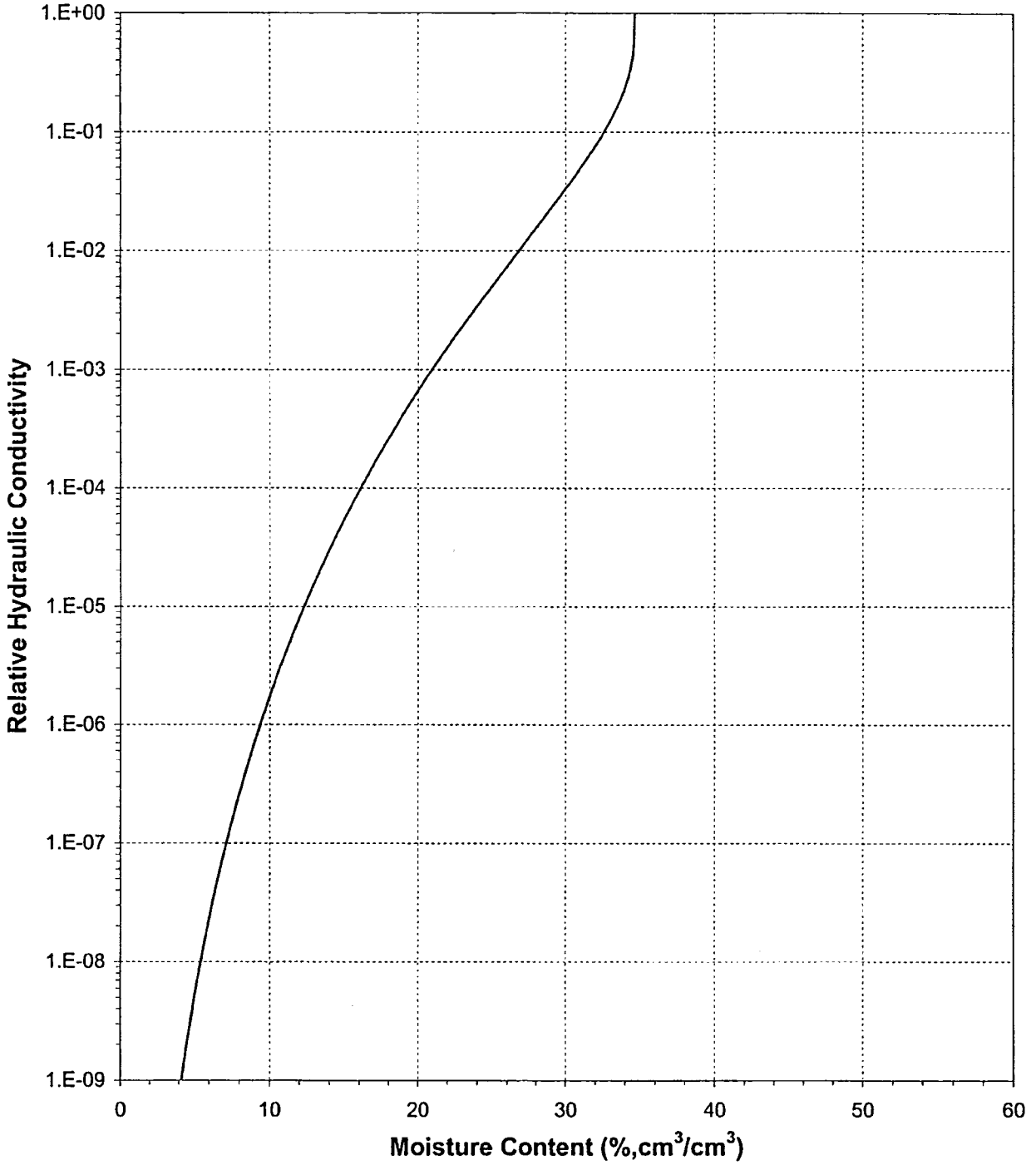
Predicted Water Retention Curve and Data Points

Sample Number: Anomally Area (90%)(Gravel Corrected)



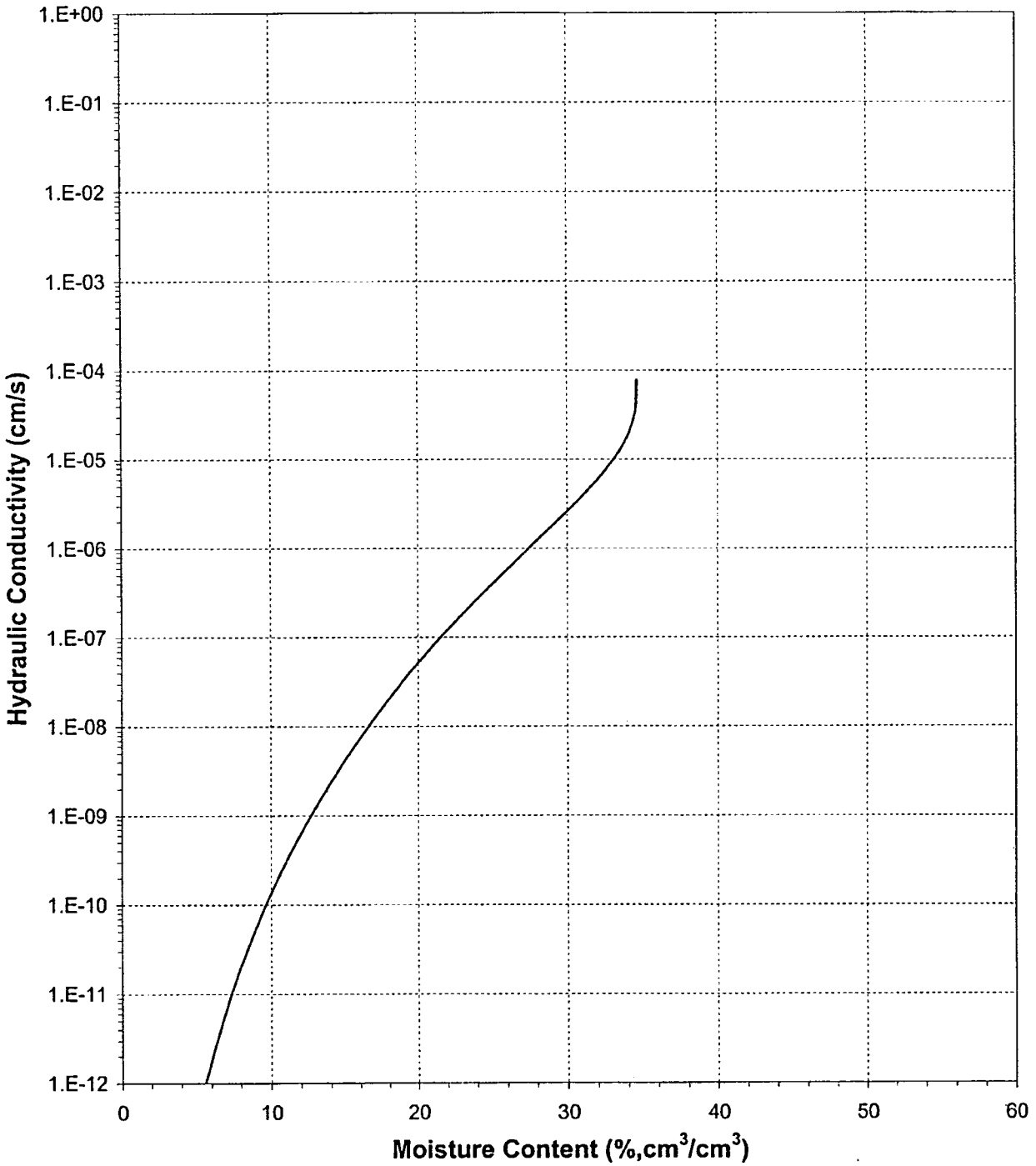
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: Anomally Area (90%)(Gravel Corrected)



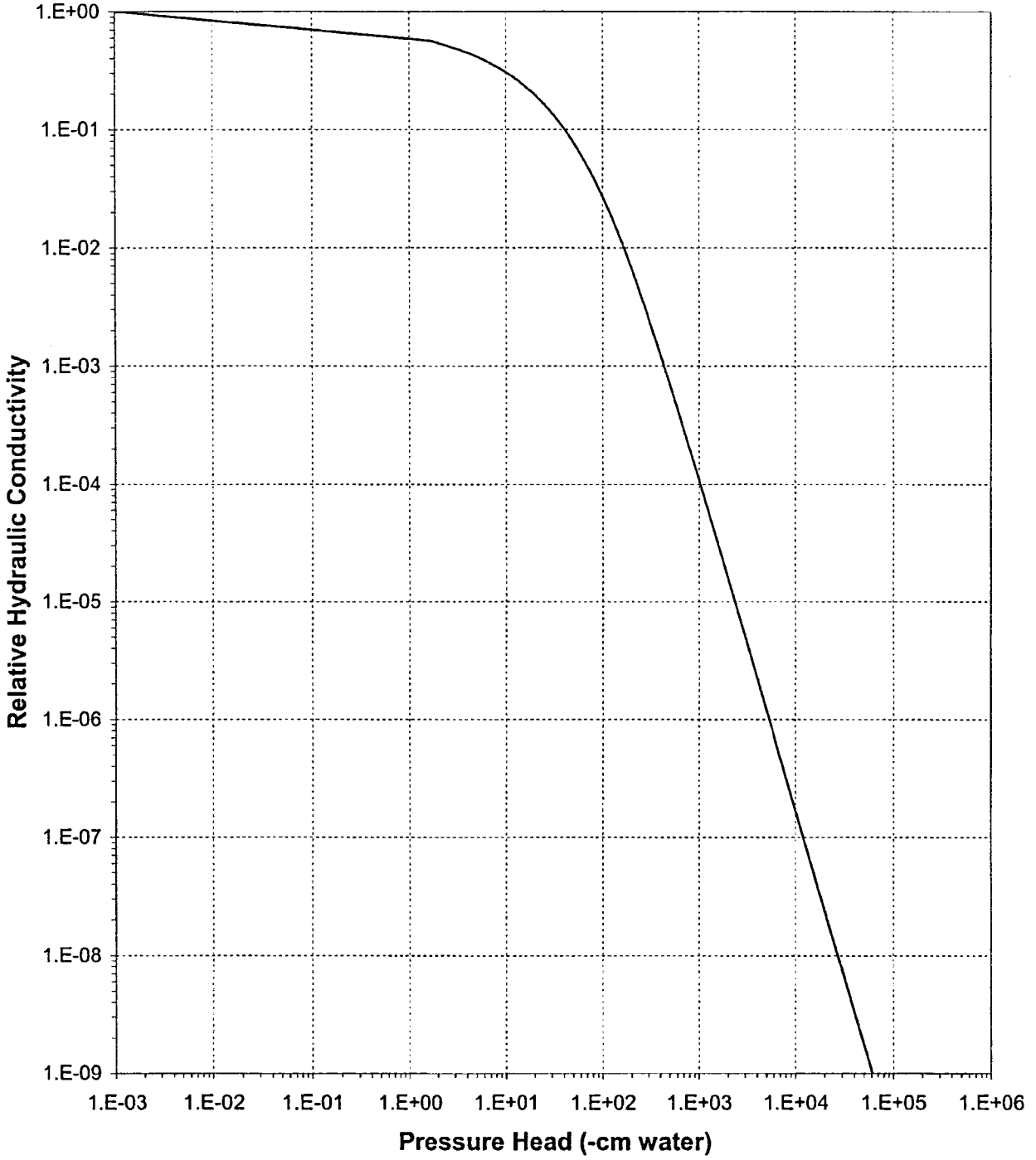
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: Anomally Area (90%)(Gravel Corrected)



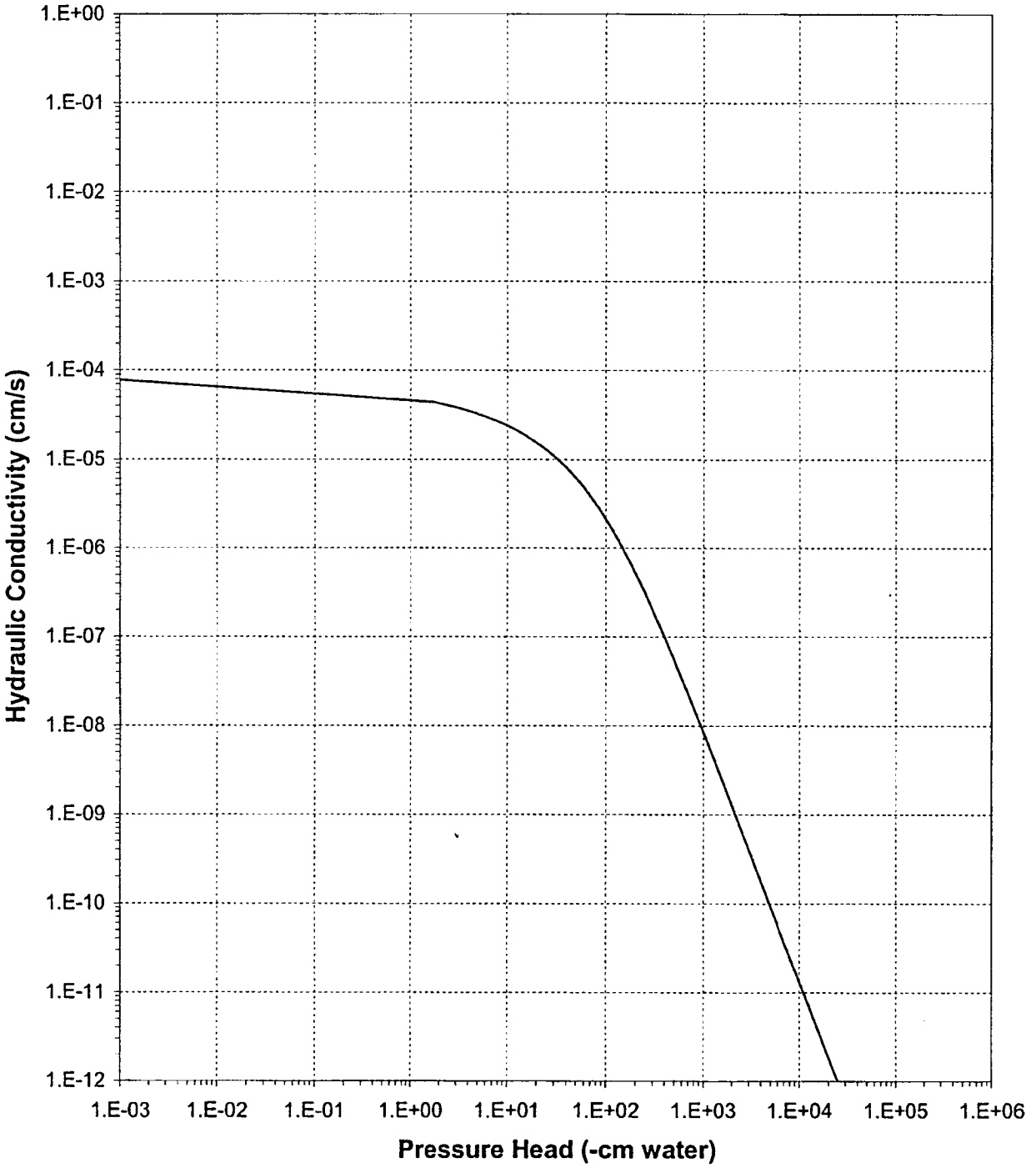
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: Anomally Area (90%)(Gravel Corrected)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: Anomally Area (90%)(Gravel Corrected)



Laboratory Tests and Methods

Tests and Methods

Dry Bulk Density:	ASTM D4531; ASTM D6836
Moisture Content:	ASTM D2216; ASTM D6836
Calculated Porosity:	Klute, A. 1986. Porosity. Chp.18-2.1, pp. 444-445, in A. Klute (ed.), Methods of Soil Analysis, American Society of Agronomy, Madison, WI
Saturated K: Constant Head:	ASTM D 2434 (modified apparatus)
Hanging Column Method:	ASTM D6836; Klute, A. 1986. Porosity. Chp.26, in A. Klute (ed.), Methods of Soil Analysis, American Society of Agronomy, Madison, WI
Pressure Plate Method:	ASTM D6836; ASTM D2325
Water Potential Method:	ASTM D6836; Rawlins, S.L. and G.S. Campbell, 1986. Water Potential: Thermocouple Psychrometry. Chp. 24, pp. 597-619, in A. Klute (ed.), Methods of Soil Analysis, Part 1. American Society of Agronomy, Madison, WI.
Relative Humidity Box:	Karathanasis & Hajek. 1982. Quantitative Evaluation of Water Adsorption on Soil Clays.SSA Journal 46:1321-1325
Calc. Kunsat:	ASTM D6836; Soil Sci. Soc. Am. J. 1980 44:892-898
Course Fraction (Gravel) Correction (calc):	ASTM D4718; Bouwer, H. and Rice, R.C. 1984. Hydraulic Properties of Stony Vadose Zones. Groundwater Vol. 22, No. 6

Geotechnical Laboratory Results
Teratest Labs, Inc.

Teratest Labs, Inc.
A SEIMITOR GROUP COMPANY

PARTICLE - SIZE ANALYSIS of SOILS

ASTM D 422

Project Name: MCAS El Toro (CTO 74 / Anomaly Area 3) Tested By: ACS Date: 06/10/05
Project No.: 37380-0030-02 Input By: LF Date: 06/15/05
Remarks: Composite Checked By LF
Sample No.: LK537 Depth (ft.) N/A
Sample Description: Brown silty sand (SM) with lumps of clay

Calculation of Dry Weights	Whole Sample	Sample Passing #4
Container No.:	790	RX21
Wt. Air-Dry Soil + Cont.	4080.40	667.72
Wt. of Container	0.00	74.21
Dry Wt. of Soil	4080.40	593.51

Moisture Contents	Sample Retained #4	Sample Passing #4
Wt. Air-Dry Soil + Container	0.00	0.00
Wt. Dry Soil + Container	0.00	0.00
Wt. of Container	1.00	1.00
Moisture Content (%)	0.00	0.00

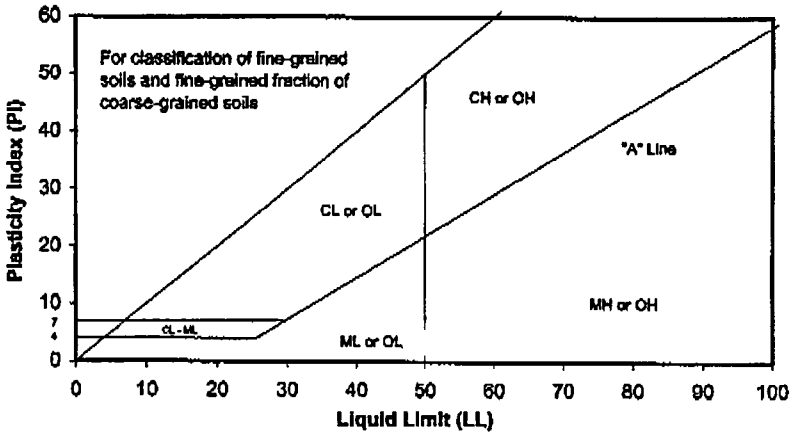
Passing #4 Material After Wet Sieve	Container No.:	RX21
	Wt. of Dry Soil + Container (g)	508.10
	Wt. of Container (g)	74.21
	Dry Wt. of Soil Retained on # 200 Sieve (g)	433.89

U. S. Sieve Size		Cumulative Weight of Dry Soil Retained		Percent Passing (%)
(in.)	(mm)	Whole Sample	Sample Passing #4	
6"	152.400			
3"	75.000	0.0		
1 1/2	37.500	0.00		100.0
3/4"	19.000	41.94		99.0
3/8"	9.500	78.07		98.1
#4	4.750	125.14		96.9
#8	2.360		9.65	95.3
#16	1.180		41.19	90.2
#30	0.600		112.37	78.6
#50	0.300		228.80	59.5
#100	0.150		344.05	40.7
#200	0.075		429.79	26.7
PAN				

GRAVEL: **3 %**
SAND: **70 %**
FINES: **27 %**
GRP. SYMBOL: **SM**

Liquid Limit: **NA**
Plastic Limit
Plasticity Index:
Cu = D60/D10
Cc=(D30)²/(D60*D10)

Remarks:

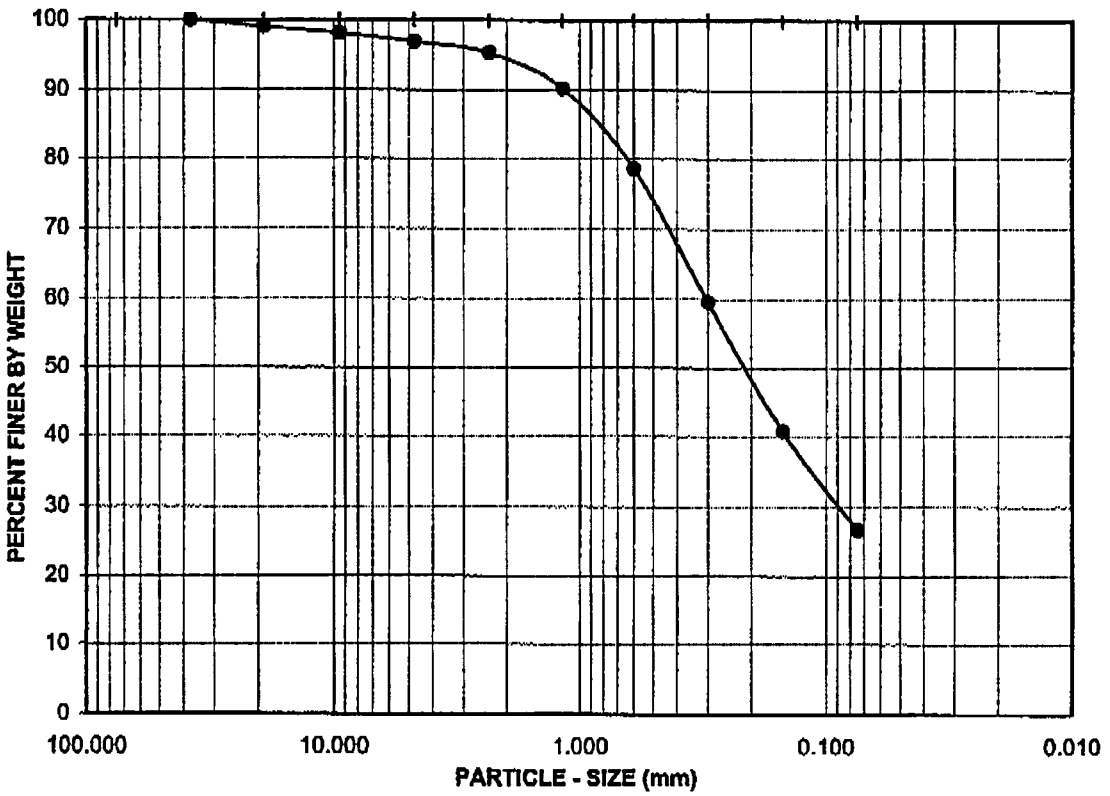


GRAVEL		SAND			FINES
COARSE	FINE	CRSE	MEDIUM	FINE	SILT

U.S. STANDARD SIEVE OPENING: 3.0" 1 1/2" 3/4" 3/8" #4

U.S. STANDARD SIEVE NUMBER: #8 #16 #30 #50 #100

HYDROMETER: #200



Remarks:	Sample No.:	Depth (ft.)	Soil Type	GR:SA:FI	LL,PL,PI
Composite	LK537	N/A	SM	3:70:27	NA,,

Soil Description: Brown silty sand (SM) with lumps of clay

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

ATTERBERG LIMITS, PARTICLE - SIZE CURVE
ASTM D 4318, D 422

Project No.: 37380-0030-02

MCAS El Toro (CTO 74 / Anomaly Area 3)

06-05

Split - Sieve LK537

Teratest Labs, Inc.

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name: MCAS El Toro (CTO 74 / Anomaly Area 3) Tested By : GEB Date: 06/10/05
Project No.: 37380 026502 Input By : LF Date: 06/15/05
Remarks: Composite Depth (ft.) N/A
Sample No. : LK537
Soil Identification: Brown silty sand (SM) with lumps of clay

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03324 *Ram Weight = 10 lb.; Drop = 18 in.*

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3550.0	3682.0	3765.0	3702.0		
Weight of Mold (g)	1680.0	1680.0	1680.0	1680.0		
Net Weight of Soil (g)	1870.0	2002.0	2085.0	2022.0		
Wet Weight of Soil + Cont. (g)	483.20	486.00	519.30	457.70		
Dry Weight of Soil + Cont. (g)	458.90	452.20	475.00	412.60		
Weight of Container (g)	51.70	47.90	52.60	54.10		
Moisture Content (%)	5.97	8.36	10.49	12.58		
Wet Density (pcf)	124.0	132.8	138.3	134.1		
Dry Density (pcf)	117.0	122.5	125.2	119.1		

Maximum Dry Density (pcf) 125.0 **Optimum Moisture Content (%)** 10.5

PROCEDURE USED

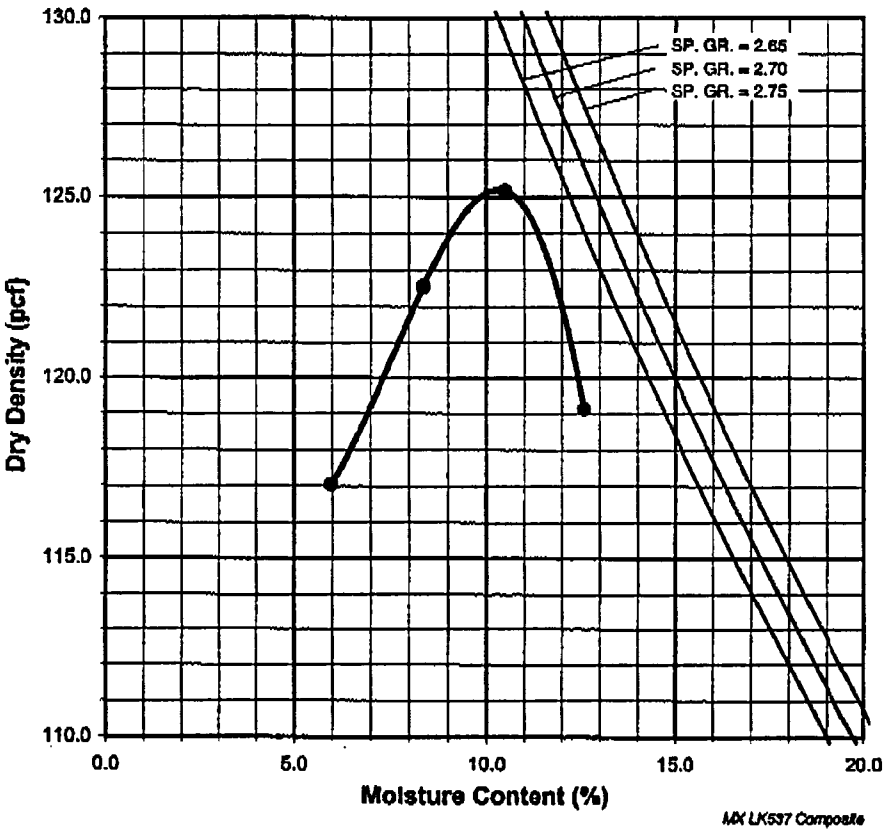
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution
[illegible]
GR:SA:FI

Atterberg Limits:
[illegible]
LL,PL,PI



MX LK537 Composite

FAX TRANSMITTAL

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DATE: 7-22-05 PROJECT NUMBER: 37380

RECIPIENT: ~~Marcus Millette~~ Crispin Wanyoike

COMPANY: Earth Tech

FAX NUMBER: ~~562-499-4129~~ 562-951-7919

SENDER: Lee Frutt

SUBJECT: Permits

COMMENTS:
The Originals will be mailed

If you do not receive 6 pages (including cover page),
Please call us as soon as possible @ (949) 253-5922.

17781 Cowan
Irvine, CA 92614
(949) 253-5922 Fax (949) 263-8843

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

Les Fruth

From: Millett, Marcus [Marcus.Millett@earthtech.com]
Sent: Thursday, July 14, 2005 5:01 PM
To: 'Les Fruth'
Subject: RE: Perm Tests

Please consolidate at 5 psi

From: Les Fruth [mailto:lfruth@leightonconsulting.com]
Sent: Thursday, July 14, 2005 4:43 PM
To: 'Millett, Marcus'
Subject: RE: Perm Tests

What effective stress do you want those consolidated at?

-----Original Message-----
From: Millett, Marcus [mailto:Marcus.Millett@earthtech.com]
Sent: Thursday, July 14, 2005 3:33 PM
To: 'lfruth@leightonconsulting.com'
Subject: Perm Tests

Les,

Please flex wall perform perms (ASTM D5084) on soil sample LK537 at 80% and 90% percent relative compaction at 2% above optimum moisture. Feel free to contact me if you have questions.

Marcus Millett
Project Engineer
Earth Tech, Inc.
300 Oceangate, Suite 700
(562) 951-2372 phone
(562) 499-4129 fax
(562) 673-9909 cell
marcus.millett@earthtech.com

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Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

SATURATED HYDRAULIC CONDUCTIVITY

FALLING HEAD METHOD

ASTM D 5084

Project Name: Former MCAS El Toro / Anomaly Area 3 / CTO 74 Tested by: RA Date: 07/16/05

Project No.: 37380-0030-02 Input By: RA / LF Date: 07/22/05

Remarks: Composite Sample Type: Remold to 80% RC @ Opt. +2%

Sample No.: LK537 Depth (in) NA

Soil Description: Brown silty sand (SM) with lumps of clay

		INITIAL CONDITION	FINAL CONDITION
Diameter (in)	1	2.501	2.500
	2	2.500	2.480
	3	2.502	2.495
	Average	2.501	2.492
Height (in)	1	3.010	3.000
	2	3.008	3.001
	3	3.009	3.002
	Average	3.009	3.001
Moisture Content (%)		12.49	22.63
Wt. Wet Sample + Container (g)		200.72	554.10
Wt. Dry Sample + Container (g)		184.86	465.98
Wt. Container (g)		57.85	76.56
Density and Saturation			
Wt. Wet Sample + Container (g)		438.00	554.10
Wt. Container (g)		0.00	76.56
Wet Density (pcf)		112.9	124.3
Dry Density (pcf)		100.3	101.4
Void Ratio		0.680	0.663
Total Porosity		0.405	0.399
Pore Volume (cc)		98.0	95.6
% Saturation		49.6	92.2

Specific Gravity Gs (Assumed) = 2.70

Back Pressure Saturation

B Value (%) = 98

Consolidation

Cell Pressure (psi) =	94.85	Burette Area (sq. in.)=	0.037
Back Pressure(psi) =	89.80	Initial Burette Ht.(cm)=	2.0
Effective Pressure (psi) =	5.05	Final Burette Ht.(cm)=	6.5

Form LK537-0 80% RC

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

SATURATED HYDRAULIC CONDUCTIVITY

FALLING HEAD METHOD (ASTM D 5084)

Project Name:	Former MCAS El Toro / Anomaly Area 3 / CTO 74	Cell Pressure:	94.85	psi	Initial Sample Height:	3.0090	in
Project No:	37380-0030-02	Bottom Pressure (Pb):	90.80	psi	Initial Area of Sample:	4.9127	in.²
Remarks:	Composite	Top Pressure (Pt):	89.80	psi	Final Sample Ht.* (L):	3.0046	in
Sample No.:	LK537	Consolidation Pressure:	5.05	psi	Final Sample Area* (A):	4.8981	in.²
Depth(ft):	NA	Burette Area (influent) (Ai):	0.381	in.²			
Sample Type:	Remold to 80% RC @ Opt. +2%	Burette Area (effluent) (Ao):	0.393	in.²			
Soil Description:	Brown silty sand (SM) with lumps of clay	Vol. Change During Consol.:	0.066	in.³			

* After Consolidation

Date	Time (min.)	Incremental Elapsed Time (t) (min)	Temperature (°C)	Water Height Influent Burette (hi) (cm)	Water Height Effluent Burette (ho) (cm)	Uncorrected Hydraulic Conductivity (cm/sec)	Corrected Conductivity at 20 °C (cm/sec)	Inflow Rate / Outflow Rate	RESULTS	
21-Jul-05	08:33:00	0		28.0	2.2	Initial Reading			Hydraulic Conductivity (cm/sec)	
21-Jul-05	08:34:00	1	22.5	25.0	5.4	3.3E-04	3.2E-04	0.91		
21-Jul-05	08:35:00	1	22.5	22.5	7.8	2.8E-04	2.7E-04	1.01	Average of Last 4 Readings	1.4E-04
21-Jul-05	08:36:00	1	22.5	20.5	9.9	2.5E-04	2.3E-04	0.92		
21-Jul-05	08:37:00	1	22.5	18.8	11.5	2.1E-04	2.0E-04	1.03	Upper Limit	1.7E-04
21-Jul-05	08:38:00	1	22.5	17.3	13.0	2.0E-04	1.9E-04	0.97	Lower Limit	1.0E-04
21-Jul-05	08:39:00	1	22.5	16.0	14.5	1.9E-04	1.8E-04	0.84	Remarks	
21-Jul-05	08:40:00	1	22.5	14.7	15.7	1.8E-04	1.7E-04	1.05		
21-Jul-05	08:41:00	1	22.5	13.5	17.0	1.8E-04	1.7E-04	0.89		
21-Jul-05	08:43:00	2	22.5	11.3	19.3	1.8E-04	1.7E-04	0.93		
21-Jul-05	08:45:00	2	22.5	9.6	21.0	1.4E-04	1.3E-04	0.97		
21-Jul-05	08:47:00	2	22.5	8.1	22.5	1.3E-04	1.2E-04	0.97		
21-Jul-05	08:49:00	2	22.5	6.8	24.0	1.3E-04	1.2E-04	0.84		

$k = Ai.Ao.L.\ln(h1/h2)/(A.t.(Ai+Ao))$ where $h1, h2 = ((Pb-Pt)/Y+(hi-ho)$ at $t0-(\text{change in } hi + \text{change in } ho)$ at $t1$ and $t2$

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

SATURATED HYDRAULIC CONDUCTIVITY

FALLING HEAD METHOD
ASTM D 5084

Project Name: Former MCAS El Toro / Anomaly Area 3 / CTO 74 Tested by: RA Date: 07/16/05
Project No.: 37380-0030-02 Input By: RA / LF Date: 07/22/05
Remarks: Composite Sample Type: Remold to 90% RC @ Opt. +2%
Sample No.: LK537 Depth (in) NA
Soil Description: Brown silty sand (SM) with lumps of clay

		INITIAL CONDITION	FINAL CONDITION
Diameter (in)	1	2.502	2.503
	2	2.501	2.502
	3	2.502	2.503
	Average	2.502	2.503
Height (in)	1	3.012	3.020
	2	3.015	3.021
	3	3.014	3.023
	Average	3.014	3.021
Moisture Content (%)		12.49	17.68
Wt. Wet Sample + Container (g)		200.72	595.70
Wt. Dry Sample + Container (g)		184.86	518.21
Wt. Container (g)		57.85	79.87
Density and Saturation			
Wt. Wet Sample + Container (g)		492.00	595.70
Wt. Container (g)		0.00	79.87
Wet Density (pcf)		126.5	132.2
Dry Density (pcf)		112.5	112.4
Void Ratio		0.499	0.500
Total Porosity		0.333	0.333
Pore Volume (cc)		80.8	81.2
% Saturation		67.6	95.4

Specific Gravity Gs (Assumed) = 2.70

Back Pressure Saturation

B Value (%) = 95

Consolidation

Cell Pressure (psi) =	93.82	Burette Area (sq. in.)=	0.037
Back Pressure(psi) =	88.85	Initial Burette Ht.(cm)=	5.2
Effective Pressure (psi) =	4.97	Final Burette Ht.(cm)=	8.1

Teratest Labs, Inc.
A LEIGHTON GROUP COMPANY

SATURATED HYDRAULIC CONDUCTIVITY

FALLING HEAD METHOD (ASTM D 5084)

Project Name:	Former MCAS El Toro / Anomaly Area 3 / CTO 74	Cell Pressure:	93.82	psi	Initial Sample Height:	3.0137	in
Project No:	37380-0030-02	Bottom Pressure (Pb):	90.78	psi	Initial Area of Sample:	4.9153	in.²
Remarks:	Composite	Top Pressure (Pt):	88.85	psi	Final Sample Ht.* (L):	3.0108	in
Sample No.:	LK537	Consolidation Pressure:	4.97	psi	Final Sample Area* (A):	4.9059	in.²
Depth(ft):	NA	Burette Area (influent) (Ai):	0.408	in.²			
Sample Type:	Remold to 90% RC @ Opt. +2%	Burette Area (effluent) (Ao):	0.389	in.²			
Soil Description:	Brown silty sand (SM) with lumps of clay	Vol. Change During Consol.:	0.042	in.³			

* After Consolidation

Date	Time (min.)	Incremental Elapsed Time (t) (min)	Temperature (°C)	Water Height Influent Burette (hi) (cm)	Water Height Effluent Burette (ho) (cm)	Uncorrected Hydraulic Conductivity (cm/sec)	Corrected Conductivity at 20 °C (cm/sec)	Inflow Rate / Outflow Rate	RESULTS	
21-Jul-05	08:22:00	0		27.4	1.8	Initial Reading			Hydraulic Conductivity (cm/sec)	
21-Jul-05	08:25:00	3	22.5	25.6	3.8	4.1E-05	3.9E-05	0.94		
21-Jul-05	08:28:00	3	22.5	24.1	5.3	3.3E-05	3.1E-05	1.05	Average of Last 4 Readings	2.2E-05
21-Jul-05	08:31:00	3	22.5	22.9	6.6	2.8E-05	2.7E-05	0.97		
21-Jul-05	08:35:00	4	22.5	21.2	8.4	3.0E-05	2.8E-05	0.99	Upper Limit	2.7E-05
21-Jul-05	08:40:00	5	22.5	19.2	10.5	2.9E-05	2.7E-05	1.00	Lower Limit	1.6E-05
21-Jul-05	08:46:00	6	22.5	17.3	12.6	2.4E-05	2.3E-05	0.95	Remarks	
21-Jul-05	08:52:00	6	22.6	15.3	14.8	2.6E-05	2.5E-05	0.95		
21-Jul-05	09:04:00	12	22.6	11.8	18.4	2.3E-05	2.2E-05	1.02		
21-Jul-05	09:14:00	10	22.7	9.2	21.2	2.2E-05	2.1E-05	0.97		
21-Jul-05	09:24:00	10	22.7	6.7	23.8	2.2E-05	2.0E-05	1.01		

$k = A_i A_o L \ln(h_1/h_2)/(A t (A_i + A_o))$ where $h_1, h_2 = ((P_b - P_t)/\gamma + (h_i - h_o)$ at t_0 - (change in h_i + change in h_o) at t_1 and t_2

Appendix L
CIWMB – Agreement Letter

DEPARTMENT OF THE NAVY
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132 - 5190

5090
Ser 06CC.AP/0665
June 24, 2004

Ms. Nicole Moutoux
Remedial Project Manager
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street, Mail Code STD-8-2
San Francisco, CA 94105

Mr. Tayseer Mahmoud
Remedial Project Manager
California Department of Toxic Substances Control
Office of Military Facilities
5796 Corporate Ave.
Cypress, CA 90630

Mr. John Broderick
Remedial Project Manager
California Regional Water Quality Control Board
3737 Main Street, Suite 500
Riverside, CA 92501

Fellow Federal Facility Agreement (FFA) Representatives:

Subj: PROPOSED LANDFILL GAS CONTROL MEASURES AND POSTCLOSURE LAND USE AT INSTALLATION RESTORATION PROGRAM (IRP) SITE 3, IRP SITE 5, AND ANOMALY AREA 3, FORMER MARINE CORPS AIR STATION, EL TORO, CALIFORNIA

The Navy has recently discussed and reached agreement with the California Integrated Waste Management Board (CIWMB) and California Department of Toxic Substances Control (DTSC) and other FFA Signatories regarding proposed engineering and institutional controls pertaining to landfill gas control measures at Installation Restoration Program (IRP) Site 3 (Original Station Landfill), IRP Site 5 (Perimeter Road Landfill), and Anomaly Area 3 at the former Marine Corps Air Station (MCAS) El Toro. The agreement is based on the results of landfill gas investigations at the three sites, anticipated postclosure land use, the Navy's consultation with representatives of CIWMB and DTSC at a meeting on December 4, 2003, and subsequent discussions with CIWMB and our fellow FFA representatives via e-mail, letter, telephone conferences on February 5 and 18, 2004, and a Base Realignment and Closure (BRAC) Cleanup Team (BCT) meeting on April 1, 2004.

The proposed engineering and institutional controls will be incorporated into the appropriate Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) documents (e.g., FS Addendum and revised Draft Proposed Plan for IRP Sites 3 and 5) for review and comment by fellow FFA Signatories. The Proposed Plan will then be published for public review and comment following regulatory concurrence. This letter memorializes the concepts discussed at the aforementioned meetings; as is appropriate and customary, details will be worked out in the post-ROD deliverables.

Based on the site history and environmental setting of the landfills, the nature and volume of the wastes, and the results of landfill gas investigations, the Navy requested guidance from CIWMB concerning regulations on postclosure land use on and around landfill sites. In a letter to the Navy dated April 20, 2004, regarding postclosure land use at IRP Sites 3 and 5 and Anomaly Area 3, CIWMB noted the Navy's proposal for final covers at the landfills, the proposed 100-foot buffer zone between the landfill footprint and the landfill property boundary, and proposed compliance gas monitoring, and stated the following:

> Current CIWMB regulations prescribe development standards for postclosure land uses on and within 1,000 feet of a landfill footprint [Title 27, California Code of Regulations, Section 21190 (27 CCR 21190)]. These regulations do not prohibit development but contain standards that are designed primarily to prevent damage to the environmental control systems at a closed landfill and to protect the public health and safety from landfill gas migration. However, these regulations are only applicable to "onsite" development within 1,000 feet of a landfill footprint. Therefore, neither the Board, nor the Solid Waste Local Enforcement Agency, can enforce these regulations outside the established property boundary of the disposal site even if the proposed development is less than 1,000 feet from the landfill footprint. Therefore, the requirements of 27 CCR 21190 are not applicable to development outside of the above-described 100-foot buffer zone.

To address the underlying concern of potential landfill gas migration at IRP Sites 3 and 5 and Anomaly Area 3, the Navy proposed to incorporate the following engineering and institutional controls into the appropriate CERCLA deliverables as agreed during the April 1, 2004 BCT meeting (see enclosed Landfill Gas Evaluation and Proposed Engineering and Institutional Controls table with 100-foot buffer zone maps):

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June 24, 2004

1. Construction of a single-barrier cap with a flexible membrane liner, erosion control, land-use restrictions, and environmental monitoring (including landfill gas, leachate, and groundwater) at IRP Sites 3 and 5. Implementation of an appropriate response action at Anomaly Area 3.
2. Installation of an active landfill gas collection system or gas vent system during remedy implementation at IRP Sites 3 and 5 and Anomaly Area 3. The system will remain inactive or vent passively unless a contingency is triggered based on monitoring. While inactive, wells/pipes screened within the waste will be used to monitor landfill gas inside the waste itself, providing an early warning feature.
3. As an additional safety feature, construction of passive gas control gravel trenches within the compliance monitoring zone during remedy implementation.
4. Implementation of CIWMB monitoring protocol with compliance landfill gas monitoring probes within 50 feet of the waste boundary. The perimeter will be monitored to demonstrate that landfill gas is not migrating. Once adequate data are collected, and with CIWMB concurrence, monitoring would be discontinued and land-use restrictions would be removed.
5. Implementation of land-use restrictions within approximately 100 feet of the waste boundary (including the 50-foot compliance monitoring zone plus another 50 feet as an additional safety measure). Within this 100-foot land-use restriction buffer zone, construction of structures would require obtaining approval from the Navy and CIWMB.

Should you have questions or need additional information regarding these proposed engineering and institutional controls at IRP Sites 3 and 5 and Anomaly Area 3, please contact Mr. Karnig Ohannessian, Remedial Project Manager, at (619) 532-0796 or me at (619) 532-0784.

Sincerely,

F. A. Piszkin

F. ANDREW PISZKIN
Base Realignment and Closure
Environmental Coordinator
By direction of the Commander

M60050_004321
MCAS EL TORO

SENSITIVE RECORD

PORTIONS OF THIS RECORD ARE CONSIDERED SENSITIVE AND ARE NOT AVAILABLE FOR PUBLIC VIEWING.

ADDRESS OF PRIVATE CITIZEN

FOR ADDITIONAL INFORMATION, CONTACT:

DIANE C. SILVA, RECORDS MANAGER
NAVAL FACILITIES ENGINEERING COMMAND, SOUTHWEST
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132

TELEPHONE: (619) 556-1280
E-MAIL: diane.silva@navy.mil

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Ser 06CC.AP/0665
June 24, 2004

Encl: (1) CIWMB Letter Regarding "Postclosure Land Use at Sites 3, 5, and Anomaly 3, Former Marine Corps Air Station El Toro (El Toro), Orange County, California," of April 20, 2004.
(2) Landfill Gas Evaluation and Proposed Engineering and Institutional Controls with 100-foot buffer zone maps, Site 3, Site 5, and Anomaly Area 3, Former MCAS El Toro, of June 2004.

Copy to:
Commander
Attn: AC/S ENVIRON MGT
Marine Corps Air Bases, Miramar
P.O. Box 452001
San Diego, CA 92145-2001

Mr. Jim Kikta
Marine Corps BRAC Project Manager
MCAS El Toro
7040 Trabuco Road
Irvine, CA 92618

Mr. Robert L. Woodings
Director, Public Works
City of Lake Forest
25550 Commercentre Dr., Ste. 100
Lake Forest, 92630

Ms. Marcia Rudolph
Subcommittee Chair
El Toro Restoration Advisory Board
24922 Muirlands #139
Lake Forest, CA 92630

Mr. Daniel Jung
City of Irvine
PO Box 19575
Irvine, CA 92623-9575

Mr. Gino Yekta
California Integrated Waste
Management Board
1001 "I" Street
P.O Box 4025
Mail Stop 20
Sacramento, CA 95812-4025

California Integrated Waste Management Board

Linda Moulton-Patterson, Chair
1001 I Street • Sacramento, California 95814 • (916) 341-6000
Mailing Address: P. O. Box 4025, Sacramento, CA 95812-4025
www.ciwmb.ca.gov

Terry Tamminen
Secretary for Environmental Protection

Arnold Schwarzenegger
Governor

April 20, 2004

Mr. F. Andrew Piszkin, P.E.
Naval Facilities Engineering Command
BRAC Operations Office, Code 06CC.AP
1230 Columbia Street, Suite 870
San Diego, California 92101

POSTCLOSURE LAND USE AT SITES 3, 5, AND ANOMALY 3, FORMER MARINE CORPS AIR STATION EL TORO (EL TORO), ORANGE COUNTY, CALIFORNIA

Dear Mr. Piszkin:

The U.S. Department of the Navy (Navy) is in the process of transferring ownership of properties at El Toro and is requesting California Integrated Waste Management Board (Board) guidance concerning postclosure land use on and around the above-referenced sites

It is our understanding that the Navy's proposed final cover for Sites 3, 5, and Anomaly 3 will consist of a two-foot foundation layer, a flexible membrane liner (FML), and a two-foot drainage/vegetation layer. In addition there will be a 100-foot buffer zone between the landfill footprint and the landfill property boundary. Permanent compliance gas monitoring probes will be periodically monitored.

Current CIWMB regulations prescribe development standards for postclosure land uses on and within 1,000 feet of a landfill footprint [Title 27, California Code of Regulations, Section 21190 (27 CCR 21190)]. These regulations do not prohibit development but contain standards that are designed primarily to prevent damage to the environmental control systems at a closed landfill and to protect the public health and safety from landfill gas migration. However, these regulations are only applicable to "onsite" development within 1,000 feet of a landfill footprint. Therefore, neither the Board, nor the Solid Waste Local Enforcement Agency, can enforce these regulations outside the established property boundary of the disposal site even if the proposed development is less than 1,000 feet from the landfill footprint. Therefore, the requirements of 27 CCR 21190 are not applicable to development outside of the above-described 100-foot buffer zone.

Should you have any questions or comments concerning the above matter, please contact Mr. Gino Yekta of my staff at (916) 341-6354 or me at (916) 341-6318.

Sincerely;

Michael B. Wochnick, P.E., Supervisor
Remediation, Closure and Technical Services

cc: Mr. Tayseer Mahmoud, Department of Toxic Substances Control
Mr. David Murchison, Department of Toxic Substances Control
Mr. Karnig Ohanessian, Department of the Navy
Ms. Patricia Henshaw, Orange County Solid Waste Local Enforcement Agency

Landfill Gas Evaluation and Proposed Engineering and Institutional Controls
Site 3, Site 5, and Anomaly Area 3
Former MCAS El Toro

Discussion Point	Site 3	Site 5	Anomaly Area 3
(1) Site History	The Site 3 landfill was active from 1943 until 1955. It was the original Station landfill and was operated as a cut-and-fill disposal facility. Wastes were burned at a former incinerator to reduce volume prior to burial. Typical of municipal landfills, Site 3 contains a variety of materials disposed at assorted locations within the landfill. Reportedly, almost any wastes generated on the Station may have been disposed at Site 3. The wastes are likely to have included metals, incinerator ash, solvents, paint residues, hydraulic fluids, engine coolants, construction debris, oily wastes, municipal solid waste, and various inert solid wastes.	The Site5 landfill was active from about 1955 until the late 1960s. It was operated as a trench disposal facility where wastes were typically burned to reduce volume prior to burial. Typical of municipal and military landfills, Site 5 contains a variety of materials disposed at assorted locations within the landfill. Reportedly, almost any wastes generated on the Station may have been disposed at Site 5. The wastes are likely to have included burnable trash, municipal solid waste, cleaning fluids, scrap metals, paint residues, and unspecified fuels, oils, and solvents.	Source of borrow material, partially backfilled with mostly construction debris between 1972 and 1988 and covered with 2 to 5 feet of soil. Sampling and analysis documented a low level release of hazardous substances from the site, including volatile organic compounds, semi-volatile organic compounds, petroleum hydrocarbons, and metals detected in groundwater, soil, or soil gas.
(2) Landfill Gas Investigation Data Quality Objectives	• Confirm the presence or absence of landfill gas within the waste. • Provide data to support development of appropriate engineering and institutional controls. • Determine whether hot spots are present and, if so, determine their extent. • Determine whether landfill gases are migrating out of the landfill at ground surface or subsurface.	• Confirm the presence or absence of landfill gas within the waste. • Provide data to support development of appropriate engineering and institutional controls. • Determine whether hot spots are present and, if so, determine their extent. • Determine whether landfill gases are migrating out of the landfill at ground surface or subsurface.	• Is soil vapor being produced within the waste, and if yes, does it exceed threshold levels listed as decision inputs and require a waste placement gas collection system? • Does soil vapor migrate from the site to impact adjacent property?
(3) Landfill gas has been investigated in the waste placement locations. Landfill gas has been found either at low concentrations (Sites 3 and 5) or appears to be confined (AA3). If gas concentrations are low in the waste, or the volume of landfill gas is limited, then there is low potential for generation or concern of migration.	Supplemental landfill gas investigation shows very low levels of methane within the waste. RI conclusion is that landfill gas hotspots are not present. Two soil gas surveys (air SWAT and RI) performed at Site 3 found total VOC concentrations to be much less than the hot spot threshold of 300 µg/L. Pre-design investigation of perimeter soil gas confirmed findings. Refer to maps.	Supplemental landfill gas investigation shows very low levels of methane within the waste. RI conclusion is that landfill gas hotspots are not present. Two soil gas surveys (air SWAT and RI) performed at Site 5 found total VOC concentrations to be much less than the hot spot threshold of 300 µg/L. Pre-design investigation of perimeter soil gas confirmed findings. Refer to maps.	Methane in excess of the 5 percent threshold detected in 3 out of 33 sampling locations within the waste. Methane is confined to the subsurface (deeper than 5 feet) in the central portion of the site and is not migrating. No VOCs detected in landfill gas. Refer to maps.

Discussion Point	Site 3	Site 5	Anomaly Area 3
(4) Perimeter soil gas monitoring shows that methane is not migrating. Further monitoring was not implemented because gas inside the landfills was found to be of low concern.	Low methane concentrations were detected during the air SWAT and RI at six perimeter locations and one waste area location that was thought to be a perimeter location. Pre-design investigation of perimeter soil gas confirmed methane findings and showed low concentrations of VOCs in perimeter soil gas samples.	Low methane concentrations were detected during the air SWAT and RI at three perimeter locations. Pre-design investigation of perimeter soil gas confirmed methane findings and showed low concentrations of VOCs in perimeter soil gas samples.	No methane was detected at six perimeter wells, confirming that methane is not migrating. Low concentrations of VOCs were detected in perimeter soil gas samples.
(5) Landfills are old, suggesting low gas generation potential.	Landfill stopped accepting waste in 1955.	Landfill stopped accepting waste in late 1960's.	Mostly construction debris backfill between 1972 and 1988.
(6) Waste was burned at Sites 3 and 5 prior to placement, lowering the gas generation potential. AA3 contains predominately inert construction debris.	Waste volume was estimated at 163,500 to 243,000 cubic yards in the RI, and was decreased to 30,000 cubic yards following the pre-design investigation.	Waste volume was estimated at 40,000 cubic yards in the RI, and was decreased to 16,000 cubic yards following the pre-design investigation.	Only 1 out of 30 trenches contained domestic refuse. The debris is predominately concrete, rubble, rebar, metallic debris, wood, plastic and asbestos pipes, wire, brick chips, asphalt, and gravel.
(7) The waste sites have been uncovered and unlined for a long period of time, suggesting that water has already infiltrated.	Currently covered by soil only.	Currently covered by soil only.	Currently covered by soil only.
(8) Groundwater at Sites 3 and 5 is deep relative to waste placement. Groundwater is in contact with waste at AA3.	Groundwater at Site 3 is at 200 to 220 feet bgs. Landfill depth is about 20 feet.	Groundwater at Site 5 is at 160 to 170 feet bgs. Landfill dept is about 15 feet.	Groundwater at AA3 is at about 25 to 35 feet bgs and possibly is in contact with the bottom of the waste.
(9) Footprint area is small (and expected to be smaller following waste consolidation) relative to default land use restriction zones.	Site 3 encompasses about 11 acres. Refer to map.	Site 5 covers about 1.8 acres. Refer to map.	Site covers about 9 acres. Refer to map.
(10) Remedial action and implementation.	Draft ROD selected waste consolidation (Units 1 and 4) followed by construction of a single-barrier cap with a flexible membrane liner, erosion control, land-use restrictions, and environmental monitoring (including landfill gas, leachate, and groundwater).	Draft ROD selected a single-barrier cap with a flexible membrane liner, erosion control, land-use restrictions, and environmental monitoring (landfill gas, leachate, and groundwater).	Navy proposes to take further response action at AA3.

Discussion Point	Site 3	Site 5	Anomaly Area 3
(11) Navy proposes active gas control contingency.	Although a landfill gas collection system was found to be unnecessary, the Navy proposes to install an active gas collection system during remedy implementation. The system would remain inactive unless a contingency was triggered based on monitoring. While inactive, wells/pipes screened within the waste could be used to monitor landfill gas inside the waste itself, providing an early warning feature.	Although a landfill gas collection system was found to be unnecessary, the Navy proposes to install an active gas collection system during remedy implementation. The system would remain inactive unless a contingency was triggered based on monitoring. While inactive, wells/pipes screened within the waste could be used to monitor landfill gas inside the waste itself, providing an early warning feature.	A landfill gas control system was not envisioned at AA3 in the Draft Expanded Site Inspection report. However, regardless of whether or not the site is capped, the Navy proposes to install an active gas collection system or gas vent system during response action. The system would remain inactive or vent passively unless a contingency was triggered based on monitoring. While inactive, wells/pipes screened within the waste could be used to monitor landfill gas inside the waste itself, providing an early warning feature.
(12) Navy proposes passive gas control gravel trenches within 50 feet of waste boundary.	Passive gas control proposed to be constructed during remedy implementation as an additional safety feature.	Passive gas control proposed to be constructed during remedy implementation as an additional safety feature.	Passive gas control proposed to be constructed during response action as an additional safety feature.
(13) CIWMB monitoring protocol proposed post remedy implementation within 50 feet of final waste boundary.	In accordance with the Draft ROD, propose monitoring the perimeter to demonstrate that landfill gas is not migrating. Once adequate data are collected, and with CIWMB approval, monitoring would be discontinued and land-use restrictions would be removed.	In accordance with the Draft ROD, propose monitoring the perimeter to demonstrate that landfill gas is not migrating. Once adequate data are collected, and with CIWMB approval, monitoring would be discontinued and land-use restrictions would be removed.	Regardless of whether or not capping is implemented, propose monitoring the perimeter to demonstrate that landfill gas is not migrating. Once adequate data are collected, and with CIWMB approval, monitoring would be discontinued and land-use restrictions would be removed.
(14) Navy proposes additional 50-foot zone of land use restrictions conforming to technically defensible use of site features.	A proposed final safety measure is obtaining approval from the Navy and CIWMB to construct structures within approximately 50 feet past the 50-foot monitoring zone, giving a total of about 100 feet for the land-use restriction zone. Actual distance is proposed based on site features. Given site conditions, this distance is adequate to protect human health and the environment.	A proposed final safety measure is obtaining approval from the Navy and CIWMB to construct structures within approximately 50 feet past the 50-foot monitoring zone, giving a total of about 100 feet for the land-use restriction zone. Actual distance is proposed based on site features. Given site conditions, this distance is adequate to protect human health and the environment.	A proposed final safety measure is obtaining approval from the Navy and CIWMB to construct structures within approximately 50 feet past the 50-foot monitoring zone, giving a total of about 100 feet for the land-use restriction zone. Actual distance is proposed based on site features. Given site conditions, this distance is adequate to protect human health and the environment.

SENSITIVE RECORD

PORTIONS OF THIS RECORD ARE CONSIDERED SENSITIVE AND ARE NOT AVAILABLE FOR PUBLIC VIEWING

FIGURES 1 AND 2

FOR ADDITIONAL INFORMATION, CONTACT:

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SAN DIEGO, CA 92132

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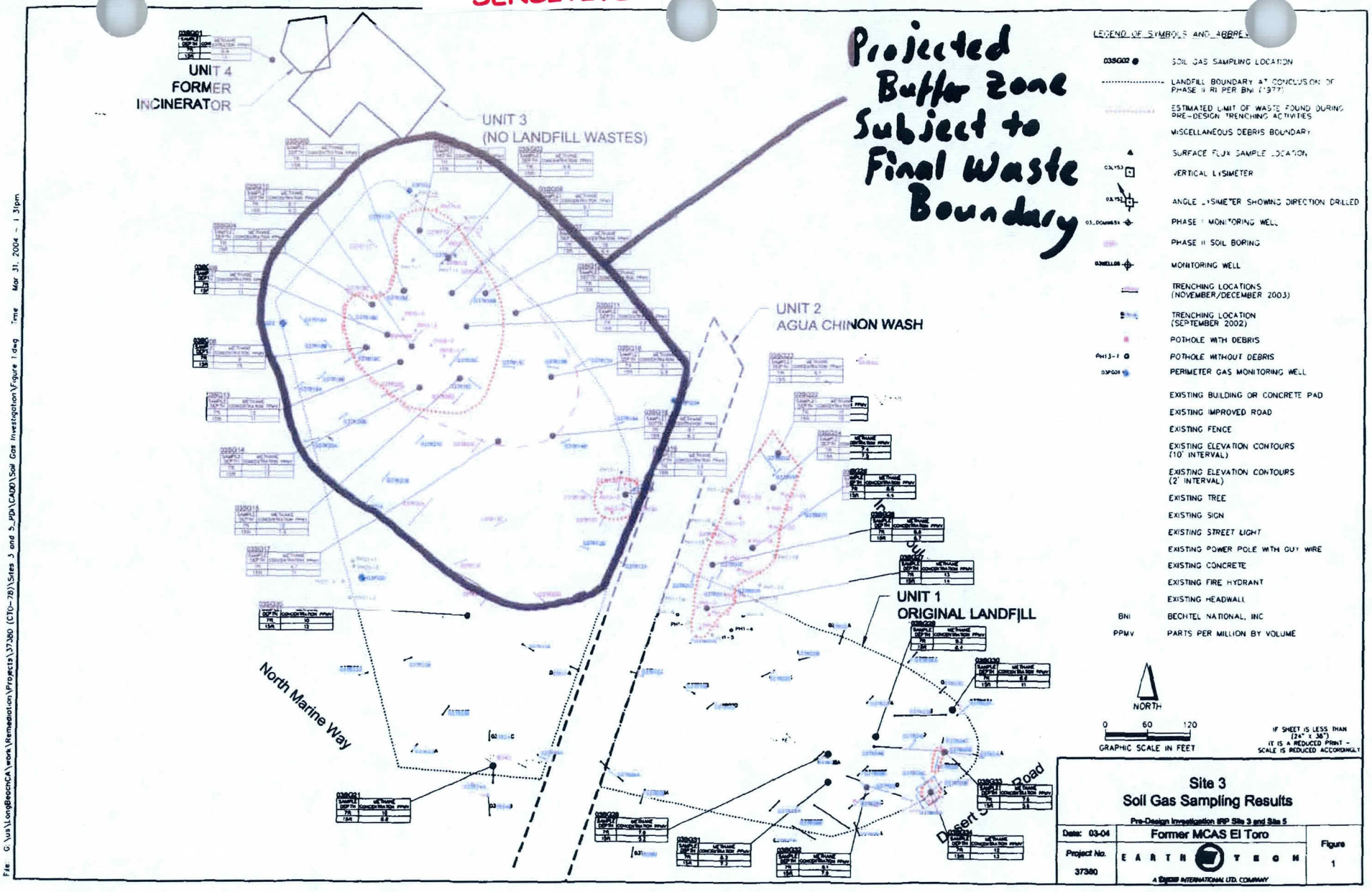
SENSITIVE



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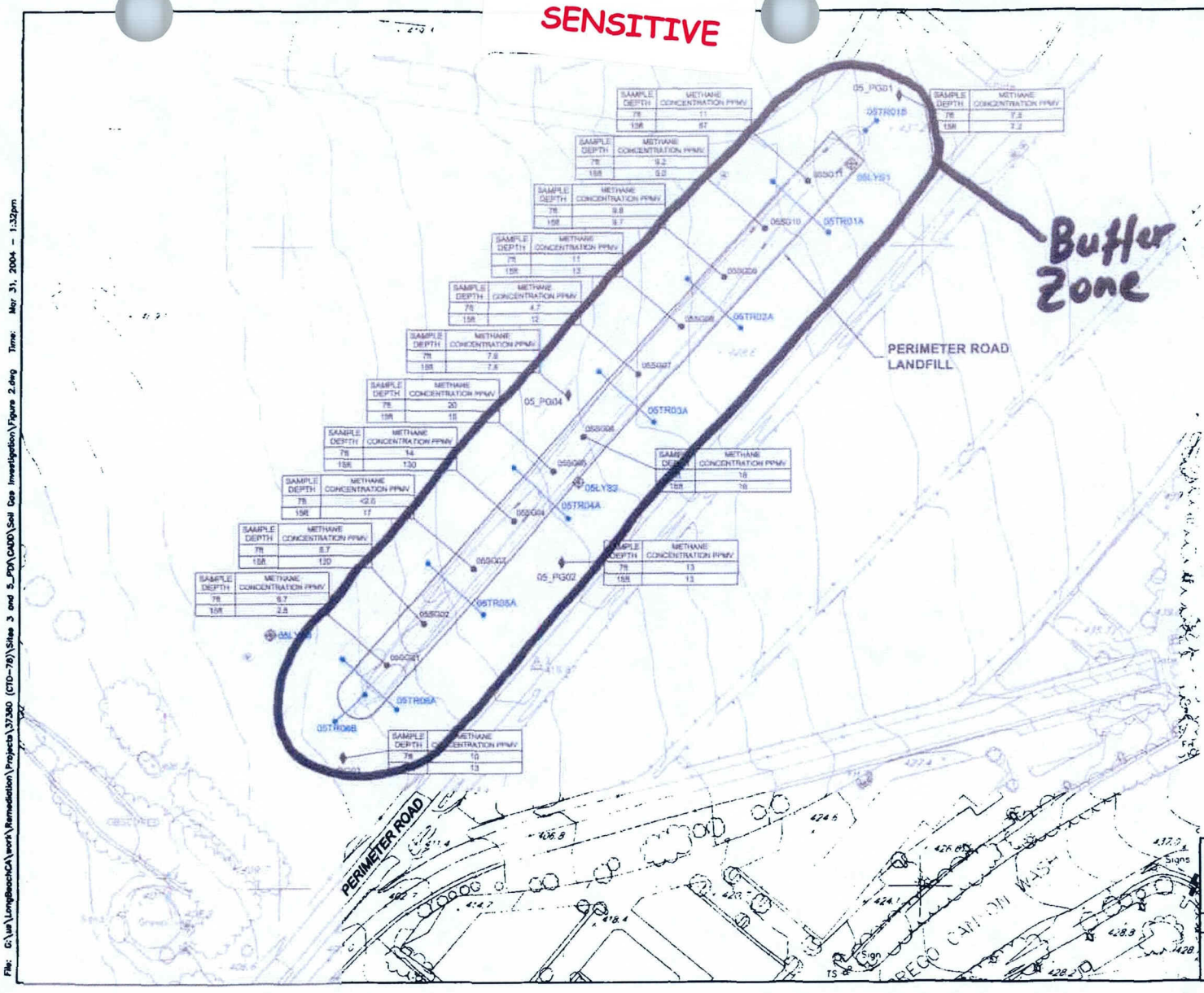


LEGEND OF SYMBOLS AND ABBREVIATIONS:

- EXISTING IMPROVED ROAD
- EXISTING FENCE
- 430 — EXISTING ELEVATION CONTOURS (10' INTERVAL)
- EXISTING ELEVATION CONTOURS (2' INTERVAL)
- LANDFILL BOUNDARY AT CONCLUSION OF PHASE II RI PER BNI (1997)
- INFERRED UTILITY LINES (PHASE II RI; BNI 1996)
- TRENCHING LOCATION
- 05LYS3 — LYSIMETER
- BNI — BECHTEL NATIONAL, INC.
- 05_PG01 — PERIMETER SOIL GAS MONITORING PROBE LOCATION
- 05SG11 — SOIL GAS SAMPLING LOCATION
- PPMV — PARTS PER MILLION BY VOLUME

NORTH

0 75 150

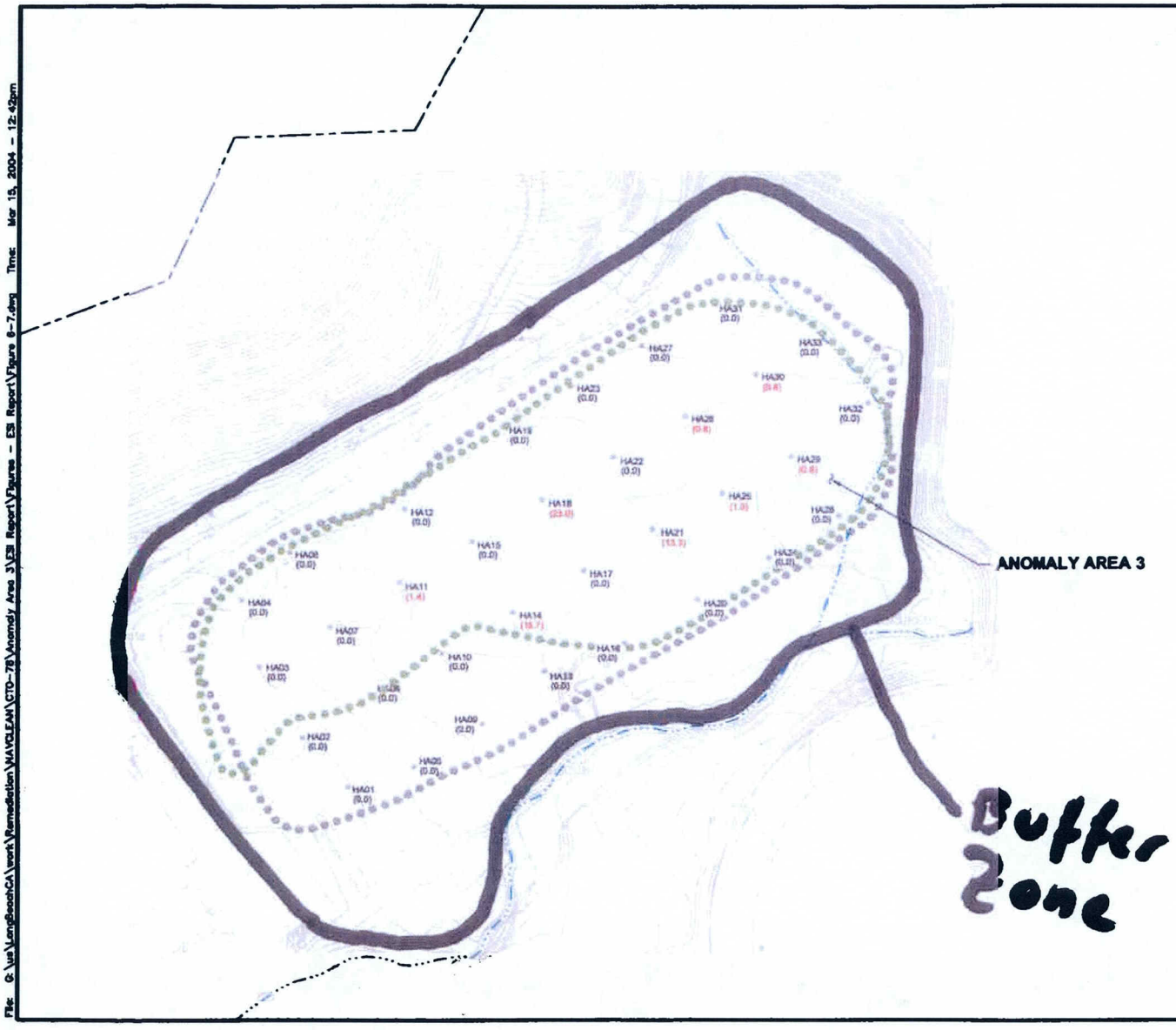
GRAPHIC SCALE

Site 5 - Soil Gas Sampling Results

Date: 03-04	Former MCAS El Toro	Figure
Project No. 37360	EARTH TECH — A EARTH TECH INTERNATIONAL LTD. COMPANY	2

File: G:\us\LongBeachCA\work\Remediation\Projects\37360 (CTO-78)\Sites 3 and 5_PG\CADD\Soil Gas Investigation\Figure 2.dwg Time: Mar 31, 2004 - 1:32pm

SENSITIVE



LEGEND

MINOR SURFACE ELEVATION: 2-FOOT INTERVALS

MAJOR SURFACE ELEVATION: 10-FOOT INTERVALS

MCAS EL TORO BOUNDARY

EXISTING STREAM OR WASH

PREVIOUSLY ESTIMATED EXTENT OF WASTE PLACEMENT BEFORE RSE INVESTIGATION (EARTH TECH 2001)

REVISED EXTENT OF WASTE PLACEMENT BASED ON TRENCHING ACTIVITY (MARCH 2000 AND OCTOBER 2002)

HA31 (1.4) RSE SOIL/SOIL VAPOR SAMPLING LOCATIONS FIELD SCREENING METHANE READING (PERCENT)

NOTES

1. TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHOD FROM AERIAL PHOTOGRAPHY DATED DECEMBER 2001 BY SAN-LO AERIAL SURVEYS.
2. COORDINATES ARE IN CALIFORNIA STATE PLANE COORDINATE SYSTEM, NAD 83, ZONE 6.
3. ELEVATIONS IN FEET; BENCHMARK BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
4. ALL SOIL VAPOR SAMPLES WERE COLLECTED AT A DEPTH OF 15 FEET BELOW GROUND SURFACE. A 25-FOOT SAMPLE WAS COLLECTED AT THE HA25 LOCATION. AND THE FIELD METHANE READING WAS THE SAME AS THE 15-FOOT SAMPLE

NORTH

60 0 60 120 FEET

SCALE: 1"=120'

ESI Report — Draft

Subsurface Soil Gas Field Screening Results (Methane Only) - RSE Investigation

Removal Site Evaluation for Anomaly Area 3

Date: 11-03	MCAS El Toro	Figure 1
Project No. 37380	EARTH TECH — A CH2M HILL COMPANY	

File: G:\us\LongBeachCA\work\Remediation\NAVCLEAN\CTO-78\Anomaly Area 3\ESI Report\Figures - ESI Report\Figure 6-7.dwg Time: Mar 15, 2004 - 12:42pm

Appendix M
Final Technical Memorandum, Anomaly Area 3, Supplemental Groundwater Monitoring

Final

Letter Report Anomaly Area 3 Supplemental Groundwater Monitoring

FORMER MARINE CORPS AIR STATION EL TORO, CALIFORNIA

Prepared for:
Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108

Prepared under:
Naval Facilities Engineering Command
Contract Number N62742-94-D-0048
Contract Task Order 0068
DCN: ET-0048-0068-0006

Final

Letter Report Anomaly Area 3 Supplemental Groundwater Monitoring

FORMER MARINE CORPS AIR STATION EL TORO, CALIFORNIA

Prepared for:
Base Realignment and Closure
Program Management Office West
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Prepared by:
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Prepared under:
Naval Facilities Engineering Command
Contract Number N62742-94-D-0048
Contract Task Order 0068
DCN: ET-0048-0068-0006

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APPENDIX

A Groundwater Monitoring Well Purging and Sampling Log

B Round 9 Piper Diagram

ACRONYMS AND ABBREVIATIONS

µg/L	micrograms per liter
AA 3	Anomaly Area 3
ARAR	applicable or relevant and appropriate requirement
BCT	Base Realignment and Closure (BRAC) Cleanup Team
BRAC	Base Realignment and Closure
CLEAN	Comprehensive Long-Term Environmental Action Navy
CTO	contract task order
DO	dissolved oxygen
DON	Department of the Navy
DQO	data quality objectives
ESI	expanded site inspection
FS	feasibility study
FSP	field sampling plan
IDW	investigation-derived waste
IRP	Installation Restoration Program
mg/L	milligram per liter
MCAS	Marine Corps Air Station
MCL	maximum contaminant level
NAVFAC	Naval Facilities Engineering Command
NTUs	nephelometric units
ORP	oxygen reduction potential
PMO	Program Management Office
PSI	pounds per square inch
QAPP	Quality Assurance Project Plan
RI/FS	remedial investigation/feasibility study
RSE	Removal Site Evaluation
SAP	Sampling and Analysis Plan
SRA	screening risk assessment
SVOC	semi-volatile organic compound
TDS	total dissolved solids
TPH	total petroleum hydrocarbon
U.S.	United States
VOC	volatile organic compound
WP	work plan

1. INTRODUCTION

This Technical Memorandum was prepared by Earth Tech, Inc. (Earth Tech) on behalf of the United States (U.S.) Department of the Navy (DON), Southwest Division, Naval Facilities Engineering Command (NAVFAC SW; formerly abbreviated as Southwest Division [SWDIV]) and the Base Realignment and Closure (BRAC) Program Management Office (PMO) West, under Contract Task Order (CTO) numbers 0068 and 0078 of the Comprehensive Long-Term Environmental Action Navy (CLEAN) II program, contract number N62742-94-D-0048.

Former Marine Corps Air Station (MCAS) El Toro is located in Orange County, California, approximately 8 miles southeast of Santa Ana and 12 miles northeast of Laguna Beach. Anomaly Area 3 (AA 3) encompasses an area of approximately 9 acres and is located in the northern section of the former MCAS El Toro facility near Pusan Way, adjacent to Agua Chinon Wash (Figure 1).

This technical memorandum presents results of the most recent round of groundwater monitoring (Round 9 – February 2007) that was conducted at AA 3 pursuant to the Removal Site Evaluation (RSE) sampling and analysis plan (SAP) Addendum #1 (Earth Tech 2007) and the RSE work plan (WP) (Earth Tech 2002). Monitoring activities at AA 3 consisted of measuring water levels and collecting groundwater samples for analysis from 12 monitoring wells at the site.

SAP Addendum #1 was prepared in response to Regional Water Quality Control Board, Santa Ana Region's (RWQCB's) comments on the Draft Remedial Investigation/Feasibility (RI/FS) Report (Earth Tech and Barajas and Associates, Inc. 2005), regarding the adequacy of the groundwater characterization at AA 3. Additional sampling constituents proposed as part of SAP Addendum #1 supplemented the original RSE groundwater sampling suite by adding general minerals, common cations and anions, total dissolved solids (TDS), total alkalinity, and total hardness.

SAP Addendum #1 also proposed that data from selected monitoring wells at AA 3 and other stationwide groundwater monitoring wells (02NEW11, 02UGMW25, 17NEW02, 18BGMW02E, 18BGMW15, 18BGMW16, 18BGMW17, 18BGMW18, 18BGMW24, 19UGMW35, 19DBMW54, and 20DGMW88) be analyzed using the DUMPStat statistical program to evaluate whether waste placed at AA 3 has impacted groundwater at the site (i.e., verify if downgradient monitoring wells at the point-of-compliance show statistically significant evidence of impact or release to groundwater).

1.1 CERCLA Investigation History

The RSE WP for AA 3 included data quality objectives (DQOs) for the project and a SAP, which consisted of a field sampling plan (FSP) and a quality assurance project plan (QAPP) (Earth Tech 2002). The primary objectives of the RSE were to evaluate the impacts, if any, to human health and the environment, delineate debris placement boundaries and to assess the existing soil cover. A significant portion of the RSE investigation was performed between Fall 2002 and Winter 2003, with periodic groundwater monitoring and well installation activities occurring through April 2005.

As part of the RSE investigation, 11 wells (AA3-MW05 through AA3-MW14, including a single dual nested well at AA3-MW09) were installed. These wells supplemented four existing wells

AA3-MW01 through AA3-MW04. However, Well AA3-MW03 was abandoned in 2004 to facilitate transfer of property, after the Round 3 RSE groundwater monitoring event.

Prior to the RSE, two rounds of groundwater monitoring were performed; samples were analyzed for total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), metals, mercury, perchlorate, nitrate, lead, gross alpha and gross beta radiation, and the following radioisotopes: uranium, radium, thorium, americium, and lead^{210}. As part of the RSE, eight rounds of groundwater monitoring (Rounds 1 through 8) were conducted from November 2002 through April 2005; groundwater samples were analyzed for TPH, VOCs, semi-volatile organic compounds (SVOCs), metals, and perchlorate.

Following the initial phase of fieldwork for the RSE, a Draft Expanded Site Inspection (ESI) Report (Earth Tech 2003) was prepared and submitted to the regulatory agencies in 2003. This report presented results of previous investigations and those of the RSE field investigation including results of a human-health screening risk assessment (SRA) and an ecological SRA for AA 3. The DON received and responded to regulatory agency comments on the Draft ESI Report on 28 June 2004. Based on the comments received from the regulatory agencies and on subsequent discussions during BRAC Cleanup Team (BCT) meetings, the DON agreed that additional site investigation and evaluation of AA 3, pursuant to a RI/FS was required. Therefore, an RI/FS process was initiated and responses to regulatory agency comments on the Draft ESI Report (Earth Tech 2003) were incorporated into the Draft RI/FS Report (Earth Tech and Barajas and Associates, Inc. 2005). Results of groundwater monitoring and all other investigations were presented and evaluated in the RI Report; it concluded that investigations of all potentially contaminated media (air, soil, soil gas, groundwater, sediment, and surface water) and site characterizations for contiguous areas associated with AA 3 were complete. The RI Report quantified human health and ecological risks and concluded that they were within the risk management ranges. However, due to the presence of construction-related debris in proximity to groundwater, and the presence of elevated methane concentrations in soil gas samples from the central portion of the site, the RI Report concluded that an evaluation of response actions was necessary for continued protection of human-health and the environment.

The RI Report also indicated that there were no conclusive trends to indicate that historical activities at AA 3 resulted in any statistically significant releases of contaminants to groundwater at the point of compliance. In addition, since the groundwater-related human health risks attributed a significant portion of the risk to background levels of arsenic at AA 3, no groundwater-specific response action was recommended for AA 3. However, the report recommended that groundwater monitoring consistent with potential action-specific applicable or relevant and appropriate requirements (ARARs) for soil for capping alternatives may be required.

The DON received regulatory agency comments on the Draft RI/FS Report (Earth Tech and Barajas and Associates, Inc. 2005) and in response to RWQCB's comments, an Addendum to the original SAP (Appendix A of the WP for the RSE [Earth Tech 2002]) was prepared and the Round 9 groundwater monitoring event performed.

2. AA 3 GROUNDWATER MONITORING WELL NETWORK

Figure 1 presents the locations of all groundwater monitoring wells at AA 3; Table 1 presents the installation dates and rationale for the monitoring wells in the network for detection monitoring at AA 3.

For data evaluation purposes, the designated background/upgradient wells include: AA3-MW03, AA3-MW06, and AA3-MW13. The designated downgradient point-of-compliance wells include: AA3-MW01, AA3-MW02, AA3-MW04 and AA3-MW10. Concentrations in background/ upgradient wells were compared with concentrations in downgradient point-of-compliance wells to indicate potential releases.

3. GROUNDWATER MONITORING PROCEDURES

Round 9 groundwater monitoring was conducted pursuant to the final SAP Addendum #1 (Earth Tech 2007) with which all agencies concurred. Monitoring activities at AA 3 consisted of measuring water levels and collecting groundwater samples for analysis from 12 monitoring wells at the site. Water level measurements were recorded in field logs prior to sample collection. These water levels were used to document groundwater flow directions and gradients at the site (Figure 2). Groundwater samples collected from 12 wells at the site were analyzed for TPH, VOCs, SVOCs, metals (filtered), and general chemistry parameters. Field parameters (temperature, electrical conductivity, turbidity, dissolved oxygen, ORP, and pH) were also recorded during sampling.

Low-flow groundwater purge and sampling was conducted using a non-dedicated bladder pump system according to *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, EPA Ground Water Issue, EPA/540/S-95/504, 1996.

Locking caps were first removed from the wells and a photoionization detector was used to obtain an initial reading for organic vapors; these readings were recorded on a groundwater monitoring well purging and sampling log, see Appendix A. Once water levels in groundwater monitoring wells reached their static levels, depths to water were measured and recorded prior to the start of sampling.

A new disposable bladder was installed in a non-dedicated QED SamplePro® MicroPurge bladder pump prior to sampling at each of groundwater monitoring wells. The outside of the bladder pump was decontaminated using a liquinox, and deionized water, three-rinse system between monitoring locations. Dedicated tubing was used for each well. Once the pump was slowly lowered to and secured with a dedicated Nylon string at the appropriate depth in each well, it was connected to a QED MP15 Digital Pressure Controller and Power Pack. The pressure controller was set for 3 cycles per minute (cpm), of 16.0 seconds of air refill and 4.0 seconds groundwater discharge at approximately 50 to 75 pounds per square inch (psi). A Horiba U-22 or YSI 556 meter was used to measure conductivity, pH, DO, turbidity, and temperature during purging. These readings were recorded on groundwater monitoring well purging and sampling logs. Groundwater samples were collected once the parameters stabilized within 10 percent for three consecutive measurements and turbidity was below 10 nephelometric units (NTUs) (or was stabilized within 10 percent if above 10 NTUs). Any variances in these readings were noted in the sampling logs.

Liquid investigation-derived waste (IDW) was generated during the following activities:

- Decontamination of non-disposable sampling equipment, and
- Purging groundwater prior to collecting samples.

Liquid IDW was collected and stored in 55-gallon drums, which were transferred to a staging area (Earth Tech Main Office at the Station) at the completion of sampling activities and disposal is pending. Since this IDW water is generally classified as non-hazardous waste, it was disposed of along with other IDW waste generated as part of other CERCLA related activities.

4. QUALITY CONTROL AND DATA VALIDATION

Laboratory data were validated by Laboratory Data Consultants of Carlsbad, California, in accordance with the guidance cited below:

- EPA Contract Laboratory National Functional Guidelines for Organic Data Review, October 1999
- EPA Contract Laboratory National Functional Guidelines for Inorganic Data Review, October 2004
- EPA SW 846 Third Edition, Test Methods for Evaluating Solid Waste, update I, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996), Update IIIA (April 1998)

Laboratory data were validated as specified in the U.S. Navy Engineering Command, Southwest Division, Environmental Work Instruction EW#1. Level IV validation was performed on 20 percent or more of the samples, with the balance validated at Level III.

The data validation findings are summarized, indicating the findings of the review process. Data are reported flagged with appropriate qualifiers to indicate their usability.

Data was assigned the following qualifiers:

U	not detected (including not present or adjusted detection limit because of blank contamination)
J	estimated concentration
R	Data is not usable

Combinations of qualifiers such as UJ are possible.

Field logs and sampling records were reviewed. Except as noted below, the field parameters were within acceptance criteria for sampling. In wells AA3-MW10 and AA3-MW13, turbidity values exceeded the criteria due to the presence of entrained gas off-gassing and collecting on the instrument sensor. Other parameters reached the stabilization criteria and so samples were collected.

The field duplicate pairs were compared and the results were within the acceptance criteria. Field and method blanks analyzed did not have any analytes reported that were also reported in field samples.

Field quality control samples (field, trip and equipment blanks) were analyzed in accordance with the project requirements. Analytes detected in quality control samples and associated field samples were qualified in accordance with validation criteria.

All data were found usable for the purposes intended and no data were rejected. The qualification assigned to data was considered in the conclusions or recommendations of the investigation.

5. GROUNDWATER MONITORING RESULTS

5.1 Groundwater Elevations

As part of groundwater monitoring, depths to water in each well were measured and recorded on the sampling logs. This information was used to calculate groundwater elevations in feet above mean sea level in each of the wells (Table 2), and to evaluate groundwater flow directions and gradients at the site.

Groundwater elevations in February 2007 were on an average 2.5 feet lower than the previous measurements in April 2005. Consistent with previously recorded water level elevations, February 2007 water level elevations indicate a general westerly groundwater flow direction in two regimes (Figure 2). A horizontal hydraulic gradient of approximately 0.01 was observed to extend from the eastern portion of the site to the western portion in the vicinity and east of well AA3-MW11. To the west of well AA3-MW11, the horizontal hydraulic gradient increases to approximately 0.06; and the groundwater flows generally to the west-southwest.

5.2 RSE Groundwater Sampling Results – Round 9

A summary of constituents reported in groundwater and their concentrations is presented in Table 3.

In February 2007, twenty-two groundwater samples (including 2 duplicate samples) collected from 12 wells at the site were analyzed for TPH, VOCs, SVOCs, metals (filtered), and general chemistry parameters. Table 4 presents the Round 9 sampling results of detected constituents. A summary of the Round 9 groundwater sampling results is presented below.

- VOCs were not reported in any of wells sampled.
- Bis(2-ethylhexyl) phthalate was the only SVOC sample reported and it was reported at downgradient Well AA3-MW01 (1.9 J µg/L) and within-waste Well AA3-MW12 (duplicate sample - 1.3 J µg/L). Bis(2-ethylhexyl) phthalate was not reported in the original sample collected from Well AA3-MW12. Qualifier "J" indicates that the concentration is an estimated value.
- Metals were reported in all groundwater samples at concentrations that were consistent with historical concentrations reported at AA 3. No metals were reported at concentrations exceeding their respective maximum contaminant levels (MCLs), with the exception of selenium. Selenium was reported in upgradient Well AA3-MW13 at a concentration of 165 µg/L. Consistent with previous groundwater sampling events, manganese and iron concentrations in AA3 MW 12 and AA3 MW 14 were higher than either the upgradient or downgradient wells and reflect the reducing conditions in groundwater in this area. This reducing environment is consistent with the corresponding lower nitrate concentrations reported in these wells during this groundwater sampling event.
- TPH was reported in Well AA3-MW12 at a concentration of 0.49 J milligrams per liter (mg/L). TPH in the duplicate sample from this well was reported at a concentration of 0.40 J mg/L. Qualifier "J" indicates that the concentration is an estimated value.

- General chemistry parameters:
  - TDS was reported at concentrations ranging from 1,740 (AA3-MW08) to 3,270 mg/L (AA3-MW13).
  - Chloride was reported at concentrations ranging from 168 (AA3-MW08) to 601 mg/L (AA3-MW10).
  - Fluoride was reported at concentrations ranging from 0.448 (AA3-MW13) to 0.93 mg/L (AA3-MW04).
  - Total nitrate was reported at concentrations ranging from 0.185 J (AA3-MW12) to 9.91 mg/L (AA3-MW09A). Qualifier "J" indicates that the concentration is an estimated value.
  - Sulfate was reported at concentrations ranging from 263 (AA3-MW12) to 1,860 mg/L (AA3-MW13).
  - Alkalinity (bicarbonate) was reported at concentrations ranging from 360 (AA3-MW13) to 1,420 mg/L (AA3-MW12)
- Figure in Appendix B presents a piper diagram for the common ions reported from Round 9 groundwater monitoring event.
  - A review of the piper diagram indicates the common ions are well-clustered with the exception of some of the common ion data from wells within the waste placement boundary, AA3-MW11, AA3-MW12, and AA3-MW14 and upgradient well, AA3-MW13.
  - The highest TDS values were reported from upgradient monitoring well, AA3-MW13 (3,370 mg/L). In addition, AA3-MW12, a well within the waste placement boundary, had a TDS concentration of 2,520 mg/L. All other TDS values reported were consistent between the upgradient and downgradient locations.
  - This data suggests a common groundwater flow regime.

6. STATISTICAL EVALUATION

The principal study question presented in SAP Addendum #1 was: *are adequate data available to confirm if there has been a release from the site to groundwater at the point of compliance*?

Data from a total of nine groundwater monitoring rounds at AA 3 and additional data from basewide monitoring wells were sufficient to evaluate this question using the DUMPStat statistical program.

6.1 DUMPStat Statistical Evaluation

A statistical evaluation of the data was conducted in accordance with the *U.S. EPA Interim Final Guidance Document - Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities* (1989), the addendum to that guidance (EPA 1992), and *The Statistical Methods for Evaluating Groundwater Monitoring from Hazardous Waste Facilities; Final Rule* (EPA 1988).

DUMPStat is a statistical groundwater monitoring analysis system introduced by Discerning Systems in a collaborative effort with R. D. Gibbons that is consistent with the RCRA Subtitle C (40 CFR Part 264), and D (40 CFR Part 258), USEPA guidance, ASTM D6312-98 guidance, and meets the intent of California Code of Regulations (CCR) Title 22 and 27 requirements for statistically evaluating whether there is evidence of a release.

DUMPStat evaluates the existing data and develops prediction limits/intervals based on treatment of non-detects, trend analysis, and outlier detection and distribution testing. DUMPStat then assesses whether there is a statistically significant evidence of release by:

- Establishing a prediction interval that is constructed from the data from background wells (upgradient).
- Using the prediction interval to evaluate one or more future observations from the same population with a specified confidence.
  - i.e., the concentrations from the point-of-compliance wells (downgradient) are then compared with the prediction interval.
- If the compliance well concentrations do not fall in the prediction interval, this would suggest a statistically significant evidence of release.

6.1.1 Statistical Evaluation Procedures

The general steps that were employed for generating prediction limits were as follows:

1. The initial step involved a review of the historical background data (Rounds 1 through 8) for outliers, anomalies, and trends, using DUMPStat. To remove the possibility of outliers creating false statistical limits, the data were tested for the presence of outliers. Outliers are removed from consideration during the establishment of statistical limits. After the outliers and anomalies are removed from the data set, an input table that represents the DUMPStat model data input is generated.
2. After Step 1, a statistical analysis is performed and tables summarizing the detection frequencies and tests of normality for each groundwater constituent are generated (see Tables 5 and 7).
   a) The most appropriate statistical method for calculating constituent-specific prediction limits at the site is based on detection frequency and distributional form (such as normal, lognormal, non-parametric) of the upgradient/background data set.
3. After the detection frequencies and tests of normality are generated and checked, a statistical table presenting the summary statistics and an estimate of prediction limits for each groundwater constituent is generated (see Tables 5 and 7).
4. These prediction limits are then used to compare new downgradient monitoring data (i.e., Round 9 data) to assess whether a statistically significant event has occurred (see Tables 6 and 8). The possible outcomes of this evaluation are:
   a) * – current value failed; additional data required to verify the exceedance,
   b) ** – current value passed; previous exceedance not verified,
   c) *** – current value failed; exceedance verified,
   d) **** – current value passed; awaiting one data point/event for verification, and
   e) ***** – insufficient data to compute prediction limit. This happens when there is insufficient background data to compute the prediction limits.

If exceedances for a specific constituent or well were noted in both inter-well statistical evaluations (i.e., comparison to prediction limits based on upgradient wells or the stationwide wells) an intra-well comparison was performed to assess the observed trends.

6.2 AA 3 - Statistical Evaluation Results

The DQOs presented in SAP Addendum #1 (Earth Tech 2007) identified the following decision rules:

- If the common ion concentrations at the point of compliance wells are comparable (within the prediction intervals) to common ion concentrations in upgradient wells and other stationwide groundwater monitoring wells, then the groundwater quality at the site has not been impacted by the wastes at the site and further assessment is not necessary.
- If concentrations of common ions in point of compliance wells are not comparable (not within the prediction intervals) to concentrations in upgradient wells and other stationwide groundwater monitoring wells, then the groundwater quality at the site may have been impacted by the wastes at the site and further assessment will be considered.

Consistent with the DQOs two data sets were evaluated. The first was specific to AA3 and the second incorporated a larger stationwide data set. The results from these evaluations are presented in the following sections.

6.2.1 Inter-well Statistical Evaluation with AA 3 Upgradient versus Downgradient Data Set

This evaluation compared upgradient (background) data (AA3-MW03, AA3-MW06, and AA3-MW13) with the following downgradient point-of-compliance wells (AA3-MW01, AA3-MW02, AA3-MW04 and AA3-MW10).

This statistical evaluation was conducted using only AA 3's relatively smaller upgradient (background) data set. Although this was a relatively small data set, it spanned a period of approximately 5 years which includes data from both the dry season wet season, and historically high and low precipitation periods. Due to the relatively small upgradient data set for AA 3, the Round 9 general chemistry concentrations could not be statistically evaluated. However these constituents were statistically evaluated using the stationwide dataset (section 6.2.2). Selected DUMPStat output tables presented include:

- Table 5 presents summary statistics and prediction limits for the groundwater data set from upgradient wells (AA3-MW03, AA3-MW06, and AA3-MW13)
- Table 6 presents a comparison of prediction limits to downgradient wells (AA3-MW01, AA3-MW02, AA3-MW04 and AA3-MW10)

Based on the DUMPStat program output results, there were three constituents: arsenic [at AA3-MW04], manganese [at AA3-MW02], and sodium [at AA 3-MW02 and AA3-MW04], whose current Round 9 values failed the test. As a result, these wells are candidates for a verification procedure which per Title 27 may include a statistical evaluation that augments or reanalyzes the data from the monitoring point that failed. The verification procedure, which is presented in section 6.2.3, was only performed when a constituent or well also exceeded prediction limits developed based on the stationwide evaluation (section 6.2.2) dataset.

Sodium (at AA3-MW10) and vanadium (at AA3-MW04), were the only constituents whose current Round 9 value failed and confirmed a previous exceedance (i.e., the Round 9 value confirmed the exceedance identified during the Round 8 sampling event).

In the event that a well or constituent exceedance is verified, ASTM 6312-98 states that intra-well analysis be conducted for wells that that fail upgradient versus downgradient comparison. It further states that if no VOCs or hazardous metals are detected and no trend is detected in other indicator constituents, use of intra-well comparisons for detection monitoring of those wells and constituents is recommended. Therefore, intra-well evaluations for these two wells were conducted (see section 6.2.3).

6.2.2 AA 3 Inter-well Statistical Evaluation with Station-wide Data Set

This evaluation compared the upgradient (background) dataset consisting of the following AA3 and stationwide data set (AA3-MW03, AA3-MW06, AA3-MW13, 02NEW11, 02UGMW25, 17NEW02, 18BGMW02E, 18BGMW15, 18BGMW16, 18BGMW17, 18BGMW18, 18BGMW24, 19UGMW35, 19DBMW54, and 20DGMW88) to the following downgradient point-of-compliance wells AA3-MW01, AA3-MW02, AA3-MW04 and AA3-MW10. Selected DUMPStat output tables presented include:

- Table 7 presents summary statistics and prediction limits for this AA3/stationwide groundwater data set
- Table 8 provides a comparison of prediction limits to downgradient wells (AA3-MW01, AA3-MW02, AA3-MW04 and AA3-MW10)

Using Round 9 data, the following five constituents: alkalinity (at AA3-MW01 and AA3-MW02), arsenic (at AA3-MW04), bicarbonate (at AA3-MW01 and AA3-MW02), chloride (at AA3-MW10), and sodium (at AA3-MW01, AA 3-MW02, and AA3-MW04), exceeded the prediction limits.

Consistent with the statistical evaluation using the AA 3 dataset, sodium (at AA3-MW10) and vanadium (at AA3-MW04) were the only constituents whose current Round 9 value failed and confirmed a previous exceedance (i.e., the Round 9 value confirmed the exceedance identified during the Round 8 sampling event).

Therefore, to further evaluate the statistically significant exceedance of sodium at AA3-MW10 and vanadium at AA3-MW04, an intra-well statistical comparison was conducted for the data set from these wells. Result of this comparison is presented in Section 6.2.3.

6.2.3 Intra-well Comparison – Wells AA 3-MW04 and AA3-MW10

Intra-well evaluations are the preferred evaluation method for wells that have data that predates waste placement. However, ASTM 6312-98 also recommends intra-well analysis be conducted for wells that that fail upgradient versus downgradient comparison. It further states that if no VOCs or hazardous metals are detected and no trend is detected in other indicator constituents, use of intra-well comparisons for detection monitoring of those wells and constituents is recommended.

Therefore an intra-well statistical comparison was also performed to evaluate trends and the variability of groundwater data for the two wells that had a verified release based on an inter-well evaluation. Trends relating to sodium and vanadium at monitoring wells AA3-MW10 and AA3-MW04, respectively, were evaluated.

At AA3-MW04, using all available historical data from this well, the intra-well limits for all groundwater constituents were estimated (Table 9). This intra-well evaluation concluded that the current reported value for sodium at this well was below its lower intra-well prediction limit. There were no significant differences in any of the other groundwater constituents reported in this well.

Similarly at AA3-MW10, using all available historical data from this well, the prediction limits for all groundwater constituents were estimated (Table 9). The current reported value for vanadium at this well was below its lower intra-well prediction limit. In addition, there were no significant differences in any of the other groundwater constituents reported in this well.

The inter-well evaluation of sodium and vanadium indicated statistically significant variations; however, further intra-well statistical evaluations indicate that the Round 9 values are lower than the intra-well prediction limits that would indicate a statistically significant event. In addition, a review of historical data does not show increasing trends for these constituents.

7. CONCLUSIONS AND RECOMMENDATIONS

The project decision question for the SAP Addendum #1 was:

- *Are adequate data available to confirm if there has been a release from the site to groundwater at point of compliance?*

In order to appropriately respond to this project decision question, the following decision rules were formulated as part of the SAP Addendum #1:

> ***Rule #1: If*** common ion concentrations at the point of compliance wells are comparable (i.e., within the prediction intervals) to common ion concentrations in upgradient wells and other stationwide groundwater monitoring wells, ***then*** the groundwater quality at the site has not been impacted by the debris at the site and further assessment is not necessary.
>
> ***Rule #2: If*** concentrations of common ions in point of compliance wells are not comparable (i.e., not within the prediction intervals) to concentrations in upgradient wells and other stationwide groundwater monitoring wells, ***then*** the groundwater quality at the site may have been impacted by the debris at the site and further assessment will be considered.
>
> ***Rule #3: If*** metals concentrations at the point of compliance wells are within the station-wide background ranges (i.e., within the prediction intervals), ***then*** groundwater has not been impacted by debris at the site.

The results of Round 9 groundwater sampling and subsequent DUMPStat statistical evaluation were presented in this report and based on these results, the following conclusions were reached.

Conclusions:

- The groundwater quality at the downgradient point-of-compliance wells is consistent with the groundwater quality at the upgradient background wells, specifically,
  - Round 9 results for VOCs and SVOCs are consistent with results from previous groundwater monitoring rounds. One SVOC was reported in Round 9. This single SVOC was reported at very low concentrations and with a "J" qualifier, which means that it is an estimated laboratory value.

  - Round 9 results for metals are consistent with background concentrations, historic data, and previous interpretations. Results from the DUMPStat statistical evaluation (Section 6.2) indicate that the downgradient point-of-compliance wells do not show evidence of impact by debris or release to groundwater. Therefore, as per the DQO decision rules presented above, there is no impact to groundwater and further assessment is not necessary.
  - Round 9 results indicate petroleum hydrocarbons were reported in one well within the debris and were not reported in any of the point-of-compliance wells.
- General chemistry parameters recorded at the point-of-compliance monitoring wells do not show evidence that these wells have been impacted by previous debris placement activities.
  - A review of general chemistry results using DUMPStat (Section 6.2) indicated no statistically significant impact or release to groundwater at all the downgradient point-of-compliance wells. Therefore, per the DQO rules presented above, further assessment is not necessary.
- Based on a review of the piper diagram, common ions are relatively well clustered and the data indicate that groundwater quality at the downgradient point-of-compliance is not significantly different than the groundwater quality at upgradient locations at the site.
- All data from wells within the debris placement boundary are consistent with previous monitoring results and do not show significant impacts to groundwater quality.

The conclusions of this effort supports the RI/FS conclusions and the project decision Rules #1 and #3 of the SAP Addendum #1, namely, the groundwater quality at the AA 3 has not been impacted by the debris at the site and there is no statistically significant release at point-of-compliance wells. In addition, the results also indicate that the existing soil cover at AA 3 has effectively controlled the amount of infiltration and is protective of groundwater quality. Therefore, the following recommendations are proposed for this project.

Recommendations:

Since the statistical evaluation results have verified the conclusions presented in the Draft RI/FS Report with respect to identifying no impacts to groundwater at the point-of-compliance locations, no additional groundwater monitoring events are required. Based on the results documented in this technical memorandum, a groundwater-specific response action is not required at the site. It is recommended that these results be incorporated in the Draft Final RI/FS Report.

8. REFERENCES

Earth Tech, Inc. and Barajas and Associates, Inc. 2002. *Final Work Plan, Removal Site Evaluation Anomaly Area 3, Former Marine Corps Air Station, El Toro, California.* Honolulu. August.

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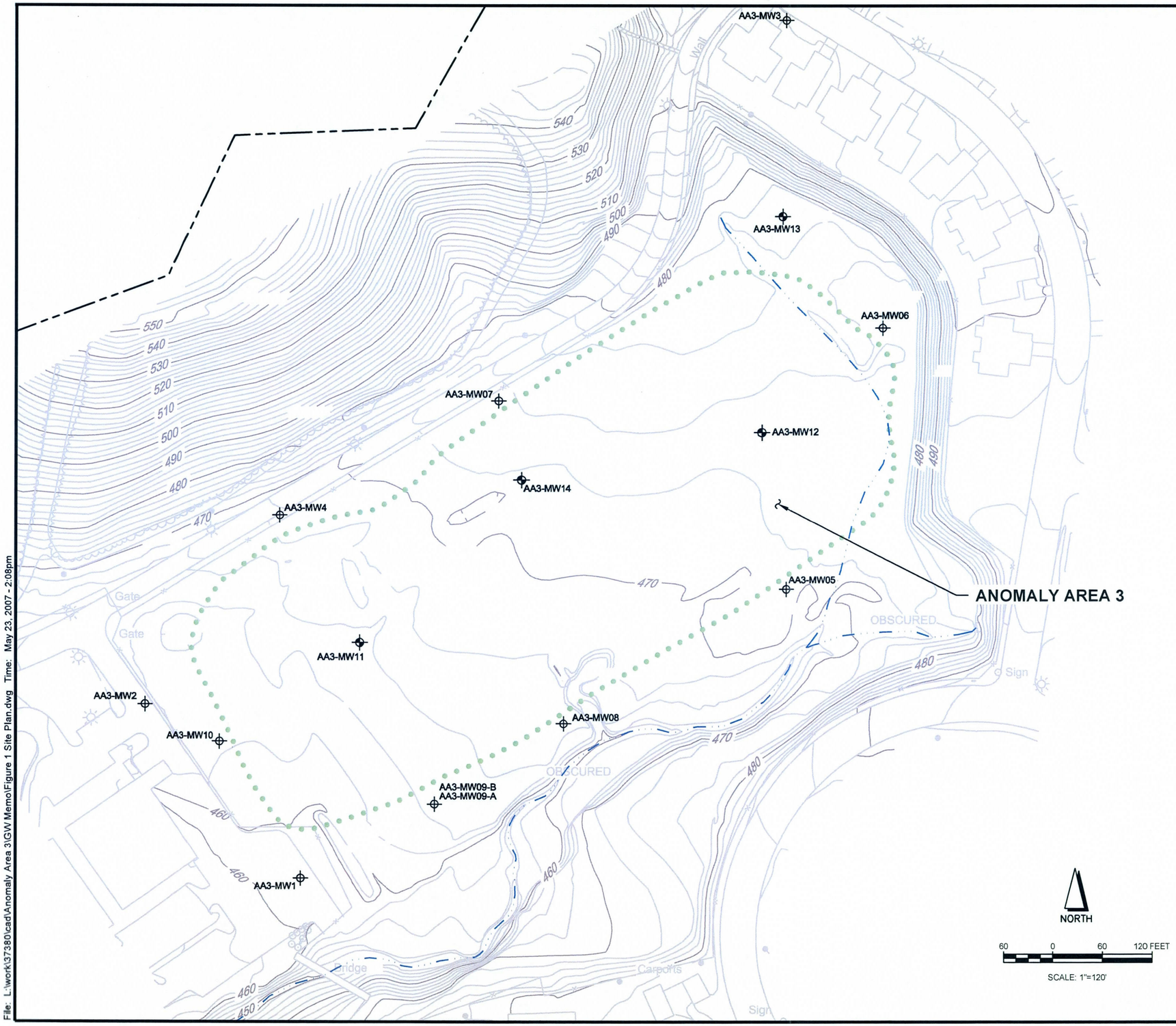
Figures



LEGEND

- MINOR SURFACE ELEVATION: 2-FOOT INTERVALS
- 460 MAJOR SURFACE ELEVATION: 10-FOOT INTERVALS
- MCAS EL TORO BOUNDARY
- EXISTING STREAM OR WASH
- ESTIMATED EXTENT OF WASTE PLACEMENT BEFORE RSE INVESTIGATION (EARTH TECH 2001)
- MW4 GROUNDWATER MONITORING WELL

NOTES

1. TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHOD FROM AERIAL PHOTOGRAPHY DATED DECEMBER 2001 BY SAN-LO AERIAL SURVEYS.
2. COORDINATES ARE IN CALIFORNIA STATE PLANE COORDINATE SYSTEM, NAD 83, ZONE 6.
3. ELEVATIONS IN FEET; BENCHMARK BASED ON NORTH AMERICAN VERTICAL DATUM 1988.

NORTH

60 0 60 120 FEET

SCALE: 1"=120'

Groundwater Memo

AA 3 Groundwater Monitoring Well Locations

Anomaly Area 3

Date: 05-07	Former MCAS El Toro	Figure
Project No. 37380	EarthTech A Tyco International Ltd. Company	1

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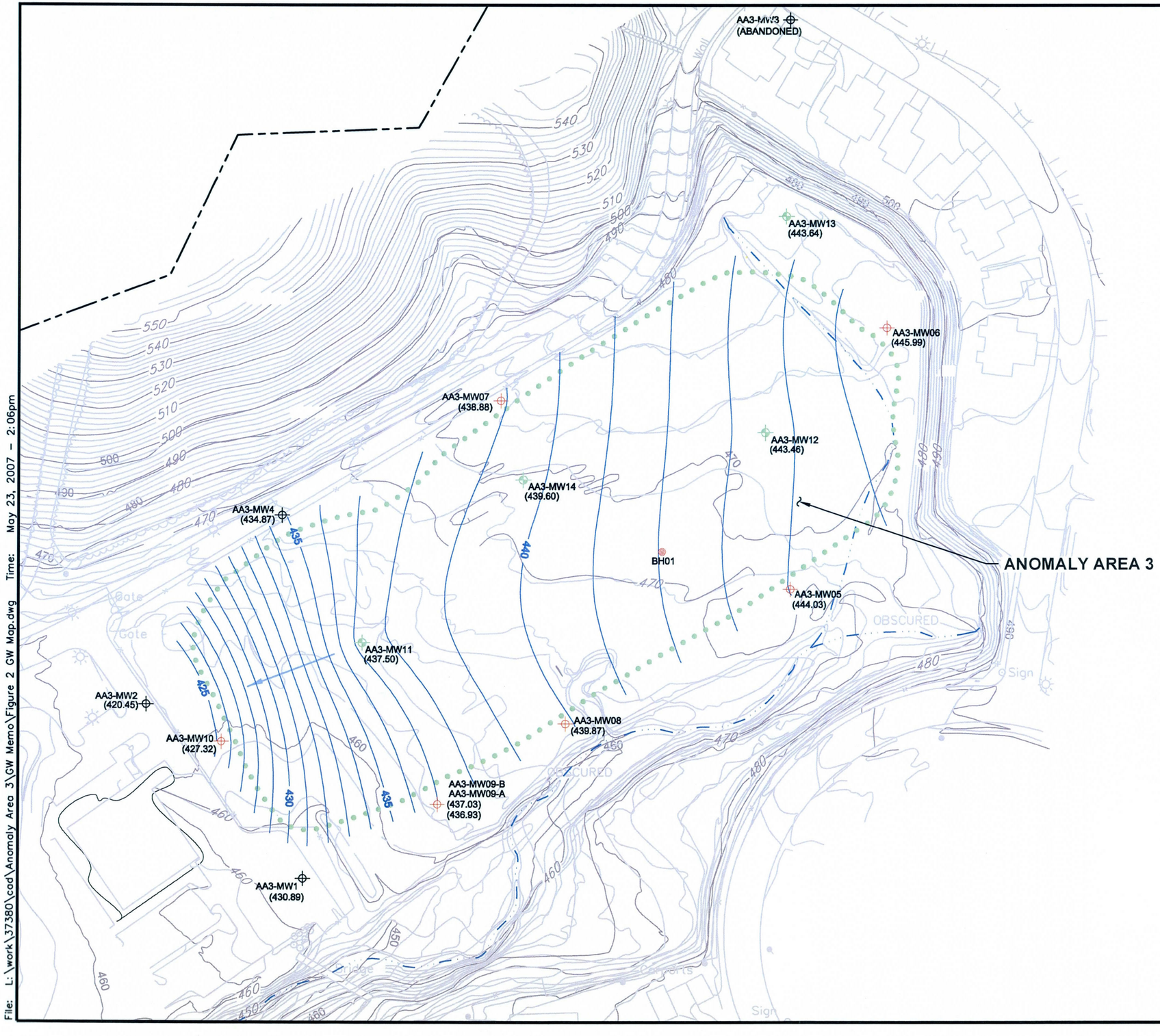

LEGEND

- MINOR SURFACE ELEVATION: 2-FOOT INTERVALS
- 460 — MAJOR SURFACE ELEVATION: 10-FOOT INTERVALS
- 427 — GROUNDWATER EQUIPOTENTIAL LINES USING GROUNDWATER LEVELS COLLECTED DURING FEBRUARY 2007
- MCAS EL TORO BOUNDARY
- EXISTING STREAM OR WASH
- ESTIMATED EXTENT OF WASTE PLACEMENT BEFORE RSE INVESTIGATION (EARTH TECH 2001)
- MW06 — RSE GROUNDWATER MONITORING WELL LOCATION
- MW4 — EXISTING GROUNDWATER MONITORING WELL
- MW12 — ADDITIONAL GROUNDWATER MONITORING WELL LOCATIONS - FEBRUARY 2005
- BH01 — ADDITIONAL BOREHOLE LOCATION FEBRUARY 2005
- GROUNDWATER GRADIENT DIRECTION - FEBRUARY 2007

NOTES

1. TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHOD FROM AERIAL PHOTOGRAPHY DATED DECEMBER 2001 BY SAN-LO AERIAL SURVEYS.
2. COORDINATES ARE IN CALIFORNIA STATE PLANE COORDINATE SYSTEM, NAD 83, ZONE 6.
3. ELEVATIONS IN FEET; BENCHMARK BASED ON NORTH AMERICAN VERTICAL DATUM 1988.

NORTH

60 0 60 120 FEET

SCALE: 1"=120'

Groundwater Memo

AA 3 Groundwater Equi-potential Map (updated with February 2007 groundwater elevations)

Anomaly Area 3

Date: 05-07	Former MCAS El Toro	Figure
Project No. 37380	EarthTech A Tyco International Ltd. Company	2

File: L:\work\37380\cad\Anomaly Area 3\GW Memo\Figure 2 GW Map.dwg Time: May 23, 2007 - 2:06pm

Tables

Table 1: Round 9 Monitoring Well Network, per SAP Addendum #1

Well ID	Well Installation Dates	Location	Rationale
Downgradient Wells			
AA3-MW01	10/12/1999	Downgradient	Downgradient – Point of Compliance
AA3-MW02	10/14/1999	Downgradient	Downgradient – Point of Compliance
AA3-MW04	10/20/1999	Downgradient	Downgradient – Point of Compliance
AA3-MW10	10/31/2002	Downgradient	Downgradient – Point of Compliance
Upgradient Wells			
AA3-MW06	11/04/2002	Upgradient	Upgradient – Background
AA3-MW13	02/02/2005	Upgradient - Replacement for MW03	Upgradient – Background
Wells within Waste			
AA3-MW11	01/31/2005	Possible release location	First evidence of release
AA3-MW12	02/01/2005	Possible release location	First evidence of release
AA3-MW14	02/04/2005	Possible release location	First evidence of release
Other Wells			
AA3-MW08	11/06/2002	Near Wash; Cross gradient	Transport Evaluation
AA3-MW09A	10/29/2002	Near Wash; Cross gradient	Transport Evaluation
AA3-MW09B	10/29/2002	Near Wash; Cross gradient	Transport Evaluation

Table 2 - Anomaly Area 3 Historical Depth-to-Groundwater and Groundwater Elevation Information

Well ID	Screen Interval (feet below ground surface)	Northing	Easting	TOC Elevation (feet above MSL)	November-99		December-99		February-01		August-01		November-02		December-02		January-03	
					Depth-to Water (feet below TOC)	Groundwater Elevation (feet above MSL)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above MSL)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above MSL)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above MSL)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above MSL)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above MSL)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above MSL)
AA3-MW01	16.5 – 46.5	2194691.311	6116936.679	459.03	23.5	435.53	24.05	434.98	24.98	434.05	21.67	437.36	27.16	431.87	27.22	431.81	27.45	431.58
AA3-MW02	21 – 51	2194900.483	6116746.935	463.74	39.15	424.59	39.64	424.10	40.8	422.94	41.34	422.40	--	--	42.47	421.27	42.65	421.09
AA3-MW03	50 – 80	2194761.799	6117116.175	500.85	60.15	440.70	61.02	439.83	62.49	438.36	63.14	437.71	64.74	436.11	64.97	435.88	65.28	435.57
AA3-MW04	25 – 45	2195127.919	6116911.118	468.43	28.91	439.52	29.57	438.86	--	--	31.27	437.16	32.59	435.84	32.7	435.73	32.94	435.49
AA3-MW05	40 – 55	2195039.239	6117525.408	473.07	*	*	*	*	*	*	*	*	27.52	445.55	27.68	445.39	28.04	445.03
AA3-MW06	20 – 40	2195353.272	6117642.832	475.72	*	*	*	*	*	*	*	*	27.93	447.79	28.14	447.58	28.61	447.11
AA3-MW07	30 – 50	2195265.463	6117176.68	475.60	*	*	*	*	*	*	*	*	34.12	441.48	34.26	441.34	34.59	441.01
AA3-MW08	25 – 55	2194877.084	6117254.834	469.65	*	*	*	*	*	*	*	*	28.27	441.38	28.43	441.22	28.73	440.92
AA3-MW09A	20 – 50	2194780.357	6117099.868	466.52	*	*	*	*	*	*	*	*	28.17	438.35	28.38	438.14	28.56	437.96
AA3-MW09B	60 – 75	2194780.475	6117099.588	466.45	*	*	*	*	*	*	*	*	28.37	438.08	28.43	438.02	28.69	437.76
AA3-MW10	60 – 75	2194855.815	6116838.023	463.76	*	*	*	*	*	*	*	*	37.45	426.31	37.48	426.28	37.67	426.09
AA3-MW11	22 – 37	2194974.72	6117008.111	467.35	*	*	*	*	*	*	*	*	*	*	*	*	*	*
AA3-MW12	24 – 39	2195227.469	6117495.47	475.87	*	*	*	*	*	*	*	*	*	*	*	*	*	*
AA3-MW13	25 – 45	2195487.055	6117520.993	479.39	*	*	*	*	*	*	*	*	*	*	*	*	*	*
AA3-MW14	25 – 40	2195170.273	6117203.852	474.10	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Notes:

* Wells MW05 though MW10 were installed in November 2002. Wells MW11 though MW14 were installed in February 2005.

-- *Not recorded. Depth to groundwater measurements not collected due to obstruction (dead animal) in the well.*

TOC - top of casing

MSL - mean sea level

Table 2 - Anomaly Area 3 Historical Depth-to-Groundwater and Groundwater Elevation Information

Well ID	Screen Interval (feet below ground surface)	Northing	Easting	TOC Elevation (feet above MSL)	March-03		November-03		March-04		June-04		October-04		February-05		April-05		February-07	
					Depth-to Water (feet below TOC)	Groundwater Elevation (feet above MSL)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above MSL)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above MSL)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above MSL)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above MSL)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above MSL)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above MSL)	Depth-to Water (feet below TOC)	Groundwater Elevation (feet above MSL)
AA3-MW01	16.5 – 46.5	2194691.311	6116936.679	459.03	26.54	432.49	28.28	430.75	28.22	430.81	28.51	430.52	28.89	430.14	26.55	432.48	26.56	432.47	28.14	430.89
AA3-MW02	21 – 51	2194900.483	6116746.935	463.74	42.42	421.32	43.30	420.44	43.04	420.70	43.45	420.29	43.80	419.94	41.40	422.34	40.58	423.16	43.29	420.45
AA3-MW03	50 – 80	2194761.799	6117116.175	500.85	65.43	435.42	66.33	434.52	Well Abandoned		Well Abandoned		Well Abandoned		Well Abandoned		Well Abandoned		Well Abandoned	
AA3-MW04	25 – 45	2195127.919	6116911.118	468.43	32.73	435.70	33.62	434.81	33.50	434.93	33.82	434.61	34.16	434.27	32.00	436.43	31.44	436.99	33.56	434.87
AA3-MW05	40 – 55	2195039.239	6117525.408	473.07	26.74	446.33	29.30	443.77	29.25	443.82	29.78	443.29	30.46	442.61	27.80	445.27	27.01	446.06	29.04	444.03
AA3-MW06	20 – 40	2195353.272	6117642.832	475.72	27.76	447.96	29.89	445.83	29.98	445.74	30.56	445.16	31.29	444.43	27.00	448.72	27.88	447.84	29.73	445.99
AA3-MW07	30 – 50	2195265.463	6117176.68	475.60	34.44	441.16	35.65	439.95	35.63	439.97	36.05	439.55	36.60	439.00	34.00	441.60	33.23	442.37	36.72	438.88
AA3-MW08	25 – 55	2194877.084	6117254.834	469.65	27.98	441.67	29.88	439.77	29.80	439.85	30.08	439.57	30.82	438.83	27.00	442.65	27.88	441.77	29.78	439.87
AA3-MW09A	20 – 50	2194780.357	6117099.868	466.52	27.77	438.75	29.59	436.93	29.46	437.06	29.86	436.66	30.32	436.20	27.90	438.62	26.22	440.30	29.49	437.03
AA3-MW09B	60 – 75	2194780.475	6117099.588	466.45	27.93	438.52	29.66	436.79	29.52	436.93	29.91	436.54	30.36	436.09	28.50	437.95	27.88	438.57	29.52	436.93
AA3-MW10	60 – 75	2194855.815	6116838.023	463.76	37.25	426.51	38.46	425.30	38.14	425.62	38.57	425.19	38.96	424.80	36.60	427.16	36.44	427.32	38.5	425.26
AA3-MW11	22 – 37	2194974.72	6117008.111	467.35	*	*	*	*	*	*	*	*	*	*	28.50	438.85	28.09	439.26	29.85	437.50
AA3-MW12	24 – 39	2195227.469	6117495.47	475.87	*	*	*	*	*	*	*	*	*	*	30.90	444.97	30.21	445.66	32.41	443.46
AA3-MW13	25 – 45	2195487.055	6117520.993	479.39	*	*	*	*	*	*	*	*	*	*	34.15	445.24	33.58	445.81	35.75	443.64
AA3-MW14	25 – 40	2195170.273	6117203.852	474.10	*	*	*	*	*	*	*	*	*	*	32.75	441.35	26.62	447.48	34.5	439.60

Notes:

* Wells MW05 though MW10 were installed during November 2002. Wells MW11 though MW14 were installed during February 2005.

-- *Not recorded. Depth to groundwater measurements not collected due to obstruction (dead animal) in the well.*

TOC - top of casing

MSL - mean sea level

Table 3: Summary of Detected Analytes - Round 1 through Round 9 Groundwater Sampling - RSE Investigation

		WELL ID:	AA3-MW01																			
		EPA ID:	LK256	LK332	LK333	LK362	LK363	LK391	LK392	LK393	LK394	LK419	LK420	LK421	LK454	LK455	LK456	LK484	LK485	LK524	LK525	LK547
		SAMPLE DATE:	12/3/2002	4/1/2003	4/1/2003	11/18/2003	11/18/2003	4/6/2004	4/6/2004	4/6/2004	4/6/2004	7/6/2004	7/6/2004	7/6/2004	10/7/2004	10/7/2004	10/7/2004	2/23/2005	2/23/2005	4/28/2005	4/28/2005	2/7/2007
		SAMPLE TYPE:	Regular Unfiltered	Regular Unfiltered	Duplicate Unfiltered	Regular Unfiltered	Duplicate Unfiltered	Regular Unfiltered	Regular Filtered	Duplicate Unfiltered	Duplicate Filtered	Regular Unfiltered	Regular Filtered	Duplicate Unfiltered	Regular Unfiltered	Duplicate Unfiltered	Regular Filtered	Regular Unfiltered	Regular Filtered	Regular Unfiltered	Regular Filtered	Regular Filtered
Parameter		ROUND #:	Round 1	Round 2		Round 3		Round 4				Round 5			Round 6			Round 7		Round 8		Round 9
Petroleum Hydrocarbons	**Units**	**Method**																				
Motor Oil	mg/L	8015B DRO	0.096 U	0.096 U	0.096 U	0.13 U	0.13 U	0.096 U	--	0.096 U	--	0.096 U	--	0.03 J	0.096 U	0.096 U	--	0.096 U	--	0.096 U	--	1 U
Diesel Fuel	mg/L	8015B DRO	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	--	0.096 U	--	0.096 U	--	0.096 U	0.096 U	0.096 U	--	0.096 U	--	0.096 U	--	1 U
Gasoline	mg/L	8015B DRO	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.02 J	--	0.03 J	--	0.1 U	--	0.1 U	0.05 J	0.1 U	--	0.1 U	--	0.1 U	--	1 U
VOCs																						
4-Methyl-2-Pentanone	ug/L	8260B	50 U	50 U	50 U	50 UJ	50 UJ	50 UJ	--	50 UJ	--	50 U	--	50 U	50 UJ	50 UJ	--	50 U	--	50 U	--	50 U
Chloroform	ug/L	8260B	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.11 U	--	0.11 U	--	0.11 U	--	0.11 U	0.1 U	0.1 U	--	0.1 U	--	0.1 U	--	0.2 U
2-Butanone (MEK)	ug/L	8260B	100 U	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	--	100 UJ	--	100 UJ	--	100 UJ	100 U	100 U	--	100 UJ	--	100 U	--	100 U
Methylene Chloride	ug/L	8260B	3 U	3 U	3 U	3 U	3 U	3 UJ	--	3 UJ	--	3 U	--	3 U	3 U	3 U	--	3 U	--	3 U	--	3 U
SVOCs																						
4-Methylphenol	ug/L	8270C	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	10 U
Acenaphthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U
Anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U
Benzo(a)anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U
Benzo(a)pyrene	ug/L	8270 SIM	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	--	0.19 U	--	0.19 U	--	0.19 U	0.19 U	0.19 U	--	0.19 U	--	0.19 U	--	0.2 U
Benzo(b)fluoranthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U
Benzo(g,h,i)perylene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U
Bis(2-Ethylhexyl)Phthalate	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	1.9 J
Bis(2-chloroethoxy)methane	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	10 U
Butyl Benzyl Phthalate	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	10 U
Chrysene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U
Dibenz(a,h)anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U
Diethyl Phthalate	ug/L	8270C	2 J	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	10 U
Fluoranthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U
Fluorene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U
Indeno(1,2,3-c,d)pyrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U
Napthalene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U
Phenanthrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U
Phenol	ug/L	8270C	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	10 U
Pyrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U
Metals																						
Aluminum	ug/L	6010B	13.1	22.5 UJ	8.2 UJ	38.2 UJ	24.4 UJ	16.7 J	12.9 J	200 UJ	200 UJ	6.9 UJ	14.6 UJ	14.8 UJ	83	11.4 UJ	32.3	16.8 J	200 UJ	24.2 UJ	200 U	100 U
Antimony	ug/L	6010B	4.4 UJ	3.8	60 U	5.8 UJ	7.8 UJ	8.2 UJ	60 U	3.1 UJ	3.1 UJ	3.3 UJ	2.5 UJ	60 U	60 UJ	3	2.4	5.4	60 U	60 U	5	10 U
Arsenic	ug/L	6010B	8.4 UJ	5.3	3.7	10 UJ	1.7 J	7.5 UJ	7.2 UJ	7.1 UJ	5.8 UJ	4.2 UJ	6 UJ	4.7 UJ	4.9 UJ	3.8 UJ	2.6 UJ	2.9 J	2.3 J	8.8 UJ	10.1 UJ	5.24
Barium	ug/L	6010B	45.6	36.8	36.1	36.4	36	36	36.9	35.1	37.9	38	40	37.5	42.9	36.8	3.4	40.1	39.6	38.2 J	39.3 J	40.7
Cadmium	ug/L	6010B	0.15 UJ	5 U	0.15 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	0.63 UJ	0.44 UJ	0.97 UJ	5 U	5 U	5 U	5 U	2 U
Calcium	ug/L	6010B	170000	134000	131000	126000	128000	135000	139000	133000	138000	145000	144000	139000	135000	133000	116000	144000	143000	140000 J	144000 J	149000
Chromium	ug/L	6010B	27.4	203	120	5.1	3.5	47.4	2.3	18.9	3.5	4.8	1.3	10.1	50.4	47.9	4.3	20.6	0.62 UJ	10 UJ	10 UJ	5 U
Cobalt	ug/L	6010B	1.1 UJ	0.55 UJ	50 U	50 U	50 U	0.63 UJ	50 U	50 U	0.29 UJ	50 U	50 U	50 U	50 U	50 U	50 U	8.8 J	7.9	50 UJ	50 UJ	5 U
Copper	ug/L	6010B	5.9 UJ	7.4	3.2	6.3	3.6	8.4 J	5.3	4.5 J	6.8	6.4 UJ	11 UJ	4 UJ	6.6 UJ	11.5	12.1	7.7 J	7	3.5 J	2.7	0.632 J
Iron	ug/L	6010B	475	992	613	49.3 UJ	28.8 UJ	227 J	148	86.4 J	122	33.8 J	57.9 J	61.7 J	206	150	91.3	62.1 J	100 UJ	13.4 UJ	100 UJ	50 U
Lead	ug/L	6010B	3.1 UJ	3 U	3 U	1 UJ	1 UJ	3 U	3 U	3 U	3 U	1.6	2.6	1.4	2.9	3.7	9.3	1.5	1.6	3 U	3 U	5 U
Magnesium	ug/L	6010B	83600	68000	67600	68600	69200	69000	71700	68700	70500	70100	70900	68300	63800	64400	56.5	75600	73600	76400	78800	74000
Manganese	ug/L	6010B	19.6	7.5	5.2	2.1 UJ	2.1 UJ	3.9 UJ	4.1 UJ	3.2 UJ	4.5	1.8 UJ	2.9 UJ	2 UJ	4.8	3.2	3.9	1.4 J	1.2	15 UJ	15 UJ	2.40 J
Mercury	ug/L	7470A	0.18	0.15 UJ	0.12 UJ	0.067 J	0.07 J	0.11 J	0.15	0.085 J	0.099	0.018	0.046	0.027	1.1	0.97	0.96	0.34 J	0.31	0.2 J	0.24J	0.5 U
Nickel	ug/L	6010B	105	55.3 J	40.8 J	7.1	6.9	29.1	15	16.6	16.1	2.2 UJ	3.1 UJ	4.8 UJ	21.7	20	18.8	7.5	5.7 UJ	3.8	4.5	2.94
Potassium	ug/L	6010B	3410	2670 J	2570 J	2500	2590	2670 J	2810 J	2690 J	2670 J	3010	2890	2780	2520	2270	1930	3120	2970	2990 J	3120 J	2010
Selenium	ug/L	6010B	14.3	11.8	13.4	17.9	16.1	12.4	13.3	14.1	13.5	21.9	17.2	16.7	18.1	15.1	13.6	26.1	29.1	26.9 UJ	30.6 UJ	21.1
Silver	ug/L	6010B	1.2	2.3 UJ	2.5 UJ	0.94 UJ	2.5 UJ	10 U	10 U	10 U	10 U	1.5 UJ	1.1 UJ	10 U	10 UJ	10 U	0.97	2.1 UJ	10 U	2 UJ	3.3 UJ	10 U
Sodium	ug/L	6010B	451000	357000	359000	377000	383000	395000	410000	394000	405000	369000	375000	360000	342000	348000	308000	386000	378000	448000 J	465000 J	441000
Thallium	ug/L	6010B	10 U	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	2 U
Vanadium	ug/L	6010B	25.2	22.6	22.3	22.2	22.7	23.8	21.6	20.6	24.5	20.6	20.7	20.1	18.6	18.9	16.1	20.4	19.7	21.9	22.2 J	19
Zinc	ug/L	6010B	48	6.6	6.6	26.2 J	33.4 J	5.1 J	2.8 UJ	1.9 UJ	4 UJ	4.3 J	29.3 J	17.6 J	22.1	4.2	13.1	21.1 J	5.4 UJ	20 UJ	20 UJ	10 U
Miscellaneous																						
pH	pH	9040	7	7	7.06	6.99	7	7.01	--	6.97	--	7.03	--	7.06	7.26	7.29	--	--	--	7.02	--	7.15
Chromium, hexavalent	ug/L	7199	--	--	--	--	--	1 U	--	--	--	1 U	--	--	1 U	--	--	--	--	--	--	--

Table 3: Summary of Detected Analytes - Round 1 through Round 9 Groundwater Sampling - RSE Investigation

		WELL ID:	AA3-MW02																					
		EPA ID:	LK264	LK340	LK341	LK368	LK369	LK395	LK396	LK397	LK398	LK425	LK426	LK427	LK428	LK460	LK461	LK462	LK488	LK489	LK522	LK523	LK548	LK549
		SAMPLE DATE:	12/4/2002	4/2/2003	4/2/2003	11/19/2003	11/19/2003	4/6/2004	4/6/2004	4/6/2004	4/6/2004	7/7/2004	7/7/2004	7/7/2004	7/7/2004	10/8/2004	10/8/2004	10/8/2004	2/24/2005	2/24/2005	4/28/2005	4/28/2005	2/7/2007	2/7/2007
		SAMPLE TYPE:	Regular Unfiltered	Regular Unfiltered	Duplicate Unfiltered	Regular Unfiltered	Duplicate Unfiltered	Regular Unfiltered	Regular Filtered	Duplicate Unfiltered	Duplicate Filtered	Regular Unfiltered	Duplicate Unfiltered	Regular Filtered	Duplicate Filtered	Regular Unfiltered	Duplicate Unfiltered	Regular Filtered	Regular Unfiltered	Regular Filtered	Regular Unfiltered	Regular Filtered	Regular Filtered	Duplicate Filtered
Parameter		ROUND #:	Round 1	Round 2		Round 3		Round 4				Round 5				Round 6			Round 7		Round 8		Round 9	
Petroleum Hydrocarbons	**Units**	**Method**																						
Motor Oil	mg/L	8015B DRO	0.37	0.096 U	0.08 J	0.096 U	0.096 U	0.096 U	--	0.096 U	--	0.02 J	0.02 J	--	--	0.096 U	0.096 U	--	0.02 J	--	0.07 J	--	1 U	1 U
Diesel Fuel	mg/L	8015B DRO	1.3	0.096 U	0.02 J	0.096 U	0.096 U	0.096 U	--	0.096 U	--	0.02 J	0.02 J	--	--	0.096 U	0.096 U	--	0.03 J	--	0.06 J	--	1 U	1 U
Gasoline	mg/L	8015B DRO	0.1 U	0.1 U	0.1 U	0.02 J	0.02 J	0.03 J	--	0.1 U	--	0.1 U	0.1 U	--	--	0.1 U	0.02 J	--	0.1 U	--	0.1 U	--	1 U	1 U
VOCs																								
4-Methyl-2-Pentanone	ug/L	8260B	50 U	50 U	2 J	50 U	50 U	50 UJ	--	50 UJ	--	50 U	50 U	--	--	50 UJ	50 UJ	--	50 U	--	50 U	--	50 U	50 U
Chloroform	ug/L	8260B	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.11 U	--	0.11 U	--	0.11 U	0.11 U	--	--	0.1 U	0.1 U	--	0.1 U	--	0.1 U	--	0.2 U	0.2 U
2-Butanone (MEK)	ug/L	8260B	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	--	100 UJ	--	100 UJ	100 UJ	--	--	100 U	100 U	--	100 UJ	--	100 U	--	100 U	100 U
Methylene Chloride	ug/L	8260B	3 U	3 U	3 U	3 U	3 U	3 UJ	--	3 UJ	--	3 U	3 U	--	--	3 U	3 U	--	3 U	--	3 U	--	3 U	3 U
SVOCs																								
4-Methylphenol	ug/L	8270C	6 J	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	9.6 U	--	--	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	10 U	10 U
Acenaphthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	0.48 U	--	--	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U	1 U
Anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	0.48 U	--	--	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U	1 U
Benzo(a)anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	0.48 U	--	--	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U	1 U
Benzo(a)pyrene	ug/L	8270 SIM	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	--	0.19 U	--	0.19 U	0.19 U	--	--	0.19 U	0.19 U	--	0.19 U	--	0.19 U	--	0.2 U	0.2 U
Benzo(b)fluoranthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	0.48 U	--	--	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U	1 U
Benzo(g,h,i)perylene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	0.48 U	--	--	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U	1 U
Bis(2-Ethylhexyl)Phthalate	ug/L	8270C	9.6 UJ	9.6 U	2 J	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	3 J	--	--	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	2 U	2.1 U
Bis(2-chloroethoxy)methane	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	9.6 U	--	--	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	10 U	10 U
Butyl Benzyl Phthalate	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	9.6 U	--	--	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	10 U	10 U
Chrysene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	0.48 U	--	--	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U	1 U
Dibenz(a,h)anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	0.48 U	--	--	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U	1 U
Diethyl Phthalate	ug/L	8270C	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	9.6 U	--	--	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	10 U	10 U
Fluoranthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	0.48 U	--	--	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U	1 U
Fluorene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	0.48 U	--	--	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U	1 U
Indeno(1,2,3-c,d)pyrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	0.48 U	--	--	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U	1 U
Napthalene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	0.48 U	--	--	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U	1 U
Phenanthrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	0.48 U	--	--	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U	1 U
Phenol	ug/L	8270C	12	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	--	9.6 U	--	9.6 U	9.6 U	--	--	9.6 U	9.6 U	--	9.6 U	--	9.6 U	--	10 U	10 U
Pyrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	0.48 U	0.48 U	--	--	0.48 U	0.48 U	--	0.48 U	--	0.48 U	--	1 U	1 U
Metals																								
Aluminum	ug/L	6010B	315	25.7 UJ	20.3 UJ	33.9 UJ	28.1 UJ	11.4 J	7.8 J	14.7 J	18.7 J	29.5 UJ	34.1	12.5 UJ	23.5 UJ	12.7 UJ	18.3 UJ	50.6	45.5 UJ	70.7 UJ	31.8 UJ	28.5 UJ	100 U	100 U
Antimony	ug/L	6010B	4.2 UJ	60 U	2.7	5.9 UJ	2.5 UJ	2.3 UJ	6.5 UJ	2.3 UJ	3.5 UJ	7.2 UJ	7.2 UJ	7.3 UJ	3.1 UJ	60 U	2.9	60 U	60 U	60 U	60 U	4.2	10 U	10.U
Arsenic	ug/L	6010B	12 UJ	11.1	13.4	10 UJ	10 UJ	5.3 UJ	7 UJ	5.3 UJ	6.8 UJ	2.6	10 U	10 U	10 U	2.9 UJ	3.1 UJ	3 UJ	7.6	7.6	10.2 UJ	8.6 UJ	4.07	3.97
Barium	ug/L	6010B	48.4	44.1	43.1	41.5	40.5	41.6	41.5	40.3	40	45	44.5	42.5	44.1	41.2	40.1	39.7	37.5	38.7	50.4 J	52.4 J	39.1	39.1
Cadmium	ug/L	6010B	0.25 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	0.74 UJ	1.7	0.85 UJ	5 UJ	5 UJ	5 U	5 U	2 U	2 U
Calcium	ug/L	6010B	183000	177000	173000	176000	173000	188000	193000	187000	186000	191000	191000	188000	193000	182000	180000	171000	141000	148000	203000 J	207000 J	190000	188000
Chromium	ug/L	6010B	296	15.4	11.4	12.8	12.8	11.8	1.8	13.2	5.7	15.8	10.3	2	1.8	5.6	5.2	6	8.4	3.5 UJ	12.8	10 U	0.63 J	0.56 J
Cobalt	ug/L	6010B	3.9 UJ	50 U	50 U	50 U	50 U	0.71 UJ	0.66 UJ	0.56 UJ	0.54 UJ	0.9 UJ	0.96 UJ	0.74 UJ	0.47 UJ	0.45	0.48	0.55	0.71 UJ	0.62 UJ	50 UJ	50 U	0.7 J	0.73 J
Copper	ug/L	6010B	47.2	8.5	5	6	5.8	5.8 J	4.7	6.8 J	9.6	7.7	14.6	5.3	5.7	5.1 UJ	6.8 UJ	8.1 UJ	14.8	14.4	20.6 J	17.2	8.49 J	9.58 J
Iron	ug/L	6010B	3430	3660	3150	1100	1060	1030 J	894 J	1440 J	1190 J	516	495	458	394	509	490	556	32.8 J	25.9 J	70.1	11.5 UJ	50 U	50 U
Lead	ug/L	6010B	2.9 UJ	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	1.4	3 U	3.2 J	12.3 J	5.9	1.9 J	1.2	3 UJ	3 U	5 U	5 U
Magnesium	ug/L	6010B	94500	96100	95000	97600	95700	96400	99400	96400	96200	99700	100000	98600	100000	88600	88000	82000	66500	69300	106000	113000	97100	96900
Manganese	ug/L	6010B	829	799	768	688	663	714	729	710	706	725	722	712	723	717	707	659	7.1 UJ	8 UJ	121 J	141 J	356	387
Mercury	ug/L	7470A	0.2 U	0.33	0.15 UJ	0.036 J	0.017 J	0.15 J	0.081	0.064 J	0.15	0.021 J	0.2 U	0.2 U	0.019	1.4 J	1 J	0.9	0.13 J	0.11	0.35 J	0.27 J	0.5 U	0.5 U
Nickel	ug/L	6010B	54.2	19.3 J	6.9 J	12.8	12.2	18.4	17.6	18.4	16.7	18.6	17.3	14.6	18.3	13.3	11.8	13.2	7.6	7.8	15.7	17.1	8.56	8.97
Potassium	ug/L	6010B	5670	8690 J	8020 J	7090	6520	7150 J	7200 J	6630 J	6670 J	6790	6650	6190	6580	5090	4890	4370	15300	15800	7890 J	8360 J	4280	4200
Selenium	ug/L	6010B	15.3	5.7	8	11.9	10.9	15.1	14.3	13.8	14	21	17.6	18	19.5	18.5 J	20.3 J	19.2	23.7	29.4	23.5 UJ	30.4 UJ	24.2	24
Silver	ug/L	6010B	0.4	2.7 UJ	3 UJ	3.1 UJ	3.3 UJ	10 U	10 U	10 U	10 U	1.4 UJ	10 U	1.4 UJ	10 U	10 U	10 U	53.8	0.88 UJ	0.83 UJ	4.3 UJ	3.9 UJ	10 U	10 U
Sodium	ug/L	6010B	413000	399000	397000	413000	407000	430000	444000	433000	433000	411000	417000	413000	416000	373000	370000	347000	387000	404000	408000 J	436000 J	468000	470000
Thallium	ug/L	6010B	10 U	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	4.6 UJ	4.1 UJ	7.8	7.2	2 U	2 U
Vanadium	ug/L	6010B	8	0.98 UJ	0.8 UJ	1.3 UJ	1.3 UJ	3.4	2.9 UJ	3.7	3.8	3.4	4.1	4.9	4.3	4.4	4.9	4.8	15.3	15.4	12.9	12.7	12.1	12.1
Zinc	ug/L	6010B	26.4	6.6	115	24 J	6.3 J	2.7 UJ	2.9 UJ	14.4 J	7.4	4 J	5.6 J	5.4	6.1	2 J	2.9 J	13.5	6 J	22.2	20 UJ	20 UJ	5.98 UJ	5.79 UJ
Miscellaneous																								
pH	pH	9040	7	6.89	6.95	6.9	6.97	6.89	--	6.94	--	6.94	6.93	--	--	7.09	7.1	--	--	--	6.86	--	7.00	6.99
Chromium, hexavalent	ug/L	7199	--	--	--	--	--	1 U	--	1 U	--	1 U	--	--	--	1 U	--	--	--	--	--	--	--	

Table 3: Summary of Detected Analytes - Round 1 through Round 9 Groundwater Sampling - RSE Investigation

		WELL ID:	AA3-MW03			AA3-MW04									AA3-MW05							
		EPA ID:	LK261	LK297	LK346	LK258	LK329	LK359	LK384	LK418	LK451	LK482	LK515	LK544	LK243	LK324	LK355	LK378	LK412	LK446	LK498	LK513
		SAMPLE DATE:	12/4/2002	3/19/2003	11/11/2003	12/3/2002	3/28/2003	11/17/2003	4/5/2004	7/6/2004	10/7/204	2/18/2005	4/27/2005	2/6/2007	11/27/2002	3/27/2003	11/13/2003	4/1/2004	7/1/2004	10/6/2004	2/28/2005	4/27/2005
		SAMPLE TYPE:	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Filtered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered
Parameter		ROUND #:	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	Round 9	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8
Petroleum Hydrocarbons	**Units**	**Method**																				
Motor Oil	mg/L	8015B DRO	0.096 U	0.13 U	0.096 U	0.096 U	0.13 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	*1 U*	100 U	0.14 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.05 J
Diesel Fuel	mg/L	8015B DRO	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.008 J	0.096 U	0.096 U	*1 U*	0.096 U	0.1 U	0.096 U	0.096 U	0.01 J	0.096 U	0.096 U	0.06 J
Gasoline	mg/L	8015B DRO	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.02 J	0.04 J	0.1 U	0.1 U	0.1 U	0.1 U	*1 U*	0.1 U	0.1 U	0.03 J	0.03 J	0.1 U	0.02 J	0.1 U	0.1 U
VOCs																						
4-Methyl-2-Pentanone	ug/L	8260B	50 U	50 U	50 UJ	50 U	50 U	50 UJ	50 U	50 U	50 UJ	50 UJ	50 U	*50 U*	50 U	50 U	50 UJ	50 U	50 U	50 U	50 U	50 U
Chloroform	ug/L	8260B	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.11 U	0.1 U	0.1 U	0.1 U	*0.2 U*	0.1 U	0.1 U	0.1 U	0.11 U	0.11 U	0.1 U	0.1 U	0.1 U
2-Butanone (MEK)	ug/L	8260B	100 U	100 UJ	100 UJ	100 U	100 UJ	100 U	100 U	100 UJ	100 U	100 U	100 U	*100 U*	100 UJ	100 UJ	100 U	100 UJ	100 UJ	100 U	100 UJ	100 U
Methylene Chloride	ug/L	8260B	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 UJ	3 U	*3 U*	3 U	3 U	3 U	3 U	3 U	0.5 J	3 U	3 U
SVOCs																						
4-Methylphenol	ug/L	8270C	9.6 U	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	*10 U*	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Acenaphthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(a)anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(a)pyrene	ug/L	8270 SIM	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	*0.2 U*	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Benzo(b)fluoranthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Benzo(g,h,i)perylene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Bis(2-Ethylhexyl)Phthalate	ug/L	8270C	9.6 UJ	10 U	9.6 U	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	*2 U*	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Bis(2-chloroethoxy)methane	ug/L	8270C	9.6 UJ	10 U	9.6 U	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	*10 U*	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Butyl Benzyl Phthalate	ug/L	8270C	9.6 UJ	10 U	9.6 U	9.6 U	0.7 J	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	*10 U*	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Chrysene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Dibenz(a,h)anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Diethyl Phthalate	ug/L	8270C	9.6 U	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	*10 U*	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U
Fluoranthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Fluorene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Indeno(1,2,3-c,d)pyrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Napthalene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Phenanthrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Phenol	ug/L	8270C	9.6 U	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 UJ	9.6 U	*10 U*	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 UJ
Pyrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Metals																						
Aluminum	ug/L	6010B	18.4 J	200 U	9.4 UJ	31.4	36.6	31.2 UJ	6 J	19.6 UJ	23.4 J	39.4 UJ	35.3 UJ	*100 U*	120 J	141	43.1 UJ	33	42.4 UJ	96.4	59.8 J	159
Antimony	ug/L	6010B	60 U	60 U	60 UJ	3.2 UJ	60 U	60 U	5 UJ	60 U	3.7	60 U	60 U	*10 U*	60 U	60 U	60 U	60 UJ	60 U	4.7	60 U	60 U
Arsenic	ug/L	6010B	5.9 UJ	7.2 UJ	6.2 UJ	19.1	22.8	24.5	22.3 UJ	24.6	26	24.2	14.7 J	*26.3*	7.8 UJ	7.8	6.6	7.3	4.7	8.5 UJ	5.6	6.1
Barium	ug/L	6010B	23.9	21.6	19.6	30.3	30	31.2	27.4	33	31.5	31.3	27.2	*32*	23.2	24.3	23.2	18.8	22.3	22.1	26.5	19.8
Cadmium	ug/L	6010B	0.22 UJ	5 U	5 U	0.49 UJ	5 U	0.4 UJ	0.39 UJ	5 U	0.24 UJ	0.57 UJ	5 U	*2 U*	0.45 UJ	5 U	5 U	0.62 J	5 U	0.42 UJ	0.16 UJ	5 U
Calcium	ug/L	6010B	180000	173000	163000	191000	192000	196000	189000	205000	190000	208000	192000	*188000*	129000	134000	138000	122000	143000	137000	149000	92500
Chromium	ug/L	6010B	5.2	0.68 UJ	27.5	20.1	4.7	2	1.3	1.2	4.8 J	3.5	5.1	*1.64 J*	2 UJ	4.6	1.9 UJ	0.79 J	1.6 J	2.1	1.9	1 J
Cobalt	ug/L	6010B	0.37 UJ	50 U	0.39 UJ	0.36 UJ	50 U	50 U	50 U	0.59 UJ	0.32 UJ	1.7 UJ	50 U	*5 U*	0.84 UJ	50 U	50 U	50 U	50 U	50 U	0.44 UJ	50 U
Copper	ug/L	6010B	5 UJ	2	3.1 UJ	15.2	6.1	5 UJ	3.8 J	12.6 UJ	5.9 J	5.6	13.6	*2.5 J*	2.7 UJ	4.8	4.3 UJ	5	6.8 UJ	8	2.7 UJ	2.3 J
Iron	ug/L	6010B	38.9 UJ	100 U	143 J	258	430	100 U	20 J	37.3 J	102 J	37.2 UJ	42.2 UJ	*50 U*	181	199	46.5 UJ	42.8 J	45.9 J	120	37.1 UJ	217
Lead	ug/L	6010B	3.8	3 U	3 U	3.3 UJ	3 UJ	3 U	2.9 UJ	2.5	1.9 UJ	3 U	3 U	*5 U*	3 U	3 UJ	1.3 UJ	2.5	2.4 UJ	3 U	3 U	3 U
Magnesium	ug/L	6010B	83000	83000	76000	110000	112000	108000	106000	111000	107000	114000	108000	*105000*	69700	73600	77600	65400	78400	75400	78300	48600
Manganese	ug/L	6010B	12.9 J	7.6	11	59.7	53.3	27.3	26.1	30	21.5	22.1	4.8	*5.43*	60.5	11.5	10.9	3.8	7.5	7.8	1.9 UJ	40.1
Mercury	ug/L	7470A	0.037 J	0.067	0.087 J	0.098	0.15	0.2 U	0.08 J	0.076	0.85 J	0.29 J	0.28 J	*0.5 U*	0.021	0.18	0.013	0.028 J	0.047 J	0.63	0.24 J	0.44 J
Nickel	ug/L	6010B	4.8 UJ	6.1 UJ	14.2	31.1	23.3 UJ	10.9	33.8	33	17.1	81.9	32.8	*10.9*	4.9 UJ	2.8 UJ	1.8 UJ	0.95 UJ	1.4 UJ	1.2	40 U	1.2 UJ
Potassium	ug/L	6010B	5750	6620	5880	3100	3300	3090	3060	3440	3040	3940	3000	*2080*	7810	5260	5020	4640	5440	4810	4980	3840
Selenium	ug/L	6010B	35.8	49.9	30.6	12.4	19.2	17.5 UJ	12.7 J	18.1	17 UJ	12.8 UJ	35.2	*22.9*	21.6	27.6	32.4	26.5	37.2	33.2 UJ	28.6	17 UJ
Silver	ug/L	6010B	1	2.6 UJ	2.6 UJ	0.53	2 UJ	1.7 UJ	10 U	1.6 UJ	3.6 J	10 U	2.8	*10 U*	10 U	1.9 UJ	1.7 UJ	10 UJ	1.3 UJ	0.64 J	10 U	10 U
Sodium	ug/L	6010B	303000	302000	315000	386000	389000	387000	462000	394000	400000	441000	393000	*447000*	464000	413000	426000	454000	466000	458000	477000	361000
Thallium	ug/L	6010B	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	5.1 UJ	10 U	*2 U*	8 UJ	10 U	10 U	10 U	10 U	10 U	2.9	10 U
Vanadium	ug/L	6010B	15.8	14.2	15	43.6	37.1	42	39.7	44.4	41.9	55.3	57.5	*54.4*	19.7	21.3	21.4	18.3	22.1	21.3	24.1	20.7
Zinc	ug/L	6010B	20 J	20 U	15.1 J	20.9	11.8	30.9	2.3 UJ	9.1 J	11.9 J	10.2 J	20 U	*14*	9 UJ	40.8	14.2	4.4 UJ	5 J	14.3	2.8 UJ	32
Miscellaneous																						
pH	pH	9040	6.89	6.86	6.82	6.84	6.85	6.91	6.8	6.89	6.86	--	6.84	*7.02*	7.12	7.17	6.97	7.01	7.03	6.96	--	7.39
Chromium, hexavalent	ug/L	7199	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 3: Summary of Detected Analytes - Round 1 through Round 9 Groundwater Sampling - RSE Investigation

		WELL ID:	AA3-MW06																	
		EPA ID:	LK240	LK299	LK347	LK389	LK390	LK409	LK410	LK411	LK441	LK442	LK443	LK500	LK501	LK502	LK503	LK533	LK534	LK555
		SAMPLE DATE:	11/26/2002	3/20/2003	11/11/2003	4/6/2004	4/6/2004	7/1/2004	7/1/2004	7/1/2004	10/6/2004	10/6/2004	10/6/2004	2/28/2005	2/28/2005	2/28/2005	2/28/2005	4/29/2005	4/29/2005	2/9/2007
		SAMPLE TYPE:	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Filtered	Regular Unfiltered	Regular Unfiltered	Regular Filtered	Regular Unfiltered	Regular Unfiltered	Regular Filtered	Regular Unfiltered	Regular Unfiltered	Regular Filtered	Duplicate Filtered	Regular Unfiltered	Regular Filtered	Regular Filtered
Parameter		ROUND #:	Round 1	Round 2	Round 3	Round 4		Round 5			Round 6			Round 7				Round 8		Round 9
Petroleum Hydrocarbons	**Units**	**Method**																		
Motor Oil	mg/L	8015B DRO	0.096 U	0.13 U	0.096 U	0.096 U	--	0.01 J	--	--	0.096 U	--	--	0.1	--	--	--	0.07 J	--	1 U
Diesel Fuel	mg/L	8015B DRO	0.096 U	0.096 U	0.096 U	0.096 U	--	0.01 J	--	--	0.01 J	--	--	0.2	--	--	--	0.096 U	--	1 U
Gasoline	mg/L	8015B DRO	0.1 U	0.1 U	0.1 U	0.03 J	--	0.1 U	--	--	0.1 U	--	--	0.1 U	--	--	--	0.1 U	--	1 U
VOCs																				
4-Methyl-2-Pentanone	ug/L	8260B	50 U	0.5 J	50 UJ	50 UJ	--	50 U	--	--	50 U	--	--	50 U	--	--	--	50 U	--	50 U
Chloroform	ug/L	8260B	0.1 U	0.1 U	0.1 U	0.11 U	--	0.11 U	--	--	0.1 U	--	--	0.95 J	--	--	--	0.1 U	--	0.2 U
2-Butanone (MEK)	ug/L	8260B	100 UJ	100 UJ	100 UJ	100 UJ	--	100 UJ	--	--	100 U	--	--	100 UJ	--	--	--	100 U	--	100 U
Methylene Chloride	ug/L	8260B	3 UJ	3 U	3 U	3 UJ	--	3 U	--	--	3 U	--	--	3 U	--	--	--	3 UJ	--	3 U
SVOCs																				
4-Methylphenol	ug/L	8270C	9.6 U	10 U	9.6 U	9.6 U	--	9.6 U	--	--	9.6 U	--	--	9.6 U	--	--	--	9.6 U	--	10 U
Acenaphthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--	1 U
Anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--	1 U
Benzo(a)anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--	1 U
Benzo(a)pyrene	ug/L	8270 SIM	0.19 U	0.19 U	0.19 U	0.19 U	--	0.19 U	--	--	0.19 U	--	--	0.19 U	--	--	--	0.19 U	--	0.2 U
Benzo(b)fluoranthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--	1 U
Benzo(g,h,i)perylene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--	1 U
Bis(2-Ethylhexyl)Phthalate	ug/L	8270C	9.6 UJ	10 U	9.6 U	9.6 U	--	9.6 U	--	--	9.6 U	--	--	9.6 U	--	--	--	9.6 U	--	2 U
Bis(2-chloroethoxy)methane	ug/L	8270C	9.6 UJ	10 U	9.6 U	9.6 U	--	9.6 U	--	--	9.6 U	--	--	9.6 U	--	--	--	9.6 U	--	10 U
Butyl Benzyl Phthalate	ug/L	8270C	9.6 UJ	10 U	9.6 U	9.6 U	--	9.6 U	--	--	9.6 U	--	--	9.6 U	--	--	--	9.6 U	--	10 U
Chrysene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--	1 U
Dibenz(a,h)anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--	1 U
Diethyl Phthalate	ug/L	8270C	9.6 U	10 U	9.6 U	9.6 U	--	9.6 U	--	--	9.6 U	--	--	9.6 U	--	--	--	9.6 U	--	10 U
Fluoranthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--	1 U
Fluorene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--	1 U
Indeno(1,2,3-c,d)pyrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--	1 U
Napthalene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--	1 U
Phenanthrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--	10 U
Phenol	ug/L	8270C	9.6 U	10 U	9.6 U	9.6 U	--	9.6 U	--	--	9.6 U	--	--	9.6 U	--	--	--	9.6 U	--	1 U
Pyrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	--	0.48 U	--	--	0.48 U	--	--	0.48 U	--	--	--	0.48 U	--	1 U
Metals																				
Aluminum	ug/L	6010B	101 J	53.5 UJ	21.4 UJ	76.1	11.1 J	575	--	35 UJ	25.3 J	--	3.7 J	121 J	--	15.6 J	12.3 J	165	28.7 UJ	100 U
Antimony	ug/L	6010B	60 U	60 U	60 UJ	4.1 UJ	60 U	60 U	--	4.2 UJ	5.7	--	3.7	60 U	--	60 U	60 U	9.7	60 U	10 U
Arsenic	ug/L	6010B	2.4	12.4 UJ	4.5 UJ	9.9 UJ	10.1 UJ	4.5	--	9.1	8.5 UJ	--	5.7 UJ	5.5	--	5.6	6.3	10 U	10 U	5.66
Barium	ug/L	6010B	24.1	29.8	21.9	26 UJ	23.4 UJ	38.8	--	23.5	23.6	--	23.2	30.5	--	29.2	29.9	34.1 J	30 J	33
Cadmium	ug/L	6010B	0.47 UJ	5 UJ	0.25 UJ	0.31 J	0.35	0.55 UJ	--	0.31 UJ	0.29 UJ	--	0.3 UJ	0.57 UJ	--	0.53 UJ	0.67 UJ	5 U	5 U	2 U
Calcium	ug/L	6010B	205000	225000	203000	219000	217000	213000	--	208000	203000	--	207000	208000	--	213000	212000	150000 J	149000 J	202000
Chromium	ug/L	6010B	1.8	3.8 UJ	4.1 J	7.6	2.2	4.3 J	--	1.9 J	3.4	--	1.7	3.2	--	2.1	1.9	3.4 J	3 J	0.77 J
Cobalt	ug/L	6010B	50 U	50 UJ	50 U	50 U	50 U	0.75 UJ	--	50 U	50 U	--	50 U	1.2 UJ	--	1.2 UJ	1.1 UJ	50 UJ	50 UJ	5 U
Copper	ug/L	6010B	2.2 UJ	3.2 UJ	4.4 UJ	7.1 J	4.5	7.7 UJ	--	8 UJ	3.6	--	3.3	9.9 UJ	--	8.4 UJ	11 UJ	11.7	10.2	1.02 J
Iron	ug/L	6010B	79.1 UJ	54.2 UJ	26.3 UJ	611 J	73 J	495	--	15.1 UJ	33.2 J	--	10.7 J	120	--	22.3 UJ	23.4 UJ	155	25.8 UJ	50 U
Lead	ug/L	6010B	3 U	3 U	3 U	3 U	1.5 UJ	3 U	--	1.6 UJ	3 U	--	3 U	3 U	--	3 U	0.98 UJ	3 U	4.5	5 U
Magnesium	ug/L	6010B	98300	106000	101000	104000	105000	103000	--	101000	101000	--	99800	101000	--	101000	101000	74000	75000	92600
Manganese	ug/L	6010B	24	30.7	2.4 UJ	10.9	2.4	16.8	--	0.7	0.88 J	--	15 U	284	--	290	274	16.3 J	10.3 J	5 U
Mercury	ug/L	7470A	0.2 U	0.2	0.057 J	0.12 J	0.12	0.035 J	--	0.036 J	0.57 J	--	0.57 J	0.19 J	--	0.13 J	0.15 J	0.29 J	0.48 J	0.5 U
Nickel	ug/L	6010B	2.9 UJ	3.6 UJ	5.4 UJ	2.1 UJ	2.4 UJ	2.9 UJ	--	1.8 UJ	2.4	--	1.6	5.8	--	5.3	5.6	6.2	3.9 J	1.48
Potassium	ug/L	6010B	5350	5540 J	4810	5050 J	5100 J	5120	--	4910	5020	--	4720	5990	--	6020	5930	3060 J	2910 J	3520
Selenium	ug/L	6010B	26	28.2	18.1	23.2	22.7	26.1	--	26.4	28.5 UJ	--	30.7 UJ	5 U	--	5 U	5 U	11.2 UJ	15 UJ	23.2
Silver	ug/L	6010B	10 U	10 UJ	2.5 UJ	10 U	10 U	2.2 UJ	--	1.7 UJ	3.1 J	--	10 UJ	10 U	--	10 U	0.97	2.1 UJ	2.7 UJ	10 U
Sodium	ug/L	6010B	358000	406000	389000	390000	401000	380000	--	375000	376000	--	377000	248000	--	252000	251000	188000 J	190000 J	389000
Thallium	ug/L	6010B	6.6 UJ	5.7	10 U	10 U	10 UJ	10 U	--	10 U	10 U	--	10 U	5.3	--	2.8	3.4	10 U	10 U	2 U
Vanadium	ug/L	6010B	17.2	18.9	18.2	21.3	19.5	22.9	--	19.4	19.6	--	18.4	21.5	--	21.3	21.2	16.3	15.9	22.2
Zinc	ug/L	6010B	11.2 UJ	5.9 UJ	16 J	7.5 J	14.9	12.9 J	--	10.8 J	14.3 J	--	11.5 J	4.2 UJ	--	3.4 UJ	4.8 UJ	13 J	2.3 J	8.05 UJ
Miscellaneous																				
pH	pH	9040	6.78	6.71	6.76	6.84	--	6.86	--	--	6.63	--	--	--	--	--	--	6.97	--	6.98
Chromium, hexavalent	ug/L	7199	--	--	--	0.24	--	0.6	0.54	--	0.25 J	0.24	--	1 U	1 U	--	--	0.23	--	--

Table 3: Summary of Detected Analytes - Round 1 through Round 9 Groundwater Sampling - RSE Investigation

		WELL ID:	AA3-MW07								AA3-MW08												
		EPA ID:	LK237	LK325	LK358	LK381	LK415	LK449	LK480	LK514	LK255	LK337	LK338	LK364	LK365	LK385	LK386	LK424	LK452	LK495	LK528	LK529	LK551
		SAMPLE DATE:	11/26/2002	3/27/2003	11/17/2003	4/2/2004	7/2/2004	10/7/2004	2/18/2005	4/27/2005	12/3/2002	4/2/2003	4/2/2003	11/18/2003	11/18/2003	4/5/2004	4/5/2004	7/7/2004	10/7/2004	2/25/2005	4/29/2005	4/29/2005	2/8/2007
		SAMPLE TYPE:	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Duplicate Unfiltered	Regular Unfiltered	Duplicate Unfiltered	Regular Unfiltered	Duplicate Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Duplicate Unfiltered	Regular Filtered
Parameter		ROUND #:	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	Round 1	Round 2		Round 3		Round 4		Round 5	Round 6	Round 7	Round 8		Round 9
Petroleum Hydrocarbons	**Units**	**Method**																					
Motor Oil	mg/L	8015B DRO	0.096 U	0.14 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.13 U	0.13 U	0.096 U	0.096 U	0.02 J	0.096 U	0.096 U	0.096 U	0.096 U	1 U
Diesel Fuel	mg/L	8015B DRO	0.096 U	0.1 U	0.096 U	0.096 U	0.007 J	0.096 U	0.096 U	0.096 U	0.008 J	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.02 J	0.096 U	0.096 U	0.096 U	0.096 U	1 U
Gasoline	mg/L	8015B DRO	0.1 U	0.1 U	0.03 J	0.02 J	0.1 U	0.02 J	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.04 J	0.1 U	0.1 U	0.03 J	0.1 U	0.1 U	0.1 U	1 U
VOCs																							
4-Methyl-2-Pentanone	ug/L	8260B	50 U	50 U	50 UJ	50 U	50 U	50 U	50 UJ	50 U	50 U	50 U	50 U	50 UJ	50 UJ	50 U	50 U	50 U	50 UJ	50 UJ	50 U	50 U	50 U
Chloroform	ug/L	8260B	0.1 U	0.1 U	0.1 U	0.11 U	0.11 U	0.1 U	0.1 U	0.1 U	0.61	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.11 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U
2-Butanone (MEK)	ug/L	8260B	100 UJ	100 UJ	100 U	100 U	100 UJ	100 U	100 U	100 U	100 U	100 UJ	100 UJ	100 UJ	100 UJ	100 U	100 U	100 UJ	1 J	100 U	100 U	100 U	100 U
Methylene Chloride	ug/L	8260B	3 U	3 U	3 U	3 U	3 UJ	3 U	3 UJ	3 UJ	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
SVOCs																							
4-Methylphenol	ug/L	8270C	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	11 U
Acenaphthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	1 U
Anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	1 U
Benzo(a)anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.04 J	0.48 U	0.48 U	1 U
Benzo(a)pyrene	ug/L	8270 SIM	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.46	0.19 U	0.19 U	0.21 U
Benzo(b)fluoranthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.6	0.48 U	0.48 U	1 U
Benzo(g,h,i)perylene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.4 J	0.48 U	0.48 U	1 U
Bis(2-Ethylhexyl)Phthalate	ug/L	8270C	10 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	2.1 U
Bis(2-chloroethoxy)methane	ug/L	8270C	10 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	11 U
Butyl Benzyl Phthalate	ug/L	8270C	10 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	11 U
Chrysene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.04 J	0.48 U	0.48 U	1 U
Dibenz(a,h)anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.1 J	0.48 U	0.48 U	1 U
Diethyl Phthalate	ug/L	8270C	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	2 J	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	11 U
Fluoranthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	1 U
Fluorene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	1 U
Indeno(1,2,3-c,d)pyrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.4 J	0.48 U	0.48 U	1 U
Napthalene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.4 J	0.48 U	0.48 U	1 U
Phenanthrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	1 U
Phenol	ug/L	8270C	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	11 U
Pyrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	1 U
Metals																							
Aluminum	ug/L	6010B	302	169	370	56.6 UJ	1700	72.8	39.4 UJ	115 UJ	287	82 UJ	70.3 UJ	213	279	196	159	293	211	91	181	369	100 U
Antimony	ug/L	6010B	60 U	60 U	3.2	60 U	3.6 UJ	60 U	60 U	60 U	2.8 UJ	2.9	60 U	6.7 UJ	6.3 UJ	60 U	60 U	4.8 UJ	4	60 U	60 U	60 U	10 U
Arsenic	ug/L	6010B	3.6	8	4.6	10 U	7 UJ	7.7 UJ	4.4	4.3 UJ	4.7 UJ	10 U	4.9	10 UJ	10 UJ	4.3 UJ	6.6 UJ	10 U	6.7 UJ	2.8	8.1 UJ	7.8 J	2.5
Barium	ug/L	6010B	52.7	53.3	71.3	57.8	230	53	55.7	78 J	39.5	18.6	18.5	18.3	18.4	16.4	16.2	19.7	19.2	19.7	19.9 J	21 J	21.1
Cadmium	ug/L	6010B	0.98 UJ	0.71 UJ	0.84 UJ	0.68 UJ	1.6 UJ	1.1 UJ	0.4 UJ	5 U	0.28 UJ	5 U	5 U	5 U	0.26 UJ	0.38 UJ	0.42 UJ	5 U	0.2 UJ	5 UJ	5 U	5 U	2 U
Calcium	ug/L	6010B	243000	238000	244000	261000	250000	236000	221000	172000	96800	92000	91900	89700	89200	92300	92400	100000	99200	110000	117000	114000	110000
Chromium	ug/L	6010B	11	4	3.7	1.1	6.8	1.2 UJ	1.3	2.8 UJ	5.3	3.3	3	1.5	2.6	0.78	0.82	1.6 J	1.6 J	2.2 UJ	10 UJ	10 UJ	5 U
Cobalt	ug/L	6010B	0.82 UJ	50 U	50 U	50 U	2.4 UJ	50 U	0.55 UJ	50 U	0.59 UJ	50 U	50 U	50 U	50 U	50 U	0.5 UJ	50 U	50 U	0.76 UJ	50 UJ	0.82 J	5 U
Copper	ug/L	6010B	6.7 UJ	7.8	5.1 UJ	5.2	8.7 UJ	6.5 J	2.1	3.1	6.6	3.3	1.9	3.5	3.4	3.6 J	4.8 J	5.2	2.2 J	2.1	2.7	2.8	10 U
Iron	ug/L	6010B	430	244	421	41.4 UJ	3400	114 J	33.9 UJ	76.3	381	92.9	178	297	375	229	178	274	348	96.3	204	410	50 U
Lead	ug/L	6010B	0.84 J	3 UJ	3 U	3 U	1.7	3.1 UJ	3 U	1.8	2.3 UJ	3 U	3 U	2 UJ	0.98 UJ	5 UJ	5.9 UJ	1.5	2.2 UJ	3 U	3 U	3 U	5 U
Magnesium	ug/L	6010B	99900	104000	99600	111000	99300	102000	85600	67700	52400	49500	50000	49300	49900	48500	48600	53000	53100	56900	65400	64000	56400
Manganese	ug/L	6010B	71.5	54.2	104	91.9	275	156	12.3	9 J	145	160	164	197	218	150	150	73.7 J	195	109	245 J	275 J	308
Mercury	ug/L	7470A	0.027 J	0.17	0.014	0.074 J	0.064 J	0.58 J	0.29 J	0.37 J	0.12	0.18	0.12 UJ	0.1 J	0.061 J	0.094 J	0.12 J	0.027 J	0.7 J	0.47 J	0.31 J	0.32 J	0.5 U
Nickel	ug/L	6010B	12.6 J	9.7 UJ	12.2	12.3	25	19.1	4.2	2.1 UJ	5.2 UJ	1.9 UJ	1.6 UJ	8.9	1.3 UJ	1.8 UJ	1.9 UJ	1.3	1.8 J	2.3 UJ	1.3 J	1.6 J	1.73
Potassium	ug/L	6010B	5800	3800	3440	3690 J	4380	3270	3770	2860 J	11100	5120 J	5090 J	3920	3970	3950	3860	3880	4120	4570	5080 J	4910 J	2600
Selenium	ug/L	6010B	33.2	32.8	34.3	39.4	31.9	38 UJ	25.2 UJ	19.6	4.8 J	5 U	3.8	5.3 UJ	2.8 UJ	5 UJ	5 UJ	4.2 UJ	7 UJ	5 U	12.2 UJ	12.9 UJ	4.61 J
Silver	ug/L	6010B	10 U	2.8 UJ	2.7 UJ	1.7 UJ	1.9 UJ	1.5 J	10 U	3.4	10 U	1.5 UJ	0.98 UJ	2.4 UJ	2.2 UJ	10 U	10 U	10 U	1.4 J	0.96 UJ	2.5 UJ	2.3 UJ	10 U
Sodium	ug/L	6010B	371000	361000	355000	377000	353000	375000	353000	288000	364000	369000	369000	371000	378000	436000	433000	392000	410000	435000	499000 J	483000 J	431000
Thallium	ug/L	6010B	6.8 UJ	10 U	10 U	10 U	10 U	10 U	3.6 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	3.6 UJ	3.1	5.5	2 U
Vanadium	ug/L	6010B	18.3	20.3	22.8	23.1 J	31.5	21.2	19.5	18.2 J	5.7	1.9 UJ	1.9 UJ	3.4 UJ	3 UJ	2.8 UJ	2.7 UJ	3.2	2.3	2.2	2.8	3.8	2.04 J
Zinc	ug/L	6010B	48.3 J	40.8	27.5	20 U	19.3 J	14.5 J	8.3 J	20 U	19.8	36.6	6.8	28.7 J	31.8 J	3.4 UJ	32.4	5.3 J	13.3 J	17.2 J	20 UJ	1.3 J	5.2 UJ
Miscellaneous																							
pH	pH	9040	6.7	6.96	6.81	6.8	7	6.84	--	7.01	7.28	7.19	7.16	7.11	7.08	7.03	7.06	7.15	7.05	--	7.03	7.08	7.18
Chromium, hexavalent	ug/L	7199	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 3: Summary of Detected Analytes - Round 1 through Round 9 Groundwater Sampling - RSE Investigation

		WELL ID:	AA3-MW09A									AA3-MW09B								
		EPA ID:	LK246	LK319	LK351	LK374	LK405	LK437	LK491	LK508	LK540	LK249	LK320	LK354	LK375	LK406	LK438	LK493	LK509	LK541
		SAMPLE DATE:	11/27/2002	3/26/2003	11/12/2003	3/31/2004	6/30/2004	10/5/2004	2/24/2005	4/26/2005	2/6/2007	11/27/2002	3/26/2003	11/13/2003	3/31/2004	6/30/2004	10/5/2004	2/25/2005	4/26/2005	2/6/2007
		SAMPLE TYPE:	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Filtered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Filtered
Parameter		ROUND #:	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	Round 9	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	Round 9
Petroleum Hydrocarbons	**Units**	**Method**																		
Motor Oil	mg/L	8015B DRO	100 U	0.14 U	0.13 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	*1 U*	100 U	0.14 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	*1 U*
Diesel Fuel	mg/L	8015B DRO	0.096 U	0.1 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	*1 U*	0.096 U	0.1 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	*1 U*
Gasoline	mg/L	8015B DRO	0.1 U	0.1 U	0.02 J	0.03 J	0.1 U	0.1 U	0.1 U	0.1 U	*1 U*	0.1 U	0.1 U	0.02 J	0.02 J	0.1 U	0.1 U	0.1 U	0.1 U	*1 U*
VOCs																				
4-Methyl-2-Pentanone	ug/L	8260B	50 U	50 U	50 UJ	50 U	50 U	50 U	50 U	50 U	*50 U*	50 U	50 U	50 UJ	50 U	50 U	50 U	50 UJ	50 U	*50 U*
Chloroform	ug/L	8260B	0.1 U	0.1 U	0.1 U	0.11 U	0.11 U	0.1 U	0.1 U	0.1 U	*0.2 U*	0.1 U	0.1 U	0.1 U	0.11 U	0.11 U	0.1 U	0.1 U	0.1 U	*0.2 U*
2-Butanone (MEK)	ug/L	8260B	100 UJ	100 UJ	100 UJ	100 UJ	100 UJ	100 U	100 UJ	100 U	*100 U*	100 UJ	100 UJ	100 U	100 UJ	100 UJ	100 U	100 U	100 U	*100 U*
Methylene Chloride	ug/L	8260B	3 U	3 U	3 U	3 U	3 UJ	3 U	3 U	3 UJ	*3 U*	3 U	3 U	3 U	3 U	3 UJ	3 U	3 U	3 UJ	*3 U*
SVOCs																				
4-Methylphenol	ug/L	8270C	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	*10 U*	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	*10 U*
Acenaphthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*
Anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*
Benzo(a)anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*
Benzo(a)pyrene	ug/L	8270 SIM	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	*0.2 U*	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	*0.2 U*
Benzo(b)fluoranthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1.0 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*
Benzo(g,h,i)perylene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1.0 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*
Bis(2-Ethylhexyl)Phthalate	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	*2 U*	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	*2 U*
Bis(2-chloroethoxy)methane	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	*10 U*	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	*10 U*
Butyl Benzyl Phthalate	ug/L	8270C	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	*10 U*	9.6 UJ	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	*10 U*
Chrysene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*
Dibenz(a,h)anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*
Diethyl Phthalate	ug/L	8270C	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	*10 U*	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	*10 U*
Fluoranthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*
Fluorene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*
Indeno(1,2,3-c,d)pyrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*
Napthalene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*
Phenanthrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*
Phenol	ug/L	8270C	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	*10 U*	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	*10 U*
Pyrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	*1 U*
Metals																				
Aluminum	ug/L	6010B	195	297	413	248	183	131	654	309	*100 U*	204	156	179	66.6	12.1 J	365	76.7 UJ	70.6 UJ	*100 U*
Antimony	ug/L	6010B	60 U	60 U	60 UJ	60 UJ	2.4 UJ	9	60 U	60 U	*10 U*	60 U	60 U	60 U	60 UJ	60 U	60 U	60 U	60 U	*10 U*
Arsenic	ug/L	6010B	9.9 UJ	7.4 J	9.4 UJ	5.7	3.8	6.6 UJ	9.5	8.5	*6.18*	7.9 UJ	4.6	5.7	3.7	4	8 UJ	3.4	4.7	*4.17*
Barium	ug/L	6010B	50.1	60.4	62.6	61.5	67.2	29.5	51.8	47.3	*69.2*	36.4	29.8	29.6	25.3	28.7	63.1	28	25.9	*27.8*
Cadmium	ug/L	6010B	0.33 UJ	0.34 UJ	0.27 UJ	5 U	5 U	5 U	5 UJ	5 U	*2 U*	0.4 UJ	0.54 UJ	5 U	5 U	0.31 UJ	0.39 UJ	5 UJ	5 UJ	*2 U*
Calcium	ug/L	6010B	116000	116000	135000	147000	165000	134000	114000	105000	*191000*	114000	118000	126000	120000	135000	155000	135000	139000	*138000*
Chromium	ug/L	6010B	1.9 UJ	2 UJ	3 J	0.82 J	0.81 J	1.1 UJ	2.4 UJ	10 U	*5 U*	3.1 UJ	2.6 UJ	5.7	0.83 J	10 U	1.3 UJ	1.9 UJ	10 U	*5 U*
Cobalt	ug/L	6010B	0.8 UJ	50 U	0.4 UJ	50 U	50 U	0.37 UJ	0.83 UJ	50 UJ	*5 U*	0.61 UJ	50 U	50 U	50 U	50 U	50 U	0.46 UJ	50 U	*5 U*
Copper	ug/L	6010B	4.2 UJ	1.7	4.3 UJ	5.3 J	12.1 UJ	2.4	2.3 J	25 U	*1.48 J*	2.6 UJ	25 U	3.8 UJ	5.8 J	9.9 UJ	5.6	1.9	25 U	*0.54 J*
Iron	ug/L	6010B	263	384	617	380	254	300	889	449	*50 U*	545	439	494	183	54.5 J	500	124	148	*50 U*
Lead	ug/L	6010B	0.92 UJ	3 U	2 UJ	3 U	3 UJ	2.1 UJ	1 J	3 U	*5 U*	1.4 UJ	3 U	3 U	3 U	3 UJ	1.6 UJ	3 U	3 U	*5 U*
Magnesium	ug/L	6010B	42500	42400	53200	54400	57900	72200	42200	38700	*67300*	62500	64000	70800	62900	67800	58900	71100	76300	*71900*
Manganese	ug/L	6010B	20.5	7.1	10.7	10.5	5.3 UJ	6	19	15.2 UJ	*2.95 J*	8.9	6.1	5.1 UJ	3.7 UJ	2.8 UJ	9.5	9.4	11 UJ	*5.55*
Mercury	ug/L	7470A	0.05 J	0.2	0.21 J	0.046 J	0.15 J	0.55	0.21 J	1	*0.5 U*	0.038 J	0.19	0.013	0.03 J	0.16 J	0.73	0.29 J	0.77	*0.5 U*
Nickel	ug/L	6010B	3.8 UJ	2	3.1 UJ	1.1 UJ	1 UJ	1.8	1.3 UJ	40 UJ	*2.72*	5.1 UJ	2.4	2.3 UJ	4.3	1.2 UJ	1	0.77 UJ	40 UJ	*0.62 J*
Potassium	ug/L	6010B	4190	3770 J	3820	3940	4190	3330	4090	3240	*2720*	3520	3020 J	3050	2870	3190	4090	3140	3340	*1930*
Selenium	ug/L	6010B	13.3	14.6 UJ	17.5	21.6	29.9	7.1 UJ	11.6 UJ	11.6 UJ	*35.9*	7.5 J	7.9 UJ	5.4 UJ	5 UJ	8.1 UJ	30.3 UJ	5 U	6.1 UJ	*6.75 J*
Silver	ug/L	6010B	10 U	10 U	0.81 UJ	10 UJ	1.2 UJ	0.98 J	10 U	10 U	*10 U*	10 U	10 U	1.6 UJ	10 UJ	10 U	18.1	0.93 UJ	10 U	*10 U*
Sodium	ug/L	6010B	329000	336000 J	380000	424000	404000	400000	334000	298000	*460000*	413000	406000 J	371000	412000	394000	400000	421000	423000	*418000*
Thallium	ug/L	6010B	7.1 UJ	10 UJ	10 U	10 U	10 U	10 U	3.7 UJ	10 U	*2 U*	9.5 UJ	1.6 J	10 U	10 U	10 U	10 U	4.2 UJ	10 U	*2 U*
Vanadium	ug/L	6010B	33.9	32.9	26.9	27.4	28	13.8	40.5	29.9	*25.8*	15.4	14.7	14.9	13.1	13.5	26.8	13.1	12.4	*13.4*
Zinc	ug/L	6010B	10.3 UJ	9.3	16.8 J	3.1 UJ	4 J	11.3	6.9 J	2.7 UJ	*10 U*	11.4 UJ	8.9	17.7	3.7 UJ	2.8 J	14	5.4 J	4.7 UJ	*10 U*
Miscellaneous																				
pH	pH	9040	7.25	7.26	7.06	7	7.07	6.84	–	7.12	*7.06*	7.21	7.16	6.88	7	7.12	6.79	–	7.02	*7.13*
Chromium, hexavalent	ug/L	7199	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Table 3: Summary of Detected Analytes - Round 1 through Round 9 Groundwater Sampling - RSE Investigation

		WELL ID:	AA3-MW10										AA3-MW11					AA3-MW12						
		EPA ID:	LK252	LK253	LK301	LK350	LK373	LK402	LK436	LK478	LK512	LK539	LK466	LK467	LK520	LK521	LK546	LK469	LK472	LK530	LK532	LK531	LK552	LK553
		SAMPLE DATE:	12/2/2002	12/2/2002	3/20/2003	11/12/2003	3/30/2004	6/29/2004	10/5/2004	2/17/2005	4/27/2005	2/5/2007	2/15/2005	2/15/2005	4/28/2005	4/28/2005	2/7/2007	2/16/2005	2/16/2005	4/29/2005	4/29/2005	4/29/2005	2/8/2007	2/8/2007
		SAMPLE TYPE:	Regular Unfiltered	Duplicate Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Unfiltered	Regular Filtered	Regular Unfiltered	Regular Filtered	Regular Unfiltered	Regular Filtered	Regular Filtered	Regular Unfiltered	Regular Filtered	Regular Unfiltered	Duplicate Unfiltered	Regular Filtered	Regular Filtered	Duplicate Filtered
Parameter		ROUND #:	Round 1		Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	Round 9	Round 7		Round 8		Round 9	Round 7		Round 8			Round 9	
Petroleum Hydrocarbons	**Units**	**Method**																						
Motor Oil	mg/L	8015B DRO	0.096 U	0.096 U	0.13 U	0.13 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	1 U	0.096 U	--	0.04 J	--	1 U	0.06 J	--	0.24	0.2	--	1 U	1 U
Diesel Fuel	mg/L	8015B DRO	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	1 U	0.009 J	--	0.04 J	--	1 U	0.2	--	0.85	0.78	--	0.49J	0.40J
Gasoline	mg/L	8015B DRO	0.1 U	0.1 U	0.1 U	0.02 J	0.02 J	0.1 U	0.1 U	0.1 U	0.1 U	1 U	0.1 U	--	0.1 U	--	1 U	0.1 U	--	0.1 U	0.1 U	--	1 U	1 U
VOCs																								
4-Methyl-2-Pentanone	ug/L	8260B	50 U	50 U	0.3 J	50 UJ	50 U	50 U	50 U	50 UJ	50 U	50 U	50 UJ	--	50 U	--	50 U	50 UJ	--	50 U	50 U	--	50 U	50 U
Chloroform	ug/L	8260B	0.1 U	0.1 U	0.1 U	0.1 U	0.11 U	0.11 U	0.1 U	0.1 U	0.1 U	0.2 U	0.1 U	--	0.1 U	--	0.2 U	0.1 U	--	0.1 U	0.1 U	--	0.2 U	0.2 U
2-Butanone (MEK)	ug/L	8260B	100 U	100 U	100 UJ	100 UJ	100 U	100 UJ	100 U	100 U	100 U	100 U	100 UJ	--	100 U	--	100 U	100 U	--	100 U	100 U	--	100 U	100 U
Methylene Chloride	ug/L	8260B	3 U	3 U	3 U	3 U	3 UJ	3 U	3 U	3 U	3 U	3 U	3 U	--	3 U	--	3 U	3 U	--	3 UJ	3 U	--	3 U	3 U
SVOCs																								
4-Methylphenol	ug/L	8270C	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	10 U	9.6 U	--	9.6 U	--	10 U	9.6 U	--	9.6 U	9.6 U	--	10 U	10 U
Acenaphthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	1 U	0.48 U	--	0.48 U	--	1 U	0.2 J	--	1.6	1.5	--	1 U	1 U
Anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	1 U	0.48 U	--	0.48 U	--	1 U	0.05 J	--	0.09 J	0.08 J	--	1 U	1 U
Benzo(a)anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	1 U	0.48 U	--	0.48 U	--	1 U	0.48 U	--	0.48 U	0.48 U	--	1 U	1 U
Benzo(a)pyrene	ug/L	8270 SIM	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.2 U	0.19 U	--	0.19 U	--	0.2 U	0.19 U	--	0.19 U	0.19 U	--	0.2 U	0.2 U
Benzo(b)fluoranthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	1 U	0.48 U	--	0.48 U	--	1 U	0.48 U	--	0.48 U	0.48 U	--	1 U	1 U
Benzo(g,h,i)perylene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	1 U	0.48 U	--	0.48 U	--	1 U	0.48 U	--	0.48 U	0.48 U	--	1 U	1 U
Bis(2-Ethylhexyl)Phthalate	ug/L	8270C	9.6 UJ	9.6 U	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	2 U	9.6 UJ	--	9.6 U	--	2 U	9.6 U	--	9.6 U	9.6 U	--	2 U	1.3 J
Bis(2-chloroethoxy)methane	ug/L	8270C	9.6 UJ	9.6 U	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	10 U	9.6 UJ	--	9.6 U	--	10 U	9.6 U	--	2 J	2 J	--	10 U	10 U
Butyl Benzyl Phthalate	ug/L	8270C	9.6 U	9.6 UJ	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	10 U	9.6 U	--	9.6 U	--	10 U	9.6 U	--	9.6 U	9.6 U	--	10 U	10 U
Chrysene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	1 U	0.48 U	--	0.48 U	--	1 U	0.48 U	--	0.48 U	0.48 U	--	1 U	1 U
Dibenz(a,h)anthracene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	1 U	0.48 U	--	0.48 U	--	1 U	0.48 U	--	0.48 U	0.48 U	--	1 U	1 U
Diethyl Phthalate	ug/L	8270C	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	10 U	10 U	9.6 U	--	9.6 U	--	10 U	9.6 U	--	9.6 U	9.6 U	--	10 U	10 U
Fluoranthene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	1 U	0.48 U	--	0.48 U	--	1 U	0.02 J	--	0.09 J	0.08 J	--	1 U	1 U
Fluorene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	1 U	0.48 U	--	0.48 U	--	1 U	0.1 J	--	0.48 U	0.48 U	--	1 U	1 U
Indeno(1,2,3-c,d)pyrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	1 U	0.48 U	--	0.48 U	--	1 U	0.48 U	--	0.48 U	0.48 U	--	1 U	1 U
Napthalene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	1 U	0.48 U	--	0.48 U	--	1 U	0.48 U	--	0.04 J	0.03 J	--	1 U	1 U
Phenanthrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	1 U	0.48 U	--	0.48 U	--	1 U	0.48 U	--	0.05 J	0.05 J	--	1 U	1 U
Phenol	ug/L	8270C	9.6 U	9.6 U	10 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 UJ	10 UJ	10 U	9.6 U	--	9.6 U	--	10 U	9.6 UJ	--	9.6 U	9.6 U	--	10 U	10 U
Pyrene	ug/L	8270 SIM	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	1 U	0.48 U	--	0.48 U	--	1 U	0.48 U	--	0.06 J	0.06 J	--	1 U	1 U
Metals																								
Aluminum	ug/L	6010B	23.7 J	25.2 J	14 UJ	5 UJ	31.1 J	8.2 J	17.9 J	22.2 J	18.1 UJ	100 U	35.1 J	46.7 J	186 UJ	31 UJ	100 U	98.1 J	29.7 J	63.7 UJ	44 UJ	33 UJ	100 U	100 U
Antimony	ug/L	6010B	2.4 UJ	1.8 UJ	60 U	60 UJ	60 U	60 U	2.7	60 U	60 U	10 U	60 U	60 U	60 U	60 U	10 U	60 U	60 U	60 U	11.7	60 U	10 U	10 U
Arsenic	ug/L	6010B	5.7 UJ	4.5 UJ	9.1 UJ	8.1 UJ	3.7 UJ	7	11.6 UJ	7.6 UJ	5.4	5.63	7.3 UJ	7.5 UJ	31.7	24.5	7.11	7.7 UJ	10.6 UJ	61.9	58.6	62.2	18.5	18.2
Barium	ug/L	6010B	40	41.1	38.3	29	31	34.2	30.9	32.8	30.5	32.6	48.6	45.6	43	39	39.4	147	146	109 J	110 J	121 J	334	331
Cadmium	ug/L	6010B	0.15 UJ	0.18 UJ	5 UJ	5 U	5 U	5 U	5 U	0.42 UJ	5 UJ	2 U	5 U	0.16 UJ	5 U	5 U	2 U	0.42 UJ	0.3 UJ	5 U	5 U	5 U	2 U	2 U
Calcium	ug/L	6010B	167000	179000	209000	178000	193000	203000	186000	162000	202000	176000	147000	135000	164000	155000	152000	243000	244000	266000	279000	299000	263000	265000
Chromium	ug/L	6010B	2.8 J	2.7 J	3.1 UJ	2.4 J	1.1 J	10 U	3.9	5.4 J	10 U	5 U	1.8	1.4	2.7 UJ	3 UJ	5 U	2.9 J	2.8 J	10 U	3.8 J	10 UJ	5 U	5 U
Cobalt	ug/L	6010B	0.75 UJ	0.56 UJ	50 UJ	50 U	50 U	50 U	50 U	50 U	50 UJ	5 U	0.81 UJ	0.8 UJ	1.7 UJ	2 UJ	0.94 J	2 UJ	2.1 UJ	2.4 J	2.7 J	2.6 J	1.33 J	1.35 J
Copper	ug/L	6010B	4.9 UJ	4.3 UJ	25 UJ	2.6 UJ	24.2	8.5 UJ	3.1 J	2.4 UJ	25 U	10 U	15.5	3.1 UJ	5.4 J	3.1	0.69 J	7.6 UJ	5.6 UJ	2.5	5.4	1.9 J	10 U	10 U
Iron	ug/L	6010B	28.5 UJ	30 UJ	193	185	240 J	208	234	192 J	191	182	46 J	26.9 J	402	202	50 U	124 J	31.9 UJ	4550	4640	4950	6850	7050
Lead	ug/L	6010B	3.3 UJ	3.2 UJ	3 U	1.4 UJ	3 U	3 UJ	3.3 UJ	3 U	3 U	5 U	3 U	3 U	3 U	2.5	5 U	3 U	3 U	3 U	2	3 U	5 U	5 U
Magnesium	ug/L	6010B	87200	90800	99500	90800	90000	91000	90300	81800	101000	88000	79100	75800	134000	124000	78200	137000	139000	101000	99500	114000	123000	124000
Manganese	ug/L	6010B	35.5	38.1	14.7	10.5	13.2	14.1	13.6	11.4	17.3 UJ	12.6	69.5	57.9	685	635	264	358	362	1770	1760 J	2000	1580	1590
Mercury	ug/L	7470A	0.11 J	0.12 J	0.2	0.058 J	0.066 J	0.1 J	0.55 J	0.21 J	1.2 J	0.5 U	0.51 J	0.54 J	0.13 J	0.23 J	0.5 U	0.039 J	0.032 J	0.1 J	0.032 J	0.062 J	0.5 U	0.5 U
Nickel	ug/L	6010B	3 UJ	3.3 UJ	1.6 UJ	1.6 UJ	1.2 J	40 U	1.7	0.71 UJ	40 UJ	0.56 J	5.8	3.5 UJ	4.8	4.6	3.06	22	21.1	19.6	20.6	22.8	1.23	2.23
Potassium	ug/L	6010B	5650	6010	6520 J	5960	6110	6460	5790	6340	6720	3900	13600	13100	14800	13400	3280	29400	29300	29100 J	29300 J	31000 J	11500	11300
Selenium	ug/L	6010B	5 UJ	5 UJ	3.4 UJ	5 UJ	5 U	5 U	7.7 UJ	5 U	5 U	10 U	14.2 UJ	4.5 UJ	7.8	6.5	23.7	5 U	5 U	8.7 UJ	5.2 UJ	12.5 UJ	0.95 J	0.99 J
Silver	ug/L	6010B	1.2	0.85	10 UJ	2.1 UJ	0.96 UJ	1.5 UJ	2 J	10 U	10 U	10 U	10 U	10 U	1.6	2.9	10 U	10 U	10 U	3.5 UJ	4.5 UJ	4.8 UJ	10 U	10 U
Sodium	ug/L	6010B	421000	448000	507000	460000	494000	465000	437000	418000	500000	479000	470000	437000	415000	397000	485000	514000	531000	526000 J	451000 J	593000	483000	481000
Thallium	ug/L	6010B	10 U	10 U	3 J	10 U	10 U	10 U	10 U	6.8 UJ	10 U	2 U	5.4 UJ	4.7 UJ	10 U	10 U	2 U	8.2 UJ	10 UJ	8.7 UJ	10 U	8 UJ	2 U	2 U
Vanadium	ug/L	6010B	1.5 UJ	1.5 UJ	50 U	50 U	50 U	50 U	50 U	50 U	50 U	10 U	9.5	9.2	4	2.7	15.4	15.4	14.9	1.7	3.1	1.6	1.21 J	1.26 J
Zinc	ug/L	6010B	201	209	3.6 UJ	12 J	8.1 J	3.2 J	24.4 J	8.3 J	2 UJ	10 U	17 J	6.1 J	8.5 J	1.2 J	7.98 UJ	6.4 J	10 J	20 UJ	20 UJ	20 UJ	10 U	11.8 UJ
Miscellaneous																								
pH	pH	9040	7.07	7.01	6.83	6.71	6.85	6.86	6.64	--	6.88	7.09	--	--	7.12	--	6.95	--	--	6.73	6.76	--	6.85	6.88
Chromium, hexavalent	ug/L	7199	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 3: Summary of Detected Analytes - Round 1 through Round 9 Groundwater Sampling - RSE Investigation

		WELL ID:	AA3-MW13					AA3-MW14				
		EPA ID:	LK471	LK473	LK535	LK536	LK556	LK475	LK476	LK518	LK519	LK545
		SAMPLE DATE:	2/16/2005	2/16/2005	4/29/2005	4/29/2005	2/9/2007	2/17/2005	2/17/2005	4/28/2005	4/28/2005	2/7/2007
		SAMPLE TYPE:	Regular Unfiltered	Regular Filtered	Regular Unfiltered	Regular Filtered	Regular Filtered	Regular Unfiltered	Regular Filtered	Regular Unfiltered	Regular Filtered	Regular Filtered
Parameter		ROUND #:	Round 7		Round 8		Round 9	Round 7		Round 8		Round 9
Petroleum Hydrocarbons	**Units**	**Method**										
Motor Oil	mg/L	8015B DRO	0.096 U	--	0.096 U	--	*1 U*	0.096 U	--	0.09 J	--	*1 U*
Diesel Fuel	mg/L	8015B DRO	0.096 U	--	0.096 U	--	*1 U*	0.096 U	--	0.1	--	*1 U*
Gasoline	mg/L	8015B DRO	0.1 U	--	0.1 U	--	*1 U*	0.1 U	--	0.1 U	--	*1 U*
VOCs												
4-Methyl-2-Pentanone	ug/L	8260B	50 UJ	--	50 U	--	*50 U*	50 UJ	--	50 U	--	*50 U*
Chloroform	ug/L	8260B	0.1 U	--	0.1 U	--	*0.2 U*	0.1 U	--	0.1 U	--	*0.2 U*
2-Butanone (MEK)	ug/L	8260B	100 U	--	100 U	--	*100 U*	100 U	--	100 U	--	*100 U*
Methylene Chloride	ug/L	8260B	3 U	--	3 UJ	--	*3 U*	3 U	--	3 U	--	*3 U*
SVOCs												
4-Methylphenol	ug/L	8270C	9.6 U	--	9.6 U	--	*10 U*	9.6 U	--	9.6 U	--	*10 U*
Acenaphthene	ug/L	8270 SIM	0.48 U	--	0.48 U	--	*1 U*	0.48 U	--	0.05 J	--	*1 U*
Anthracene	ug/L	8270 SIM	0.48 U	--	0.48 U	--	*1 U*	0.48 U	--	0.48 U	--	*1 U*
Benzo(a)anthracene	ug/L	8270 SIM	0.48 U	--	0.48 U	--	*1 U*	0.48 U	--	0.48 U	--	*1 U*
Benzo(a)pyrene	ug/L	8270 SIM	0.19 U	--	0.19 U	--	*0.21 U*	0.19 U	--	0.19 U	--	*0.21 U*
Benzo(b)fluoranthene	ug/L	8270 SIM	0.48 U	--	0.48 U	--	*1 U*	0.48 U	--	0.48 U	--	*1 U*
Benzo(g,h,i)perylene	ug/L	8270 SIM	0.48 U	--	0.48 U	--	*1 U*	0.48 U	--	0.48 U	--	*1 U*
Bis(2-Ethylhexyl)Phthalate	ug/L	8270C	9.6 U	--	9.6 U	--	*2.1 U*	9.6 U	--	9.6 U	--	*2.1 U*
Bis(2-chloroethoxy)methane	ug/L	8270C	9.6 U	--	9.6 U	--	*10 U*	9.6 U	--	9.6 U	--	*10 U*
Butyl Benzyl Phthalate	ug/L	8270C	9.6 U	--	9.6 U	--	*10 U*	9.6 U	--	9.6 U	--	*10 U*
Chrysene	ug/L	8270 SIM	0.48 U	--	0.48 U	--	*1 U*	0.48 U	--	0.48 U	--	*1 U*
Dibenz(a,h)anthracene	ug/L	8270 SIM	0.48 U	--	0.48 U	--	*1 U*	0.48 U	--	0.48 U	--	*1 U*
Diethyl Phthalate	ug/L	8270C	9.6 U	--	9.6 U	--	*10 U*	9.6 U	--	9.6 U	--	*10 U*
Fluoranthene	ug/L	8270 SIM	0.48 U	--	0.48 U	--	*1 U*	0.48 U	--	0.48 U	--	*1 U*
Fluorene	ug/L	8270 SIM	0.48 U	--	0.48 U	--	*1 U*	0.48 U	--	0.48 U	--	*1 U*
Indeno(1,2,3-c,d)pyrene	ug/L	8270 SIM	0.48 U	--	0.48 U	--	*1 U*	0.48 U	--	0.48 U	--	*1 U*
Napthalene	ug/L	8270 SIM	0.48 U	--	0.48 U	--	*1 U*	0.48 U	--	0.48 U	--	*1 U*
Phenanthrene	ug/L	8270 SIM	0.48 U	--	0.48 U	--	*1 U*	0.48 U	--	0.48 U	--	*1 U*
Phenol	ug/L	8270C	9.6 UJ	--	9.6 U	--	*10 U*	9.6 UJ	--	9.6 U	--	*10 U*
Pyrene	ug/L	8270 SIM	0.48 U	--	0.48 U	--	*1 U*	0.48 U	--	0.48 U	--	*1 U*
Metals												
Aluminum	ug/L	6010B	35.5 J	29.1 J	28.9 UJ	22.8 UJ	*100 U*	127 J	40.3 J	249	58.9 J	*100 U*
Antimony	ug/L	6010B	60 U	60 U	9.7	6.7	*10 U*	60 U	60 U	60 U	60 U	*10 U*
Arsenic	ug/L	6010B	8.1 UJ	9.5 UJ	4.7 UJ	10 U	*6.54*	7.3 UJ	6.7 UJ	22.5	23.8	*7.2*
Barium	ug/L	6010B	61.4	63	35.1 J	34.4 J	*37*	32.2	32.9	113	113 J	*115*
Cadmium	ug/L	6010B	5 U	5 U	5 U	5 U	*2 U*	0.36 UJ	0.4 UJ	5 U	5 U	*2 U*
Calcium	ug/L	6010B	367000	379000	386000 J	374000	*364000*	196000	198000	214000	211000	*204000*
Chromium	ug/L	6010B	17.5	18	3.4 J	3.3 J	*5 U*	2.8 J	4.1 J	3.2 UJ	3.3 J	*5 U*
Cobalt	ug/L	6010B	0.53 UJ	0.55 UJ	50 UJ	50 UJ	*5 U*	1.3 UJ	1.2 UJ	2 UJ	1.5 J	*1.23 J*
Copper	ug/L	6010B	2.6 UJ	3.7 UJ	6	5.8	*1.54 J*	3 UJ	16.7 UJ	8	2.3 J	*10 U*
Iron	ug/L	6010B	17.8 UJ	39.1 J	25 UJ	20.2 UJ	*50 U*	139 J	94.8 J	1890	2260	*2690*
Lead	ug/L	6010B	3 U	3 U	4.3	4.3	*5 U*	3 U	3 U	3.1	1.9 J	*5 U*
Magnesium	ug/L	6010B	129000	135000	152000	147000	*144000*	105000	105000	129000	127000	*100000*
Manganese	ug/L	6010B	11.4	11.2	14 J	13.9 J	*5.71*	511	519	1450	1400	*1950*
Mercury	ug/L	7470A	0.082 J	0.092 J	0.43	0.27	*0.5 U*	0.2 J	0.18 J	0.19 J	0.45	*0.5 U*
Nickel	ug/L	6010B	1.7 UJ	1.7 UJ	2.7 J	3.4 J	*2.07*	4.7	6.3	5.9	5 J	*2.35*
Potassium	ug/L	6010B	12000	12500	3430 J	3330 J	*2200*	6710	7260	20500	19700	*3740*
Selenium	ug/L	6010B	97.9	97.2	91.8 J	87	*165*	5 U	7.5 UJ	5 U	9.3	*6.34 J*
Silver	ug/L	6010B	10 U	10 U	5.5 UJ	5.8 UJ	*10 U*	10 U	10 U	4.5	4.2 J	*10 U*
Sodium	ug/L	6010B	441000	453000	412000 J	402000	*426000*	433000	440000	390000	393000	*475000*
Thallium	ug/L	6010B	9.6 UJ	9.1 UJ	10 U	10 U	*2 U*	8.4 UJ	8.5 UJ	10 U	10 U	*2 U*
Vanadium	ug/L	6010B	14	14.6	27.5	26.4	*33.2*	15.7	15.5	2.4	1.9 J	*1.06 J*
Zinc	ug/L	6010B	5.4 J	4.7 J	20 UJ	20 UJ	*13.6 UJ*	12 J	18.5 J	3.5 J	20 U	*5.97 UJ*
Miscellaneous												
pH	pH	9040	--	--	6.94	--	*6.99*	--	--	6.9	--	*6.83*
Chromium, hexavalent	ug/L	7199	14	--	1.1	--	--	--	--	--	--	--

NOTES:
µg/L = micrograms per liter
mg/L = milligram per liter

TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds
SVOCs = semivolatile organic compounds
AA3 = Anomaly Area 3
RSE = Removal Site Evaluation

U = indicates the analyte was not detected at or above the stated limit.
UJ = indicates the analyte was not detected at or above the stated limit. The sample detection limit is an estimated value.
J = indicates an estimated value.

Table 4: Detected Results -- Additional Rounds of Groundwater Sampling at AA 3 (Per RSE SAP Addendum #1) - Round 9

			AA3-MW01	AA3-MW02		AA3-MW10	AA3-MW04	AA3-MW06	AA3-MW13	AA3-MW11	AA3-MW12		AA3-MW14	AA3-MW08	AA3-MW09A	AA3-MW09B
			LK547	LK548	LK549	LK539	LK544	LK555	LK556	LK546	LK552	LK553	LK545	LK551	LK540	LK541
			02/07/07	02/07/07	02/07/07	02/05/07	02/06/07	02/09/07	02/09/07	02/07/07	02/08/07	02/08/07	02/07/07	02/08/07	02/06/07	02/06/07
			Point of Compliance Wells					Upgradient Wells		Wells Within Waste				Near Wash; Cross Gradient		
Parameter	Method	Units	Regular	Regular	Duplicate	Regular	Regular	Regular	Regular	Regular	Regular	Duplicate	Regular	Regular	Regular	Regular
General Chemistry																
pH	SW9040B		7.15	7.00	6.99	7.09	7.02	6.98	6.99	6.95	6.85	6.88	6.83	7.18	7.06	7.13
Total Dissolved Solids	E160.1	mg/L	1920	2140	2130	2190	2420	2150	3270	2040	2330	2520	2210	1740	2130	1880
Chloride	E300	mg/L	213	296	299	601	269	267	258	248	370	359	352	168	260	187
Fluoride	E301	mg/L	0.59	0.61	0.62	0.72	0.93	0.6	0.45	0.71	0.5	0.49	0.52	0.76	0.49	0.68
Total Nitrate	E302	mg/L	5.66	6.67	6.58	0.5 U	5.34	4.35	2.34	5.64	0.23 J	0.19 J	1.33	1.33	9.91	1.92
Sulfate	E303	mg/L	700	704	712	510 J	980	916 J	1860	718	263	278	512	771	744	724
Alkalinity	SM2320B	mg/L	450	560	550	375	370	455	360	460	1390	1420	795	385	460	405
Bicarbonate	SM2320B	mg/L	450	560	555	375	370	455	360	460	1390	1420	795	385	460	405
Petroleum Hydrocarbons																
Diesel Fuel	SW8015B	mg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.49J	0.4 J	1 U	1 U	1 U	1 U
SVOCs																
Bis(2-ethylhexyl)phthalate	SW8270C	ug/L	1.9 J	2 U	2.1 U	2 U	2 U	2 U	2.1 U	2 U	2 U	1.3 J	2.1 U	2.1 U	2 U	2 U
Metals																
Antimony	SW6020A	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	0.76 J	10 U
Arsenic	SW6020A	ug/L	5.24	4.07	3.97	5.63	26.3	5.66	6.54	7.11	18.5	18.2	7.2	2.5	6.18	4.17
Barium	SW6020A	ug/L	40.7	39.1	39.1	32.6	32	33	37	39.4	334	331	115	21.1	69.2	27.8
Calcium	SW6020A	ug/L	149000	190000	188000	176000	188000	202000	364000	152000	263000	265000	204000	110000	191000	138000
Chromium	SW6020A	ug/L	5 U	0.63 J	0.56 J	5 U	1.64 J	0.77 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Cobalt	SW6020A	ug/L	5 U	0.7 J	0.73 J	5 U	5 U	5 U	5 U	0.94 J	1.33 J	1.35 J	1.23 J	5 U	5 U	5 U
Copper	SW6020A	ug/L	0.63 J	8.49 J	9.58 J	10 U	2.5 J	1.02 J	1.54 J	0.7 J	10 U	10 U	10 U	10 U	1.48 J	0.54 J
Iron	SW6020A	ug/L	50 U	50 U	50 U	182	5 U	5 U	5 U	5 U	6850	7050	2690	5 U	5 U	5 U
Magnesium	SW6020A	ug/L	74000	97100	96900	88000	105000	92600	144000	78200	123000	124000	100000	56400	67300	71900
Manganese	SW6020A	ug/L	2.4 J	356	387	12.6	5.43	5 U	5.71	264	1580	1590	1950	308	2.95 J	5.55
Nickel	SW6020A	ug/L	2.94	8.56	8.97	0.56 J	10.9	1.48	2.07	3.06	1.23	2.23	2.35	1.73	2.72	0.624 J
Potassium	SW6020A	ug/L	2010	4280	4200	3900	2080	3520	2200	3280	11500	11300	3740	2600	2720	1930
Selenium	SW6020A	ug/L	21.1	24.2	24.0	10 U	22.9	23.2	165	23.7	0.95 J	0.99 J	6.34 J	4.61 J	35.9	6.75 J
Sodium	SW6020A	ug/L	441000	468000	470000	479000	447000	389000	426000	485000	483000	481000	475000	431000	460000	418000
Thallium	SW6020A	ug/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vanadium	SW6020A	ug/L	19	12.1	12.1	10 U	54.4	22.2	33.2	15.4	1.21 J	1.26 J	1.06 J	2.04 J	25.8	13.4
Zinc	SW6020A	ug/L	10 U	5.98 UJ	5.79 UJ	10 U	14.0	8.05 UJ	13.6 UJ	7.98 UJ	10 U	11.8 UJ	5.97 UJ	5.2 UJ	10 U	10 U

NOTES:
µg/L = micrograms per liter
mg/L = milligram per liter
TEPH = total extractable petroleum hydrocarbons
SVOCs = semivolatile organic compounds
AA3 = Anomaly Area 3
RSE = Removal Site Evaluation
SAP = sampling and analysis plan
Results for metals are filtered sample results

U = indicates the analyte was not detected at or above the stated limit.
UJ = indicates the analyte was not detected at or above the stated limit. The sample detection limit is an estimated value.
J = indicates an estimated value.
ND = not detected at specified reporting limit

Table 5: Summary Statistics and Inter-Well Prediction Limits - AA 3 Upgradient versus Downgradient Data Set

Constituent	Units	Model Type	Total Number of Samples	Number of Detects	Mean	Standard Deviation	Inter-Well Prediction Limit	Confidence Level*
Alkalinity	mg/L	too few	2	2	-	-	-	-
Aluminum	ug/L	nonparametric	14	3	-	-	575	0.97
Antimony	ug/L	nonparametric	14	2	-	-	60	0.97
Arsenic	ug/L	nonparametric	14	5	-	-	10	0.97
Barium	ug/L	normal	14	12	26.09	15.40	68.29	-
Beryllium	ug/L	nonparametric	14	0	-	-	5	0.97
Bicarbonate	mg/L	too few	2	2	-	-	-	-
Cadmium	ug/L	nonparametric	14	0	-	-	5	0.97
Calcium	mg/L	normal	13	13	225	64.82	405.07	-
Chloride	mg/L	too few	2	2	-	-	-	-
Chromium	ug/L	normal	14	7	4.73	8.34	27.59	-
Cobalt	ug/L	nonparametric	14	0	-	-	50	0.97
Copper	ug/L	nonparametric	14	3	-	-	25	0.97
Fluoride	mg/L	too few	2	2	-	-	-	-
Iron	ug/L	nonparametric	14	3	-	-	495	0.97
Lead	ug/L	nonparametric	14	1	-	-	3.8	0.97
Magnesium	mg/L	normal	13	13	99.71	19.07	151.96	-
Manganese	ug/L	normal	13	8	9.03	10.09	37.07	-
Mercury	ug/L	nonparametric	14	2	-	-	0.2	0.97
Nickel	ug/L	nonparametric	14	6	-	-	40	0.97
Potassium	mg/L	normal	14	11	4.45	3.24	13.31	-
Selenium	ug/L	normal	14	11	37.43	44.63	159.71	-
Silver	ug/L	nonparametric	14	1	-	-	10	0.97
Sodium	mg/L	nonparametric	13	13	-	-	441	0.96
Sulfate	mg/L	too few	2	1	-	-	-	-
TDS	mg/L	too few	2	2	-	-	-	-
Thallium	ug/L	nonparametric	14	2	-	-	10	0.97
Total nitrate	mg/L	too few	2	2	-	-	-	-
Vanadium	ug/L	normal	14	14	19.31	4.99	32.97	-
Zinc	ug/L	nonparametric	14	1	-	-	20	0.97

NOTES:

* Confidence level for passing initial test or one verification resample at all downgradient wells for single constituent (nonparametric test only).

\- Not available

1. Model Type refers to type of prediction limit.
2. For lognormal limit, mean and standard deviation in natural log units and prediction limit in original units.
3. All sample sizes and statistics are based on outlier free data.
4. For nonparametric limits, median reporting limits are substituted for extreme reporting limit values.

Table 6: Comparison of Most Current Downgradient Monitoring Data (Round 9) with the Inter-Well Prediction Limit - AA 3 Upgradient versus Downgradient Data Set

Constituent	Units	Well	Date	Round 9 Result	Qualifier	Status of Round 9 Values	Inter-well Prediction Limit
Alkalinity	mg/L	AA3-MW01	2/7/2007	450			*****
Alkalinity	mg/L	AA3-MW02	2/7/2007	555			*****
Alkalinity	mg/L	AA3-MW04	2/6/2007	370			*****
Alkalinity	mg/L	AA3-MW10	2/5/2007	375			*****
Aluminum	ug/L	AA3-MW01	2/7/2007	100	ND		575
Aluminum	ug/L	AA3-MW02	2/7/2007	100	ND		575
Aluminum	ug/L	AA3-MW04	2/6/2007	100	ND		575
Aluminum	ug/L	AA3-MW10	2/5/2007	100	ND		575
Antimony	ug/L	AA3-MW01	2/7/2007	10	ND		60
Antimony	ug/L	AA3-MW02	2/7/2007	10	ND		60
Antimony	ug/L	AA3-MW04	2/6/2007	10	ND		60
Antimony	ug/L	AA3-MW10	2/5/2007	10	ND		60
Arsenic	ug/L	AA3-MW01	2/7/2007	5.24			10
Arsenic	ug/L	AA3-MW02	2/7/2007	4.02			10
Arsenic	ug/L	AA3-MW04	2/6/2007	26.3		*	10
Arsenic	ug/L	AA3-MW10	2/5/2007	5.63			10
Barium	ug/L	AA3-MW01	2/7/2007	40.7			68.29
Barium	ug/L	AA3-MW02	2/7/2007	39.1			68.29
Barium	ug/L	AA3-MW04	2/6/2007	32			68.29
Barium	ug/L	AA3-MW10	2/5/2007	32.6			68.29
Beryllium	ug/L	AA3-MW01	2/7/2007	4	ND		5
Beryllium	ug/L	AA3-MW02	2/7/2007	4	ND		5
Beryllium	ug/L	AA3-MW04	2/6/2007	4	ND		5
Beryllium	ug/L	AA3-MW10	2/5/2007	4	ND		5
Bicarbonate	mg/L	AA3-MW01	2/7/2007	450			*****
Bicarbonate	mg/L	AA3-MW02	2/7/2007	557.5			*****
Bicarbonate	mg/L	AA3-MW04	2/6/2007	370			*****
Bicarbonate	mg/L	AA3-MW10	2/5/2007	375			*****
Cadmium	ug/L	AA3-MW01	2/7/2007	2	ND		5
Cadmium	ug/L	AA3-MW02	2/7/2007	2	ND		5
Cadmium	ug/L	AA3-MW04	2/6/2007	2	ND		5
Cadmium	ug/L	AA3-MW10	2/5/2007	2	ND		5
Calcium	mg/L	AA3-MW01	2/7/2007	149			405.07
Calcium	mg/L	AA3-MW02	2/7/2007	189			405.07
Calcium	mg/L	AA3-MW04	2/6/2007	188			405.07

Table 6: Comparison of Most Current Downgradient Monitoring Data (Round 9) with the Inter-Well Prediction Limit - AA 3 Upgradient versus Downgradient Data Set

Constituent	Units	Well	Date	Round 9 Result	Qualifier	Status of Round 9 Values	Inter-well Prediction Limit
Calcium	mg/L	AA3-MW10	2/5/2007	176			405.07
Chloride	mg/L	AA3-MW01	2/7/2007	213			*****
Chloride	mg/L	AA3-MW02	2/7/2007	297.5			*****
Chloride	mg/L	AA3-MW04	2/6/2007	269			*****
Chloride	mg/L	AA3-MW10	2/5/2007	601			*****
Chromium	ug/L	AA3-MW01	2/7/2007	5	ND		27.59
Chromium	ug/L	AA3-MW02	2/7/2007	5	ND		27.59
Chromium	ug/L	AA3-MW04	2/6/2007	5	ND		27.59
Chromium	ug/L	AA3-MW10	2/5/2007	5	ND		27.59
Cobalt	ug/L	AA3-MW01	2/7/2007	2	ND		50
Cobalt	ug/L	AA3-MW02	2/7/2007	2	ND		50
Cobalt	ug/L	AA3-MW04	2/6/2007	2	ND		50
Cobalt	ug/L	AA3-MW10	2/5/2007	2	ND		50
Copper	ug/L	AA3-MW01	2/7/2007	10	ND		25
Copper	ug/L	AA3-MW02	2/7/2007	10	ND		25
Copper	ug/L	AA3-MW04	2/6/2007	10	ND		25
Copper	ug/L	AA3-MW10	2/5/2007	10	ND		25
Fluoride	mg/L	AA3-MW01	2/7/2007	0.588			*****
Fluoride	mg/L	AA3-MW02	2/7/2007	0.614			*****
Fluoride	mg/L	AA3-MW04	2/6/2007	0.93			*****
Fluoride	mg/L	AA3-MW10	2/5/2007	0.715			*****
Iron	ug/L	AA3-MW01	2/7/2007	50	ND		495
Iron	ug/L	AA3-MW02	2/7/2007	50	ND		495
Iron	ug/L	AA3-MW04	2/6/2007	50	ND		495
Iron	ug/L	AA3-MW10	2/5/2007	182			495
Lead	ug/L	AA3-MW01	2/7/2007	5	ND		3.8
Lead	ug/L	AA3-MW02	2/7/2007	5	ND		3.8
Lead	ug/L	AA3-MW04	2/6/2007	5	ND		3.8
Lead	ug/L	AA3-MW10	2/5/2007	5	ND		3.8
Magnesium	mg/L	AA3-MW01	2/7/2007	74			151.96
Magnesium	mg/L	AA3-MW02	2/7/2007	97			151.96
Magnesium	mg/L	AA3-MW04	2/6/2007	105			151.96
Magnesium	mg/L	AA3-MW10	2/5/2007	88			151.96
Manganese	ug/L	AA3-MW01	2/7/2007	5	ND		37.07
Manganese	ug/L	AA3-MW02	2/7/2007	371.5		*	37.07

Table 6: Comparison of Most Current Downgradient Monitoring Data (Round 9) with the Inter-Well Prediction Limit - AA 3 Upgradient versus Downgradient Data Set

Constituent	Units	Well	Date	Round 9 Result	Qualifier	Status of Round 9 Values	Inter-well Prediction Limit
Manganese	ug/L	AA3-MW04	2/6/2007	5.43			37.07
Manganese	ug/L	AA3-MW10	2/5/2007	12.6			37.07
Mercury	ug/L	AA3-MW01	2/7/2007	0.5	ND		0.2
Mercury	ug/L	AA3-MW02	2/7/2007	0.5	ND		0.2
Mercury	ug/L	AA3-MW04	2/6/2007	0.5	ND		0.2
Mercury	ug/L	AA3-MW10	2/5/2007	0.5	ND		0.2
Nickel	ug/L	AA3-MW01	2/7/2007	2.94			40
Nickel	ug/L	AA3-MW02	2/7/2007	8.765			40
Nickel	ug/L	AA3-MW04	2/6/2007	10.9			40
Nickel	ug/L	AA3-MW10	2/5/2007	1	ND		40
Potassium	mg/L	AA3-MW01	2/7/2007	2.01			13.31
Potassium	mg/L	AA3-MW02	2/7/2007	4.24			13.31
Potassium	mg/L	AA3-MW04	2/6/2007	2.08			13.31
Potassium	mg/L	AA3-MW10	2/5/2007	3.9			13.31
Selenium	ug/L	AA3-MW01	2/7/2007	21.1			159.71
Selenium	ug/L	AA3-MW02	2/7/2007	24.1			159.71
Selenium	ug/L	AA3-MW04	2/6/2007	22.9			159.71
Selenium	ug/L	AA3-MW10	2/5/2007	10	ND		159.71
Silver	ug/L	AA3-MW01	2/7/2007	10	ND		10
Silver	ug/L	AA3-MW02	2/7/2007	10	ND		10
Silver	ug/L	AA3-MW04	2/6/2007	10	ND		10
Silver	ug/L	AA3-MW10	2/5/2007	10	ND		10
Sodium	mg/L	AA3-MW01	2/7/2007	441			441
Sodium	mg/L	AA3-MW02	2/7/2007	469		*	441
Sodium	mg/L	AA3-MW04	2/6/2007	447		*	441
Sodium	mg/L	AA3-MW10	2/5/2007	479		***	441
Sulfate	mg/L	AA3-MW01	2/7/2007	0.7			*****
Sulfate	mg/L	AA3-MW02	2/7/2007	0.708			*****
Sulfate	mg/L	AA3-MW04	2/6/2007	0.98			*****
Sulfate	mg/L	AA3-MW10	2/5/2007	1	ND		*****
TDS	mg/L	AA3-MW01	2/7/2007	1920			*****
TDS	mg/L	AA3-MW02	2/7/2007	2135			*****
TDS	mg/L	AA3-MW04	2/6/2007	2420			*****
TDS	mg/L	AA3-MW10	2/5/2007	2190			*****
Thallium	ug/L	AA3-MW01	2/7/2007	2	ND		10

Table 6: Comparison of Most Current Downgradient Monitoring Data (Round 9) with the Inter-Well Prediction Limit - AA 3 Upgradient versus Downgradient Data Set

Constituent	Units	Well	Date	Round 9 Result	Qualifier	Status of Round 9 Values	Inter-well Prediction Limit
Thallium	ug/L	AA3-MW02	2/7/2007	2	ND		10
Thallium	ug/L	AA3-MW04	2/6/2007	2	ND		10
Thallium	ug/L	AA3-MW10	2/5/2007	2	ND		10
Total nitrate	mg/L	AA3-MW01	2/7/2007	5.66			*****
Total nitrate	mg/L	AA3-MW02	2/7/2007	6.63			*****
Total nitrate	mg/L	AA3-MW04	2/6/2007	5.34			*****
Total nitrate	mg/L	AA3-MW10	2/5/2007	0.5	ND		*****
Vanadium	ug/L	AA3-MW01	2/7/2007	19			32.97
Vanadium	ug/L	AA3-MW02	2/7/2007	12.1			32.97
Vanadium	ug/L	AA3-MW04	2/6/2007	54.4		***	32.97
Vanadium	ug/L	AA3-MW10	2/5/2007	10	ND		32.97
Zinc	ug/L	AA3-MW01	2/7/2007	10	ND		20
Zinc	ug/L	AA3-MW02	2/7/2007	10	ND		20
Zinc	ug/L	AA3-MW04	2/6/2007	14			20
Zinc	ug/L	AA3-MW10	2/5/2007	10	ND		20

NOTES:
* - Current value failed - awaiting verification.
** - Current value passed - previous exceedance not verified.
*** - Current value failed - exceedance verified.
**** - Current value passed - awaiting one more verification.
***** - Insufficient background data to compute prediction limit.
ND - Not Detected

Table 7: Summary Statistics and Inter-Well Prediction Limits - with Station-wide Data Set

Constituent	Units	Model Type	Total Number of Samples	Number of Detects	Mean	Standard Deviation	Inter-Well Prediction Limit	Confidence Level*
Alkalinity	mg/L	normal	68	65	205.68	75.01	385.76	-
Aluminum	ug/L	nonparametric	50	18	-	-	575	0.99
Antimony	ug/L	nonparametric	54	15	-	-	60	0.99
Arsenic	ug/L	normal	54	28	1.92	2.22	7.30	-
Barium	ug/L	normal	58	46	33.34	27.95	100.82	-
Beryllium	ug/L	nonparametric	40	1	-	-	5	0.99
Bicarbonate	mg/L	normal	66	63	212.19	77.58	398.61	-
Cadmium	ug/L	nonparametric	57	4	-	-	5	0.99
Calcium	mg/L	normal	58	57	155.14	87.17	365.57	-
Chloride	mg/L	nonparametric	66	65	-	-	359	0.99
Chromium	ug/L	lognormal	48	34	1.60	1.51	197.58	-
Cobalt	ug/L	nonparametric	40	7	-	-	50	0.99
Copper	ug/L	nonparametric	52	23	-	-	95.5	0.99
Fluoride	mg/L	nonparametric	17	6	-	-	1.4	0.98
Iron	ug/L	normal	52	27	82.67	175.20	507.48	-
Lead	ug/L	nonparametric	40	11	-	-	10	0.99
Magnesium	mg/L	normal	64	62	59.33	36.87	148.03	-
Manganese	ug/L	lognormal	59	50	2.61	1.45	452.51	-
Mercury	ug/L	nonparametric	42	6	-	-	0.2	0.99
Nickel	ug/L	normal	56	43	124.62	177.46	553.61	-
Potassium	mg/L	normal	60	53	3.32	2.05	8.27	-
Selenium	ug/L	normal	62	52	30.63	39.79	126.46	-
Silver	ug/L	nonparametric	42	3	-	-	10	0.99
Sodium	mg/L	normal	63	63	156.09	112.84	427.68	-
Sulfate	mg/L	normal	74	71	330.98	315.77	1087.10	-
TDS	mg/L	normal	60	60	1125.98	588.80	2545.60	-
Thallium	ug/L	nonparametric	44	2	-	-	10	0.99
Total	mg/L	normal	15	11	8.48	8.91	32.60	-
Vanadium	ug/L	normal	58	48	10.88	7.04	27.87	-
Zinc	ug/L	normal	58	32	10.11	19.87	58.08	-

NOTES:

* Confidence level for passing initial test or one verification resample at all downgradient wells for single constituent (nonparametric test only).

\- Not available

1. Model Type refers to type of prediction limit.
2. For lognormal limit, mean and standard deviation in natural log units and prediction limit in original units.
3. All sample sizes and statistics are based on outlier free data.
4. For nonparametric limits, median reporting limits are substituted for extreme reporting limit values.

Table 8: Comparison of Most Current Downgradient Monitoring Data (Round 9) with the Inter-Well Prediction Limit - with Station-wide Data Set

Constituent	Units	Well	Date	Round 9 Result	Qualifier	Status of Round 9 Values	Station-wide Dataset - Inter-well Prediction Limits
Alkalinity	mg/L	AA3-MW01	2/7/2007	450		*	385.76
Alkalinity	mg/L	AA3-MW02	2/7/2007	555		*	385.76
Alkalinity	mg/L	AA3-MW04	2/6/2007	370			385.76
Alkalinity	mg/L	AA3-MW10	2/5/2007	375	ND		385.76
Aluminum	ug/L	AA3-MW01	2/7/2007	100	ND		575
Aluminum	ug/L	AA3-MW02	2/7/2007	100	ND		575
Aluminum	ug/L	AA3-MW04	2/6/2007	100	ND		575
Aluminum	ug/L	AA3-MW10	2/5/2007	100	ND		575
Antimony	ug/L	AA3-MW01	2/7/2007	10	ND		60
Antimony	ug/L	AA3-MW02	2/7/2007	10	ND		60
Antimony	ug/L	AA3-MW04	2/6/2007	10	ND		60
Antimony	ug/L	AA3-MW10	2/5/2007	10			60
Arsenic	ug/L	AA3-MW01	2/7/2007	5.24			7.30
Arsenic	ug/L	AA3-MW02	2/7/2007	4.02			7.30
Arsenic	ug/L	AA3-MW04	2/6/2007	26.3		*	7.30
Arsenic	ug/L	AA3-MW10	2/5/2007	5.63			7.30
Barium	ug/L	AA3-MW01	2/7/2007	40.7			100.82
Barium	ug/L	AA3-MW02	2/7/2007	39.1			100.82
Barium	ug/L	AA3-MW04	2/6/2007	32			100.82
Barium	ug/L	AA3-MW10	2/5/2007	32.6	ND		100.82
Beryllium	ug/L	AA3-MW01	2/7/2007	4	ND		5
Beryllium	ug/L	AA3-MW02	2/7/2007	4	ND		5
Beryllium	ug/L	AA3-MW04	2/6/2007	4	ND		5
Beryllium	ug/L	AA3-MW10	2/5/2007	4			5
Bicarbonate	mg/L	AA3-MW01	2/7/2007	450		*	398.61
Bicarbonate	mg/L	AA3-MW02	2/7/2007	557.5		*	398.61
Bicarbonate	mg/L	AA3-MW04	2/6/2007	370			398.61
Bicarbonate	mg/L	AA3-MW10	2/5/2007	375	ND		398.61
Cadmium	ug/L	AA3-MW01	2/7/2007	2	ND		5
Cadmium	ug/L	AA3-MW02	2/7/2007	2	ND		5
Cadmium	ug/L	AA3-MW04	2/6/2007	2	ND		5
Cadmium	ug/L	AA3-MW10	2/5/2007	2			5
Calcium	mg/L	AA3-MW01	2/7/2007	149			365.57
Calcium	mg/L	AA3-MW02	2/7/2007	189			365.57

Table 8: Comparison of Most Current Downgradient Monitoring Data (Round 9) with the Inter-Well Prediction Limit - with Station-wide Data Set

Constituent	Units	Well	Date	Round 9 Result	Qualifier	Status of Round 9 Values	Station-wide Dataset - Inter-well Prediction Limits
Calcium	mg/L	AA3-MW04	2/6/2007	188			365.57
Calcium	mg/L	AA3-MW10	2/5/2007	176			365.57
Chloride	mg/L	AA3-MW01	2/7/2007	213			359
Chloride	mg/L	AA3-MW02	2/7/2007	297.5			359
Chloride	mg/L	AA3-MW04	2/6/2007	269			359
Chloride	mg/L	AA3-MW10	2/5/2007	601		*	359
Chromium	ug/L	AA3-MW01	2/7/2007	5	ND		197.58
Chromium	ug/L	AA3-MW02	2/7/2007	5	ND		197.58
Chromium	ug/L	AA3-MW04	2/6/2007	5	ND		197.58
Chromium	ug/L	AA3-MW10	2/5/2007	5	ND		197.58
Cobalt	ug/L	AA3-MW01	2/7/2007	2	ND		50
Cobalt	ug/L	AA3-MW02	2/7/2007	2	ND		50
Cobalt	ug/L	AA3-MW04	2/6/2007	2	ND		50
Cobalt	ug/L	AA3-MW10	2/5/2007	2	ND		50
Copper	ug/L	AA3-MW01	2/7/2007	10	ND		95.5
Copper	ug/L	AA3-MW02	2/7/2007	10	ND		95.5
Copper	ug/L	AA3-MW04	2/6/2007	10	ND		95.5
Copper	ug/L	AA3-MW10	2/5/2007	10	ND		95.5
Fluoride	mg/L	AA3-MW01	2/7/2007	0.59			1.4
Fluoride	mg/L	AA3-MW02	2/7/2007	0.614			1.4
Fluoride	mg/L	AA3-MW04	2/6/2007	0.93			1.4
Fluoride	mg/L	AA3-MW10	2/5/2007	0.715			1.4
Iron	ug/L	AA3-MW01	2/7/2007	50	ND		507.48
Iron	ug/L	AA3-MW02	2/7/2007	50	ND		507.48
Iron	ug/L	AA3-MW04	2/6/2007	50	ND		507.48
Iron	ug/L	AA3-MW10	2/5/2007	182			507.48
Lead	ug/L	AA3-MW01	2/7/2007	5	ND		10
Lead	ug/L	AA3-MW02	2/7/2007	5	ND		10
Lead	ug/L	AA3-MW04	2/6/2007	5	ND		10
Lead	ug/L	AA3-MW10	2/5/2007	5	ND		10
Magnesium	mg/L	AA3-MW01	2/7/2007	74			148.03
Magnesium	mg/L	AA3-MW02	2/7/2007	97			148.03
Magnesium	mg/L	AA3-MW04	2/6/2007	105			148.03
Magnesium	mg/L	AA3-MW10	2/5/2007	88			148.03

Table 8: Comparison of Most Current Downgradient Monitoring Data (Round 9) with the Inter-Well Prediction Limit - with Station-wide Data Set

Constituent	Units	Well	Date	Round 9 Result	Qualifier	Status of Round 9 Values	Station-wide Dataset - Inter-well Prediction Limits
Manganese	ug/L	AA3-MW01	2/7/2007	5	ND		452.51
Manganese	ug/L	AA3-MW02	2/7/2007	371.5			452.51
Manganese	ug/L	AA3-MW04	2/6/2007	5.43			452.51
Manganese	ug/L	AA3-MW10	2/5/2007	12.6			452.51
Mercury	ug/L	AA3-MW01	2/7/2007	0.5	ND		0.2
Mercury	ug/L	AA3-MW02	2/7/2007	0.5	ND		0.2
Mercury	ug/L	AA3-MW04	2/6/2007	0.5	ND		0.2
Mercury	ug/L	AA3-MW10	2/5/2007	0.5	ND		0.2
Nickel	ug/L	AA3-MW01	2/7/2007	2.94			553.61
Nickel	ug/L	AA3-MW02	2/7/2007	8.77			553.61
Nickel	ug/L	AA3-MW04	2/6/2007	10.9			553.61
Nickel	ug/L	AA3-MW10	2/5/2007	1	ND		553.61
Potassium	mg/L	AA3-MW01	2/7/2007	2.01			8.27
Potassium	mg/L	AA3-MW02	2/7/2007	4.24			8.27
Potassium	mg/L	AA3-MW04	2/6/2007	2.08			8.27
Potassium	mg/L	AA3-MW10	2/5/2007	3.9			8.27
Selenium	ug/L	AA3-MW01	2/7/2007	21.1			126.46
Selenium	ug/L	AA3-MW02	2/7/2007	24.1			126.46
Selenium	ug/L	AA3-MW04	2/6/2007	22.9			126.46
Selenium	ug/L	AA3-MW10	2/5/2007	10	ND		126.46
Silver	ug/L	AA3-MW01	2/7/2007	10	ND		10
Silver	ug/L	AA3-MW02	2/7/2007	10	ND		10
Silver	ug/L	AA3-MW04	2/6/2007	10	ND		10
Silver	ug/L	AA3-MW10	2/5/2007	10	ND		10
Sodium	mg/L	AA3-MW01	2/7/2007	441		*	427.68
Sodium	mg/L	AA3-MW02	2/7/2007	469		*	427.68
Sodium	mg/L	AA3-MW04	2/6/2007	447		*	427.68
Sodium	mg/L	AA3-MW10	2/5/2007	479		***	427.68
Sulfate	mg/L	AA3-MW01	2/7/2007	0.7			1087.10
Sulfate	mg/L	AA3-MW02	2/7/2007	0.708			1087.10
Sulfate	mg/L	AA3-MW04	2/6/2007	0.98			1087.10
Sulfate	mg/L	AA3-MW10	2/5/2007	1	ND		1087.10
TDS	mg/L	AA3-MW01	2/7/2007	1920			2545.60
TDS	mg/L	AA3-MW02	2/7/2007	2135			2545.60

Table 8: Comparison of Most Current Downgradient Monitoring Data (Round 9) with the Inter-Well Prediction Limit - with Station-wide Data Set

Constituent	Units	Well	Date	Round 9 Result	Qualifier	Status of Round 9 Values	Station-wide Dataset - Inter-well Prediction Limits
TDS	mg/L	AA3-MW04	2/6/2007	2420			2545.60
TDS	mg/L	AA3-MW10	2/5/2007	2190			2545.60
Thallium	ug/L	AA3-MW01	2/7/2007	2	ND		10
Thallium	ug/L	AA3-MW02	2/7/2007	2	ND		10
Thallium	ug/L	AA3-MW04	2/6/2007	2	ND		10
Thallium	ug/L	AA3-MW10	2/5/2007	2	ND		10
Total nitrate	mg/L	AA3-MW01	2/7/2007	5.66			32.6
Total nitrate	mg/L	AA3-MW02	2/7/2007	6.63			32.6
Total nitrate	mg/L	AA3-MW04	2/6/2007	5.34			32.6
Total nitrate	mg/L	AA3-MW10	2/5/2007	0.5	ND		32.6
Vanadium	ug/L	AA3-MW01	2/7/2007	19			27.87
Vanadium	ug/L	AA3-MW02	2/7/2007	12.1			27.87
Vanadium	ug/L	AA3-MW04	2/6/2007	54.4		***	27.87
Vanadium	ug/L	AA3-MW10	2/5/2007	10	ND		27.87
Zinc	ug/L	AA3-MW01	2/7/2007	10	ND		58.08
Zinc	ug/L	AA3-MW02	2/7/2007	10	ND		58.08
Zinc	ug/L	AA3-MW04	2/6/2007	14			58.08
Zinc	ug/L	AA3-MW10	2/5/2007	10	ND		58.08

NOTES:
* - Current value failed - awaiting verification.
** - Current value passed - previous exceedance not verified.
*** - Current value failed - exceedance verified.
**** - Current value passed - awaiting one more verification.
***** - Insufficient background data to compute prediction limit.
ND - Not Detected

Table 9: Summary Statistics and Intermediate Computations for Intra-Well Prediction Limits - AA3-MW04 and AA3-MW10 Wells

Constituent	Units	Well	Total Number of Samples	Mean	Standard Deviation	Factor	Intra-well Prediction Limit
Alkalinity	mg/L	AA3-MW04	1	-	-	-	*
Alkalinity	mg/L	AA3-MW10	1	-	-	-	*
Aluminum	ug/L	AA3-MW04	9	-	-	-	**
Aluminum	ug/L	AA3-MW10	9	-	-	-	**
Antimony	ug/L	AA3-MW04	7	-	-	-	**
Antimony	ug/L	AA3-MW10	7	-	-	-	**
Arsenic	ug/L	AA3-MW04	9	20.83	6.49	3.05	40.65
Arsenic	ug/L	AA3-MW10	9	8.67	2.04	3.05	14.90
Barium	ug/L	AA3-MW04	9	30.43	1.98	3.05	36.48
Barium	ug/L	AA3-MW10	9	33.32	3.82	3.05	44.96
Beryllium	ug/L	AA3-MW04	9	-	-	-	**
Beryllium	ug/L	AA3-MW10	9	-	-	-	**
Bicarbonate	mg/L	AA3-MW04	1	-	-	-	*
Bicarbonate	mg/L	AA3-MW10	1	-	-	-	*
Cadmium	ug/L	AA3-MW04	9	-	-	-	**
Cadmium	ug/L	AA3-MW10	9	-	-	-	**
Calcium	mg/L	AA3-MW04	9	194.56	7.18	3.05	216.47
Calcium	mg/L	AA3-MW10	9	186.89	15.91	3.05	235.45
Chloride	mg/L	AA3-MW04	1	-	-	-	*
Chloride	mg/L	AA3-MW10	1	-	-	-	*
Chromium	ug/L	AA3-MW04	9	5.32	5.77	3.05	22.94
Chromium	ug/L	AA3-MW10	9	-	-	-	**
Cobalt	ug/L	AA3-MW04	8	-	-	-	**
Cobalt	ug/L	AA3-MW10	8	-	-	-	**
Copper	ug/L	AA3-MW04	9	18.39	8.41	3.05	44.07
Copper	ug/L	AA3-MW10	9	-	-	-	**
Fluoride	mg/L	AA3-MW04	1	-	-	-	*
Fluoride	mg/L	AA3-MW10	1	-	-	-	*
Iron	ug/L	AA3-MW04	9	-	-	-	**
Iron	ug/L	AA3-MW10	9	165.89	51.75	3.05	323.86
Lead	ug/L	AA3-MW04	9	-	-	-	**
Lead	ug/L	AA3-MW10	9	-	-	-	**
Magnesium	mg/L	AA3-MW04	9	109.00	2.96	3.05	118.03
Magnesium	mg/L	AA3-MW10	9	91.27	5.82	3.05	109.03
Manganese	ug/L	AA3-MW04	9	27.80	18.63	3.05	84.68
Manganese	ug/L	AA3-MW10	9	15.77	8.02	3.05	40.26
Mercury	ug/L	AA3-MW04	9	0.17	0.05	3.05	0.32
Mercury	ug/L	AA3-MW10	9	-	-	-	**
Nickel	ug/L	AA3-MW04	9	32.39	21.42	3.05	97.78
Nickel	ug/L	AA3-MW10	7	-	-	-	**
Potassium	mg/L	AA3-MW04	9	3.12	0.49	3.05	4.61
Potassium	mg/L	AA3-MW10	9	5.79	0.86	3.05	8.42
Selenium	ug/L	AA3-MW04	9	14.20	10.60	3.05	46.55
Selenium	ug/L	AA3-MW10	9	-	-	-	**
Silver	ug/L	AA3-MW04	7	-	-	-	**

Table 9: Summary Statistics and Intermediate Computations for Intra-Well Prediction Limits - AA3-MW04 and AA3-MW10 Wells

Constituent	Units	Well	Total Number of Samples	Mean	Standard Deviation	Factor	Intra-well Prediction Limit
Silver	ug/L	AA3-MW10	8	-	-	-	**
Sodium	mg/L	AA3-MW04	9	411.00	30.03	3.05	502.68
Sodium	mg/L	AA3-MW10	9	466.06	31.55	3.05	562.37
Sulfate	mg/L	AA3-MW04	1	-	-	-	*
Sulfate	mg/L	AA3-MW10	1	-	-	-	*
TDS	mg/L	AA3-MW04	1	-	-	-	*
TDS	mg/L	AA3-MW10	1	-	-	-	*
Thallium	ug/L	AA3-MW04	8	-	-	-	**
Thallium	ug/L	AA3-MW10	8	-	-	-	**
Total nitrate	mg/L	AA3-MW04	1	-	-	-	*
Total nitrate	mg/L	AA3-MW10	1	-	-	-	*
Vanadium	ug/L	AA3-MW04	9	46.21	7.49	3.05	69.08
Vanadium	ug/L	AA3-MW10	8	-	-	-	**
Zinc	ug/L	AA3-MW04	9	19.73	5.27	3.05	35.82
Zinc	ug/L	AA3-MW10	8	-	-	-	**

NOTES
* - Insufficient Data
** - Detection Frequency < 25%
*** - Zero Variance
- Not available

Appendix A
Groundwater Monitoring Well Purging and Sampling Log

LK Sample ID	Well ID
LK547	AA3-MW01
LK548	AA3-MW02
LK549	AA3-MW02
LK544	AA3-MW04
LK555	AA3-MW06
LK551	AA3-MW08
LK540	AA3-MW09A
LK541	AA3-MW09B
LK539	AA3-MW10
LK546	AA3-MW11
LK552	AA3-MW12
LK553	AA3-MW12
LK556	AA3-MW13
LK545	AA3-MW14

EARTH TECH

Well Number

Page 1

Low Flow/Minimal Drawdown Well Sampling Log

Project Name Anomaly Area 3 Project No. 29307.01.46.02
PID/FID Readings (ppm) NA (Ambient) NA (Well Mouth)
Static Levels (ft TOC) _____ (Product) _____ (Water)
Water Column Length _____ Minimum Purge Volume (L) _____
Total Liters Extracted _____ Pump/Tubing Volumes Extracted _____
Optimum Pump Rate (L/min) _____ Disposition of Discharge Water 55gallon Drum
Optimum Controller Settings:
Refill Time (sec) _____ Discharge Time (sec) _____ Discharge Pressure (feet) _____
Sample Number and Analyses 1 Sample, VOCs, SVOCs, TPH, Metals, PH, dissolved solids, Alkalinity,

Well Information
Number MW01
Location _____
Well Diameter 4"
Well Depth _____
Well Material PVC pipe
Dedicated Pump ☐
Disposable Bailer ☐
Discharge Line Dia (in) _____
Inlet Depth (ft TOC) _____

Equipmer
Interface Probe
Sounder No.
pH Meter No.
Conductivity Me
Thermometer N
D.O. Meter No.
Turbidity Meter
ORP Meter No.
Hach No.

Time (24 hr.)	Flow Rate (L/min)	Refill Cycle (sec)	Discharge Cycle (sec)	Discharge Pressure (feet)	Water Temp. (°C)	pH	Cond. (mS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	ORP (mV) +/-	Liters Purged Before Meas.	Water Level (feet Toc)	Rem (e.g. wat
1310	420	10	5	25					~~0~~			28.20	pump on
1314	400	10	5	22	20.4	7.29	2.66	2.32	0	32		28.30	
1317	320	10	4		20.4	7.24	2.65	1.11	0	81		28.30	
1325					20.4	7.17	2.63	0.54	0	68		28.28	
1330					20.4	7.19	2.64	0.45	0	59		28.28	
1335					20.4	7.20	2.64	0.46	0	50		28.28	
1340					20.5	7.25	2.64	0.45	0	44		28.28	
1345					20.6	7.27	2.64	0.43	0	43		28.29	
1355					20.5	7.29	2.64	0.50	0	44		28.29	
1400					20.5	7.31	2.64	0.55	0	47		28.29	
1426													Collect Sam

Notes:

1 ft length	ft^3	gal.	liters
2"	0.022	0.16	0.62
3"	0.049	0.37	1.41
4"	0.087	0.65	2.47
10"	0.55	4.1	15.5
12"	0.79	5.9	22.2

Bladder Volume = 0.495 L = 0.131 gal
1/4" ID Tubing Volume = 0.010 L/ft = 0.002 gal/ft
3/16" ID Tubing Volume = 0.006 L/ft

Recorded By Vanessa Orp Date 02/07/07
Checked By Vanu/Chris Date 03/15/0

EARTH TECH

Well Number

Page 1

Low Flow/Minimal Drawdown Well Sampling Log

Project Name Anomaly Area 3 Project No. 29307.01.46.02
PID/FID Readings (ppm) NA (Ambient) NA (Well Mouth)
Static Levels (ft TOC) (Product) (Water)
Water Column Length Minimum Purge Volume (L)
Total Liters Extracted Pump/Tubing Volumes Extracted
Optimum Pump Rate (L/min) Disposition of Discharge Water 55gallon Drum
Optimum Controller Settings:
Refill Time (sec) Discharge Time (sec) Discharge Pressure (feet)
Sample Number and Analyses 1 Sample, VOCs, SVOCs, TPH, Metals, PH, dissolved solids, Alkalinity,

Well Information
Number MW02
Location
Well Diameter 4"
Well Depth
Well Material PVC pipe
Dedicated Pump ☐
Disposable Bailer ☐
Discharge Line Dia (in)
Inlet Depth (ft TOC)

Equipmen
Interface Probe N
Sounder No. H
pH Meter No. E
Conductivity Met
Thermometer No
D.O. Meter No. -
Turbidity Meter N
ORP Meter No. -
Hach No. N

Time (24 hr.)	Flow Rate (L/min)	Refill Cycle (sec)	Discharge Cycle (sec)	Discharge Pressure (feet)	Water Temp. (°C)	pH	Cond. (mS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	ORP (mV) +/-	Liters Purged Before Meas.	Water Level (feet Toc)	Rem (e.g. wate
1448	300	10	5	28								43.32	Pump on
1452	440			30	22.0	7.16	3.10	2.10	0	104		43.31	
1455					22.1	7.17	3.07	0.60	0	99		43.32	
1500					21.9	7.17	3.08	0.18	0	93		43.33	
1505					21.8	7.18	3.07	0.15	0	94		—	
1510					21.9	7.18	3.07	0.09	0	98		43.33	
1515					21.8	7.18	3.07	0.14	0	100		43.32	
1520					21.9	7.19	3.07	0.13	0	100		43.33	
1525					21.9	7.19	3.06	0.09	0	100		43.33	
1530					21.9	7.20	3.06	0.18	0	99		43.33	
1535					21.8	7.20	3.06	0.26	0	99		43.33	
1540					21.9	7.21	3.06	0.27	0	98		43.33	Pump off at

Notes: 1600 Sample taken

1 ft length	ft^3	gal.	liters
2"	0.022	0.16	0.62
3"	0.049	0.37	1.41
4"	0.087	0.65	2.47
10"	0.55	4.1	15.5
12"	0.79	5.9	22.2

Bladder Volume = 0.495 L = 0.131 gal
1/4" ID Tubing Volume = 0.010 L/ft = 0.002 gal/ft
3/16" ID Tubing Volume = 0.006 L/ft

Recorded By Vanessa Diep Date 02/07/07
Checked By Vanessa / Chris Date 03/15/07

EARTH TECH

Well Number

Page 1

Low Flow/Minimal Drawdown Well Sampling Log

Project Name Anomaly Area 3 Project No. 29307.01.46.02
PID/FID Readings (ppm) NA (Ambient) NA (Well Mouth)
Static Levels (ft TOC) _____ (Product) _____ (Water)
Water Column Length _____ Minimum Purge Volume (L) _____
Total Liters Extracted _____ Pump/Tubing Volumes Extracted _____
Optimum Pump Rate (L/min) _____ Disposition of Discharge Water 55 gallon Drum
Optimum Controller Settings:
Refill Time (sec) _____ Discharge Time (sec) _____ Discharge Pressure (feet) _____
Sample Number and Analyses 1 Sample, VOCs, SVOCs, TPH, Metals, PH, dissolved solids, Alkalinity,

Well Information
Number MW04
Location _____
Well Diameter 4"
Well Depth _____
Well Material PVC pipe
Dedicated Pump ☐
Disposable Bailer ☐
Discharge Line Dia (in) _____
Inlet Depth (ft TOC) _____

Equipmer
Interface Probe
Sounder No. H
pH Meter No. I
Conductivity Me
Thermometer N
D.O. Meter No.
Turbidity Meter
ORP Meter No.
Hach No. A

Time (24 hr.)	Flow Rate (L/min)	Refill Cycle (sec)	Discharge Cycle (sec)	Discharge Pressure (feet)	Water Temp. (°C)	pH	Cond. (mS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	ORP (mV) +/-	Liters Purged Before Meas.	Water Level (feet Toc)	Rem (e.g. wat
1325	125	10	5	20	~~20~~								Pump on
1333					24.3	7.08	3.15	3.57	0	100		33.75	
1340					24.4	6.98	3.15	1.36	0	105		33.75	
1345					24.5	7.03	3.14	1.10	0	102		33.76	
1355					24.7	7.11	3.15	0.84	0	92		33.80	
1405					24.7	7.15	3.14	0.74	0	84		33.82	
1420					24.8	7.16	3.15	0.59	0	78		33.84	
1438					24.9	7.16	3.15	0.45	0	74		33.85	
1447					24.3	7.16	3.14	0.31	0	73		33.84	
~~1459~~					24.0	7.16	3.14	0.22	0	71		33.89	
1502					23.9	7.15	3.14	0.13	0	71		33.92	
1535													pump off

Notes:

1 ft length	ft^3	gal.	liters
2"	0.022	0.16	0.62
3"	0.049	0.37	1.41
4"	0.087	0.65	2.47
10"	0.55	4.1	15.5
12"	0.79	5.9	22.2

Bladder Volume = 0.495 L = 0.131 gal
1/4" ID Tubing Volume = 0.010 L/ft = 0.002 gal/ft
3/16" ID Tubing Volume = 0.006 L/ft

Recorded By Vanessa Diaz Date 02/06/07
Checked By Varu/Chris Date 03/15/0

EARTH TECH

Well Number

Page 1

Low Flow/Minimal Drawdown Well Sampling Log

Project Name Anomaly Area 3 Project No. 29307.01.46.02

PID/FID Readings (ppm) NA (Ambient) NA (Well Mouth)

Static Levels (ft TOC) _____ (Product) _____ (Water)

Water Column Length _____ Minimum Purge Volume (L) _____

Total Liters Extracted _____ Pump/Tubing Volumes Extracted _____

Optimum Pump Rate (L/min) _____ Disposition of Discharge Water 55gallon Drum

Optimum Controller Settings:

Refill Time (sec) _____ Discharge Time (sec) _____ Discharge Pressure (feet) _____

Sample Number and Analyses 1 Sample, VOCs, SVOCs, TPH, Metals, PH, dissolved solids, Alkalinity,

Well Information

Number MW06

Location _____

Well Diameter 4"

Well Depth _____

Well Material PVC pipe

Dedicated Pump ☐

Disposable Bailer ☐

Discharge Line Dia (in) _____

Inlet Depth (ft TOC) _____

Equipmer

Interface Probe

Sounder No. 1

pH Meter No. 1

Conductivity Me

Thermometer N

D.O. Meter No.

Turbidity Meter I

ORP Meter No.

Hach No. N

Time (24 hr.)	Flow Rate (L/min)	Refill Cycle (sec)	Discharge Cycle (sec)	Discharge Pressure (feet)	Water Temp. (°C)	pH	Cond. (mS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	ORP (mV) +/-	Liters Purged Before Meas.	Water Level (feet Toc)	Rem (e.g. wat
752	280	11	4	20								29.74	Pump on
755					17.4	6.40	2.60	3.24	9.7	143		29.79	
800					19.1	6.50	2.86	0.94	6.0	116		29.79	
805					19.5	6.52	2.93	0.38	5.2	110		29.80	
810					19.5	6.52	2.93	0.22	4.4	104		29.80	
815					19.6	6.52	2.94	0.19	4.1	102		29.80	
820					19.7	6.51	2.94	0.17	4.7	101		29.80	
825					19.8	6.44	2.95	0.08	4.3	99		29.80	
830					19.7	6.48	2.95	0.14	3.5	98		29.80	
835					19.7	6.48	2.95	0.10	3.9	98		29.80	
840					19.7	6.47	2.95	0.12	2.8	97		29.81	
845					19.7	6.46	2.95	0.11	2.2	96		29.80	Continued

Notes:

1 ft length	ft^3	gal.	liters
2"	0.022	0.16	0.62
3"	0.049	0.37	1.41
4"	0.087	0.65	2.47
10"	0.55	4.1	15.5
12"	0.79	5.9	22.2

Bladder Volume = 0.495 L = 0.131 gal
1/4" ID Tubing Volume = 0.010 L/ft = 0.002 gal/ft
3/16" ID Tubing Volume = 0.006 L/ft

Recorded By Vanessa Diep Date 02/09/07

Checked By Varu/Chris B Date 03/15/07

EARTH TECH

Well

Low Flow/Minimal Drawdown Well Sampling Log

Pag

(Continuation Sheet)

Project Name Anomaly Area 3 Project Number 29307.01.46.02 Date 02/04/

Location Well No. MW06 Recorded By

Time (24 hr.)	Flow Rate (L/min)	Refill Cycle (sec)	Discharge Cycle (sec)	Discharge Pressure (feet)	Water Temp. (°C)	pH	Cond. (mS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	ORP (mV) +/-	Liters Purged Before Meas.	Water Level (feet Toc)	
850	280	11	4	20	19.8	6.47	2.95	0.12	2.2	96		29.80	
918													Pump

Notes:

1 ft length	ft^3	gal.	liters
2"	0.022	0.16	0.62
3"	0.049	0.37	1.41
4"	0.087	0.65	2.47
10"	0.55	4.1	15.5
12"	0.79	5.9	22.2

Bladder Volume = 0.495 L = 0.131 gal
1/4" ID Tubing Volume = 0.010 L/ft = 0.002 gal/ft
3/16" ID Tubing Volume = 0.006L/ft

EARTH TECH

Well Number

Page 1

Low Flow/Minimal Drawdown Well Sampling Log

Project Name Anomaly Area 3 Project No. 29307.01.46.02
PID/FID Readings (ppm) NA (Ambient) NA (Well Mouth)
Static Levels (ft TOC) _____ (Product) _____ (Water)
Water Column Length _____ Minimum Purge Volume (L) _____
Total Liters Extracted _____ Pump/Tubing Volumes Extracted _____
Optimum Pump Rate (L/min) _____ Disposition of Discharge Water 55 gallon Drum
Optimum Controller Settings:
Refill Time (sec) _____ Discharge Time (sec) _____ Discharge Pressure (feet) _____
Sample Number and Analyses 1 Sample, VOCs, SVOCs, TPH, Metals, PH, dissolved solids, Alkalinity,

Well Information
Number MW-05
Location _____
Well Diameter 4"
Well Depth _____
Well Material PVC pipe
Dedicated Pump ☐
Disposable Bailer ☐
Discharge Line Dia (in) _____
Inlet Depth (ft TOC) _____

Equipme
Interface Probe
Sounder No.
pH Meter No.
Conductivity Me
Thermometer N
D.O. Meter No.
Turbidity Meter
ORP Meter No.
Hach No.

Time (24 hr.)	Flow Rate (L/min)	Refill Cycle (sec)	Discharge Cycle (sec)	Discharge Pressure (feet)	Water Temp. (°C)	pH	Cond. (mS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	ORP (mV) +/-	Liters Purged Before Meas.	Water Level (feet Toc)	Rem (e.g. wat
0840	400	10	5	28							–	29.78	Pump on
842	270	10	5	25	18.5	7.00	2.44	1.15	0	164		29.98	
845	270	10	5	25	18.8	7.00	2.50	0.42	0	151		29.99	
847	230	11	4	25	18.9	7.12	2.51	0.21	0	139		30.03	
849	175	12	3	25	18.9	7.15	2.51	0.24	0	132		30.04	
900	175	↓	↓	25	19.1	7.20	2.50	0.00	0	112		30.04	
910	125	↓	↓	20	19.4	7.11	2.50	0.00	0	100		31.30	
920	↓	↓	↓	↓	19.0	7.14	2.50	0.00	0	102		30.09	
930	↓	↓	↓	↓	18.9	7.17	2.50	0.00	0	98		30.03	
940	↓	↓	↓	↓	18.6	7.19	2.50	0.00	0	96		30.02	
950	↓	↓	↓	↓	18.7	7.19	2.49	0.00	0.9	96		30.02	
1003													Sample take

Notes:

1 ft length	ft^3	gal.	liters
2"	0.022	0.16	0.62
3"	0.049	0.37	1.41
4"	0.087	0.65	2.47
10"	0.55	4.1	15.5
12"	0.79	5.9	22.2

Bladder Volume = 0.495 L = 0.131 gal
1/4" ID Tubing Volume = 0.010 L/ft = 0.002 gal/ft
3/16" ID Tubing Volume = 0.006 L/ft

Recorded By Vanessa Ortiz Date 02/08/10
Checked By Vasu/Chris Date 03/15/10

EARTH TECH

Well Number

Page 1

Low Flow/Minimal Drawdown Well Sampling Log

Project Name Anomaly Area 3 Project No. 29307.01.46.02
PID/FID Readings (ppm) NA (Ambient) NA (Well Mouth)
Static Levels (ft TOC) _____ (Product) _____ (Water)
Water Column Length _____ Minimum Purge Volume (L) _____
Total Liters Extracted _____ Pump/Tubing Volumes Extracted _____
Optimum Pump Rate (L/min) _____ Disposition of Discharge Water 55gallon Drum
Optimum Controller Settings:
Refill Time (sec) _____ Discharge Time (sec) _____ Discharge Pressure (feet) _____
Sample Number and Analyses 1 Sample, VOCs, SVOCs, TPH, Metals, PH, dissolved solids, Alkalinity,

Well Information
Number MW4a
Location _____
Well Diameter 4"
Well Depth _____
Well Material PVC pipe
Dedicated Pump ☐
Disposable Bailer ☐
Discharge Line Dia (in) _____
Inlet Depth (ft TOC) _____

Equipme
Interface Probe
Sounder No.
pH Meter No.
Conductivity Me
Thermometer N
D.O. Meter No.
Turbidity Meter
ORP Meter No.
Hach No.

Time (24 hr.)	Flow Rate (L/min)	Refill Cycle (sec)	Discharge Cycle (sec)	Discharge Pressure (feet)	Water Temp. (°C)	pH	Cond. (mS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	ORP (mV) +/-	~~Liters Purged Before Meas.~~ Conc	Water Level (feet Toc)	Rem (e.g. wat
844	400	10	5	26								29.48	Pump on
845					19.1	7.22	2.59	2.59	72.0	159	2.86	29.48	
855					19.2	7.19	1.72	1.72	3.0	143	2.86	29.49	
900					19.3	7.15	1.67	1.67	0	133	2.86	29.48	
905					19.4	7.16	1.54	1.54	0	127	2.86	29.49	
910					19.4	7.17	1.57	1.57	0	123	2.86	29.49	
915					19.5	7.19	1.57	1.57	0	120	2.86	29.49	
920					19.4	7.20	1.52	1.52	0	117	2.86	29.49	
925					19.4	7.32	1.53	1.53	0	115	2.86	29.49	~~Pump off~~
950													Pump off

Notes:

1 ft length	ft^3	gal.	liters
2"	0.022	0.16	0.62
3"	0.049	0.37	1.41
4"	0.087	0.65	2.47
10"	0.55	4.1	15.5
12"	0.79	5.9	22.2

Bladder Volume = 0.495 L = 0.131 gal
1/4" ID Tubing Volume = 0.010 L/ft = 0.002 gal/ft
3/16" ID Tubing Volume = 0.006 L/ft

Recorded By Vanessa Diep Date 02/06/07
Checked By Vanessa/Chris Date 03/15/07

EARTH TECH

Well Number

Page 1

Low Flow/Minimal Drawdown Well Sampling Log

Project Name Anomaly Area 3 Project No. 29307.01.46.02

PID/FID Readings (ppm) NA (Ambient) NA (Well Mouth)

Static Levels (ft TOC) _____ (Product) _____ (Water)

Water Column Length _____ Minimum Purge Volume (L) _____

Total Liters Extracted _____ Pump/Tubing Volumes Extracted _____

Optimum Pump Rate (L/min) _____ Disposition of Discharge Water 55gallon Drum

Optimum Controller Settings:

Refill Time (sec) _____ Discharge Time (sec) _____ Discharge Pressure (feet) _____

Sample Number and Analyses 1 Sample, VOCs, SVOCs, TPH, Metals, PH, dissolved solids, Alkalinity,

Well Information

Number MW9B

Location _____

Well Diameter 4"

Well Depth _____

Well Material PVC pipe

Dedicated Pump ☐

Disposable Bailer ☐

Discharge Line Dia (in) _____

Inlet Depth (ft TOC) _____

Equipme

Interface Probe

Sounder No.

pH Meter No.

Conductivity Me

Thermometer N

D.O. Meter No.

Turbidity Meter

ORP Meter No.

Hach No.

Time (24 hr.)	Flow Rate (L/min)	Refill Cycle (sec)	Discharge Cycle (sec)	Discharge Pressure (feet)	Water Temp. (°C)	pH	Cond. (mS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	ORP (mV) +/-	Liters Purged Before Meas.	Water Level (feet Toc)	Rem (e.g. wat
1015	225	8	7	35	21.0	7.51	2.54	3.07	0	108		29.54	Pump on
1025					20.7	7.39	2.54	0.79	30.0	97		29.52	
1030					20.6	7.36	2.52	0.66	19.5	92		29.54	
1040					20.7	7.35	2.52	0.43	0	90		29.55	
1050					20.8	7.38	2.53	0.33	0	88		29.54	
1100					21.0	7.19	2.53	0.21	0	86		29.53	
1110					21.2	7.22	2.53	0.09	0	92		29.54	
1135													Pump off
~~1135~~													

Notes:

1 ft length	ft^3	gal.	liters
2"	0.022	0.16	0.62
3"	0.049	0.37	1.41
4"	0.087	0.65	2.47
10"	0.55	4.1	15.5
12"	0.79	5.9	22.2

Bladder Volume = 0.495 L = 0.131 gal
1/4" ID Tubing Volume = 0.010 L/ft = 0.002 gal/ft
3/16" ID Tubing Volume = 0.006 L/ft

Recorded By Vanessia Diep Date 02/06/07

Checked By Vanessia Diep Date 03/15/07

EARTH TECH

Well Number MW

Page 1 of

Low Flow/Minimal Drawdown Well Sampling Log

Project Name Anomaly Area 3 Project No. 29307.01.46.02

PID/FID Readings (ppm) NA (Ambient) NA (Well Mouth)

Static Levels (ft TOC) _____ (Product) _____ (Water)

Water Column Length _____ Minimum Purge Volume (L) _____

Total Liters Extracted _____ Pump/Tubing Volumes Extracted _____

Optimum Pump Rate (L/min) _____ Disposition of Discharge Water 55gallon Drum

Optimum Controller Settings:

Refill Time (sec) _____ Discharge Time (sec) _____ Discharge Pressure (feet) _____

Sample Number and Analyses 1 Sample, VOCs, SVOCs, TPH, Metals, PH, dissolved solids, Alkalinity,

Well Information

Number MW10

Location _____

Well Diameter 4"

Well Depth _____

Well Material PVC pipe

Dedicated Pump ☐

Disposable Bailer ☐

Discharge Line Dia (in) _____

Inlet Depth (ft TOC) _____

Equipment Inform

Interface Probe No. N

Sounder No. Hach

pH Meter No. Horiba

Conductivity Meter No. _____

Thermometer No. _____

D.O. Meter No. _____

Turbidity Meter No. _____

ORP Meter No. _____

Hach No. NA

Time (24 hr.)	Flow Rate (L/min)	Refill Cycle (sec)	Discharge Cycle (sec)	Discharge Pressure (feet)	Water Temp. (°C)	pH	Cond. (mS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	ORP (mV) +/-	Liters Purged Before Meas.	Water Level (feet Toc)	Remarks (e.g. water clarity
1440	150	10	5	30								38.58	Pump on
1445					24.4	7.64	1.59	6.85	0.3	76		38.57	
1450					24.0	7.34	3.05	3.37	0.3	38		38.58	
1500					23.5	7.28	5.22	0.62	0.2	2		38.58	
1510					23.0	7.37	5.27	1.06	23.4	-1		38.58	lots of bubble
1520					22.5	7.35	5.32	0.24	48.2	4		38.58	
1530					22.3	7.37	5.33	0.71	42.4	-2		38.59	
1535					22.1	7.37	3.65	0.24	113.0	-5		38.59	
1613	↓	↓	↓	↓									Pump of Same
													Other parameter
													but turbidity
													bubbles noticed

Notes:

1 ft length	ft^3	gal.	liters
2"	0.022	0.16	0.62
3"	0.049	0.37	1.41
4"	0.087	0.65	2.47
10"	0.55	4.1	15.5
12"	0.79	5.9	22.2

Bladder Volume = 0.495 L = 0.131 gal
1/4" ID Tubing Volume = 0.010 L/ft = 0.002 gal/ft
3/16" ID Tubing Volume = 0.006 L/ft

Recorded By Vanessa Orep Date 02/05/07

Checked By [illegible] Date 03/15/07

EARTH TECH

Well Number

Page 1

Low Flow/Minimal Drawdown Well Sampling Log

Project Name Anomaly Area 3 Project No. 29307.01.46.02
PID/FID Readings (ppm) NA (Ambient) NA (Well Mouth)
Static Levels (ft TOC) _____ (Product) _____ (Water)
Water Column Length _____ Minimum Purge Volume (L) _____
Total Liters Extracted _____ Pump/Tubing Volumes Extracted _____
Optimum Pump Rate (L/min) _____ Disposition of Discharge Water 55gallon Drum
Optimum Controller Settings:
Refill Time (sec) _____ Discharge Time (sec) _____ Discharge Pressure (feet) _____
Sample Number and Analyses 1 Sample, VOCs, SVOCs, TPH, Metals, PH, dissolved solids, Alkalinity,

Well Information
Number MW11
Location _____
Well Diameter 4"
Well Depth _____
Well Material PVC pipe
Dedicated Pump ☐
Disposable Bailer ☐
Discharge Line Dia (in) _____
Inlet Depth (ft TOC) _____

Equipme
Interface Probe
Sounder No. 1
pH Meter No. 1
Conductivity Me
Thermometer N
D.O. Meter No.
Turbidity Meter
ORP Meter No.
Hach No. A

Time (24 hr.)	Flow Rate (L/min)	Refill Cycle (sec)	Discharge Cycle (sec)	Discharge Pressure (feet)	Water Temp. (°C)	pH	Cond. (mS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	ORP (mV) +/-	Liters Purged Before Meas.	Water Level (feet Toc)	Rem (e.g. wat
1043		11	4	22								29.80	Pump on
1046	270	11	4									29.95	
1048	225	12	3		20.0	7.05	2.85	1.60	0	32		29.98	
1100					20.1	7.10	2.85	.30	0	65		29.96	
1110					20.1	7.11	2.85	.05	0	65		29.95	
1120					20.3	7.12	2.85	0	0	67		29.45	
1130					20.5	7.13	2.85	0	0	68		29.45	
1135					20.5	7.14	2.85	0	0	68		29.45	
1140					20.5	7.14	2.85	0	0	69		29.45	
1145													
1228													Pump off Sam

Notes:

1 ft length	ft^3	gal.	liters
2"	0.022	0.16	0.62
3"	0.049	0.37	1.41
4"	0.087	0.65	2.47
10"	0.55	4.1	15.5
12"	0.79	5.9	22.2

Bladder Volume = 0.495 L = 0.131 gal
1/4" ID Tubing Volume = 0.010 L/ft = 0.002 gal/ft
3/16" ID Tubing Volume = 0.006 L/ft

Recorded By Vanessa D.P. Date 02/07/07
Checked By Vana/Chris Date 03/15/07

EARTH TECH

Well Number

Page 1

Low Flow/Minimal Drawdown Well Sampling Log

Project Name Anomaly Area 3 Project No. 29307.01.46.02
PID/FID Readings (ppm) NA (Ambient) NA (Well Mouth)
Static Levels (ft TOC) _____ (Product) _____ (Water)
Water Column Length _____ Minimum Purge Volume (L) _____
Total Liters Extracted _____ Pump/Tubing Volumes Extracted _____
Optimum Pump Rate (L/min) _____ Disposition of Discharge Water 55gallon Drum
Optimum Controller Settings:
Refill Time (sec) _____ Discharge Time (sec) _____ Discharge Pressure (feet) _____
Sample Number and Analyses 1 Sample, VOCs, SVOCs, TPH, Metals, PH, dissolved solids, Alkalinity,

Well Information
Number MW12
Location _____
Well Diameter 4"
Well Depth _____
Well Material PVC pipe
Dedicated Pump ☐
Disposable Bailer ☐
Discharge Line Dia (in) _____
Inlet Depth (ft TOC) _____

Equipmer
Interface Probe
Sounder No. _____
pH Meter No. _____
Conductivity Me
Thermometer N
D.O. Meter No.
Turbidity Meter
ORP Meter No.
Hach No. _____

Time (24 hr.)	Flow Rate (L/min)	Refill Cycle (sec)	Discharge Cycle (sec)	Discharge Pressure (feet)	Water Temp. (°C)	pH	Cond. (mS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	ORP (mV) +/-	Liters Purged Before Meas.	Water Level (feet Toc)	Rem (e.g. wat
1118	400	14	4	25								32.41	Pump on
1120	280	12	3	25	20.5	6.84	3.74	1.72	0	-96		32.50	
1125	280	12	3	25	20.5	6.78	3.82	2.54	0	-108		32.57	
1127	140	12	3	22	20.6	6.78	3.81	2.34	0	-111		32.57	
1135	140	12	3	22	20.6	6.79	3.81	2.06	0	-113		32.59	
1141	170	12.5	2.5	22	20.5	6.81	3.82	1.62	0	-115		32.61	
1145	170			22	20.5	6.84	3.83	1.34	0	-117		32.62	
1205	170			22	20.5	6.86	3.83	1.16	0	-119		32.63	
1215	150			20	20.4	6.87	3.84	0.97	0	-119		32.62	
1225	150			20	20.3	6.87	3.85	0.94	0	-120		32.62	
1235	150			20	20.5	6.87	3.84	0.79	0	-121		32.62	
1424													Pump off

Notes:

1 ft length	ft^3	gal.	liters
2"	0.022	0.16	0.62
3"	0.049	0.37	1.41
4"	0.087	0.65	2.47
10"	0.55	4.1	15.5
12"	0.79	5.9	22.2

Bladder Volume = 0.495 L = 0.131 gal
1/4" ID Tubing Volume = 0.010 L/ft = 0.002 gal/ft
3/16" ID Tubing Volume = 0.006 L/ft

Recorded By Vanessa Diep Date 02/08/10
Checked By Vanu/Chris Date 03/15/10

EARTH TECH

Well Number MW

Low Flow/Minimal Drawdown Well Sampling Log

Project Name Anomaly Area 3 Project No. 29307.01.46.02
PID/FID Readings (ppm) NA (Ambient) NA (Well Mouth)
Static Levels (ft TOC) _____ (Product) _____ (Water)
Water Column Length _____ Minimum Purge Volume (L) _____
Total Liters Extracted _____ Pump/Tubing Volumes Extracted _____
Optimum Pump Rate (L/min) _____ Disposition of Discharge Water 55gallon Drum
Optimum Controller Settings:
Refill Time (sec) _____ Discharge Time (sec) _____ Discharge Pressure (feet) _____
Sample Number and Analyses 1 Sample, VOCs, SVOCs, TPH, Metals, PH, dissolved solids, Alkalinity,

Well Information
Number MW 13
Location _____
Well Diameter 4"
Well Depth _____
Well Material PVC
Dedicated Pump ☐
Disposable Bailer ☐
Discharge Line Dia (in) _____
Inlet Depth (ft TOC) _____

Equipment Infor
Interface Probe No. _____
Sounder No. Heron
pH Meter No. Horiba
Conductivity Meter No. _____
Thermometer No. _____
D.O. Meter No. _____
Turbidity Meter No. _____
ORP Meter No. _____
Hach No. NA

Time (24 hr.)	Flow Rate (L/min)	Refill Cycle (sec)	Discharge Cycle (sec)	Discharge Pressure (feet)	Water Temp. (°C)	pH	Cond. (mS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	ORP (mV) +/-	Liters Purged Before Meas.	Water Level (feet Toc)	Remarks (e.g. water clarit
950	200	11	4	25								35.85	
955					19.4	6.52	3.83	1.57	0	101		35.85	
1000					19.8	6.52	3.91	0.08	0	100		35.85	
1005					19.8	6.53	3.92	0.00	3.1	97		35.85	
1010					19.9	6.52	3.92	0.00	2.8	91		35.85	
1015					19.9	6.55	3.93	0.00	1.4	90		35.84	
1020					19.9	6.55	3.93	0.00	3.5	85		35.84	
1025					19.9	6.55	3.92	0.00	4.0	87		35.85	
1030					20.0	6.55	3.92	0.00	0	86		35.85	
1035					20.2	6.56	3.92	0.00	13	85		35.85	Bubble in water
1040					20.1	6.55	3.93	0.00	10.5	84		35.85	
1045					20.2	6.56	3.92	0.00	13.1	82		35.85	Continued on nex

Notes:

1 ft length	ft^3	gal.	liters
2"	0.022	0.16	0.62
3"	0.049	0.37	1.41
4"	0.087	0.65	2.47
10"	0.55	4.1	15.5
12"	0.79	5.9	22.2

Bladder Volume = 0.495 L = 0.131 gal
1/4" ID Tubing Volume = 0.010 L/ft = 0.002 gal/ft
3/16" ID Tubing Volume = 0.006 L/ft

Recorded By Vanessa DeP Date 02/09/07
Checked By Vanessa/Chris Date 03/15/07

EARTH TECH

Well Numbe

Low Flow/Minimal Drawdown Well Sampling Log

(Continuation Sheet)

Page 2

Project Name Anomaly Area 3 Project Number 29307.01.46.02 Date 02/09/07

Location El Toro MCAS Well No. MW 13 Recorded By Vanessa

Time (24 hr.)	Flow Rate (L/min)	Refill Cycle (sec)	Discharge Cycle (sec)	Discharge Pressure (feet)	Water Temp. (°C)	pH	Cond. (mS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	ORP (mV) +/-	Liters Purged Before Meas.	Water Level (feet Toc)	F (e.g.
1050	200	11	4	25	20.1	6.35	3.94	0.00	8.0	81		35.85	
1110												~~3~~	Sample ta
													Other par
													but turb
													due to
													Purging

Notes:

1 ft length	ft^3	gal.	liters
2"	0.022	0.16	0.62
3"	0.049	0.37	1.41
4"	0.087	0.65	2.47
10"	0.55	4.1	15.5
12"	0.79	5.9	22.2

Bladder Volume = 0.495 L = 0.131 gal
1/4" ID Tubing Volume = 0.010 L/ft = 0.002 gal/ft
3/16" ID Tubing Volume = 0.006L/ft

EARTH TECH

Well Number

Page 1

Low Flow/Minimal Drawdown Well Sampling Log

Project Name Anomaly Area 3 Project No. 29307.01.46.02
PID/FID Readings (ppm) NA (Ambient) NA (Well Mouth)
Static Levels (ft TOC) _____ (Product) _____ (Water)
Water Column Length _____ Minimum Purge Volume (L) _____
Total Liters Extracted _____ Pump/Tubing Volumes Extracted _____
Optimum Pump Rate (L/min) _____ Disposition of Discharge Water 55gallon Drum
Optimum Controller Settings:
Refill Time (sec) _____ Discharge Time (sec) _____ Discharge Pressure (feet) _____
Sample Number and Analyses 1 Sample, VOCs, SVOCs, TPH, Metals, PH, dissolved solids, Alkalinity,

Well Information
Number MW14
Location _____
Well Diameter 4"
Well Depth _____
Well Material PVC pipe
Dedicated Pump ☐
Disposable Bailer ☐
Discharge Line Dia (in) _____
Inlet Depth (ft TOC) _____

Equipmer
Interface Probe I
Sounder No. _____
pH Meter No. E
Conductivity Met
Thermometer No
D.O. Meter No. -
Turbidity Meter N
ORP Meter No. -
Hach No. N

Time (24 hr.)	Flow Rate (L/min)	Refill Cycle (sec)	Discharge Cycle (sec)	Discharge Pressure (feet)	Water Temp. (°C)	pH	Cond. (mS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	ORP (mV) +/-	Liters Purged Before Meas.	Water Level (feet Toc)	Rem (e.g. wate
835	350	10	5	22								34.50	Pump on
840	300	11	4									34.68	
842	200	12	3		18.8	6.86	3.28	0.82	0	-43		34.67	
850					19.1	6.88	3.28	0.15	0.2	-56		34.67	
855					19.3	6.89	3.28	0	0.5	-61		34.66	
900					19.3	6.96	3.28	0	0.9	-64		34.66	
910					19.4	7.07	3.27	0	1.2	-68		34.66	
920					19.4	7.02	3.27	0	1.5	-67		34.66	
930					19.5	7.03	3.26	0	0	-65		34.66	
940					19.4	7.02	3.26	0	0	-65		34.65	
1015													Sample coll

Notes:

1 ft length	ft^3	gal.	liters
2"	0.022	0.16	0.62
3"	0.049	0.37	1.41
4"	0.087	0.65	2.47
10"	0.55	4.1	15.5
12"	0.79	5.9	22.2

Bladder Volume = 0.495 L = 0.131 gal
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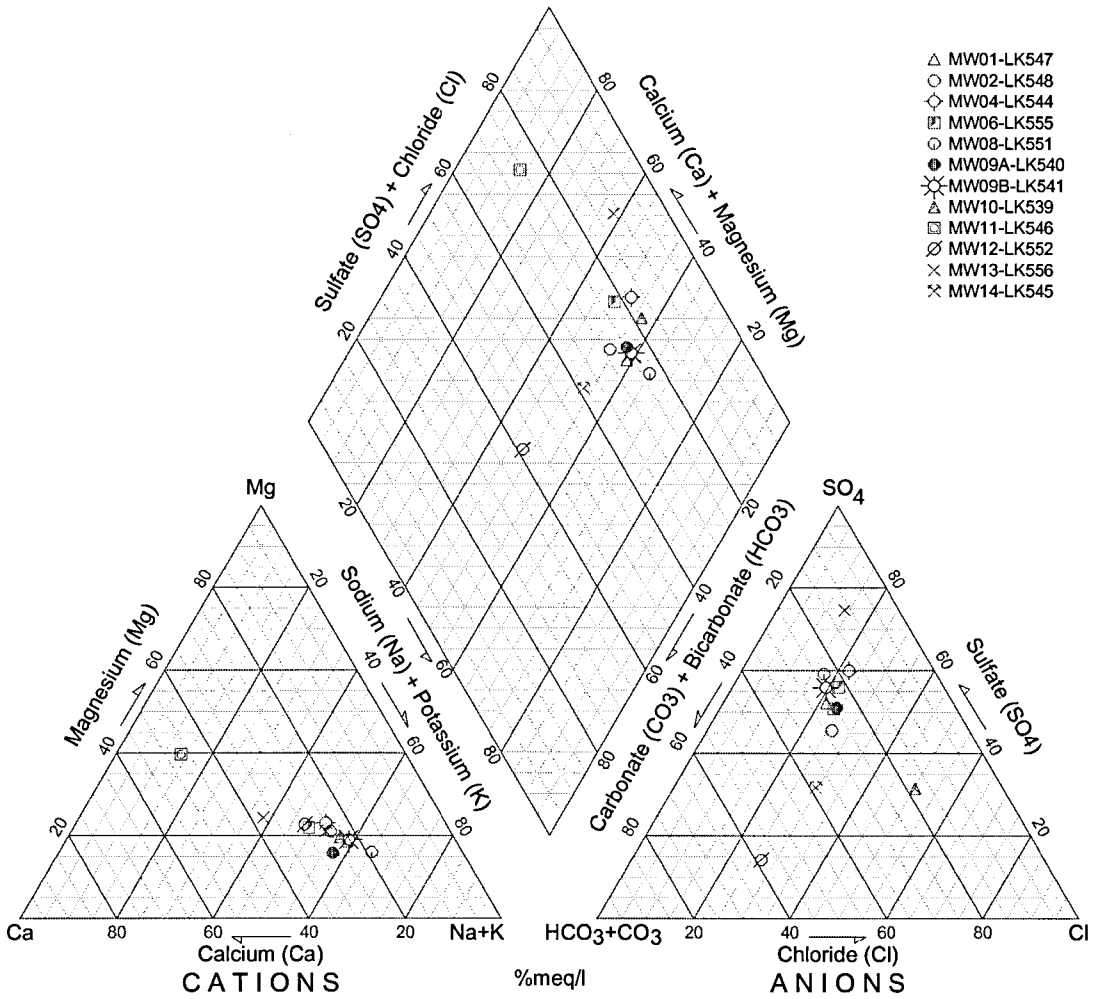
3/16" ID Tubing Volume = 0.006 L/ft

Recorded By Vanessa Diaz Date 02/07/07
Checked By Varu/Chris Date 03/15/07

Appendix B
Piper Diagram

Piper Diagram



DEPARTMENT OF THE NAVY
BASE REALIGNMENT AND CLOSURE
PROGRAM MANAGEMENT OFFICE WEST
1455 FRAZEE RD, SUITE 900
SAN DIEGO, CA 92108-4310

5090
Ser BPMOW.jtc/0223

JAN 28 2008

Mr. Richard Muza
Remedial Project Manager
U.S. Environmental Protection Agency, Region IX
75 Hawthorne Street, Mail Code SFD-8-1
San Francisco, CA 94105-3901

Mr. Quang Than
Remedial Project Manager
Southern California Base Closure and Reuse Unit
California Department of Toxic Substances Control
Office of Military Facilities
5796 Corporate Ave.
Cypress, CA 90630-4700

Mr. John Broderick
Remedial Project Manager
California Regional Water Quality Control Board
3737 Main Street, Suite 500
Riverside, CA 92501-3348

SUBJECT: DRAFT TO FINAL; TECHNICAL MEMORANDUM, ANOMALY AREA 3, SUPPLEMENTAL GROUNDWATER MONITORING FOR FORMER MARINE CORPS AIR STATION EL TORO, CALIFORNIA.

Dear Base Realignment and Closure Cleanup Team (BCT):

We are pleased to report the previously provided subject draft document can now be considered the final version. The Technical Memorandum summarizes Round 9 groundwater monitoring, which was conducted as a part of the Removal Site Evaluation and in support of the Remedial Investigation/Feasibility Study for Anomaly Area 3. The monitoring included groundwater sampling for general minerals and common ions to determine whether debris placement activities have resulted in impacts to groundwater. Evaluation of results from this monitoring, which included a statistical evaluation of results to-date, indicates that debris placement activities at the site have not impacted groundwater at the downgradient point of compliance.

The draft version of the document was transmitted to BCT Members for comments or concurrence on July 24, 2007. No comment/concurrence responses were received by the Navy from the U.S. Environmental Protection Agency and Department of Toxic Substances Control on August 20 and October 3, 2007, respectively. The Navy's response to comments received from

SENSITIVE RECORD

PORTIONS OF THIS RECORD ARE CONSIDERED SENSITIVE AND ARE NOT AVAILABLE FOR PUBLIC VIEWING

ADDRESS OF PRIVATE CITIZEN

FOR ADDITIONAL INFORMATION, CONTACT:

DIANE C. SILVA, RECORDS MANAGER
NAVAL FACILITIES ENGINEERING COMMAND, SOUTHWEST
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132

TELEPHONE: (619) 556-1280
E-MAIL: diane.silva@navy.mil

5090
Ser BPMOW.jtc/0223
JAN 28 2008

the California Regional Water Quality Control Board on September 17, 2007, is attached. If you have any questions regarding this document, please contact Mr. James Callian at (619) 532-0779 or me at (619) 532-0952.

Sincerely,

RICK WEISSENBORN
BRAC Environmental Coordinator
By direction of the Director

Enclosure: 1. Responses to Comments Received from California Regional Water Quality Control Board on the Draft Technical Memorandum Anomaly Area 3 Supplemental Groundwater Monitoring, Former Marine Corps Air Station El Toro, California. January 2008.

Copy to (w/encl):
Ms. Marcia Rudolph
Subcommittee Chair
El Toro Restoration Advisory Board
24922 Muirlands #139
Lake Forest, CA 92630

Copy to (w/o encl):
Commanding Officer
MCAS Miramar
Environmental Management Department
P.O. Box 452001
Bldg 6317
San Diego, CA 92145-2001

Mr. Robert L. Woodings
Community Co-Chair
El Toro Restoration Advisory Board
25550 Commercentre Drive, Suite 100
Lake Forest, CA 92630

Document Title:

Technical Memorandum Anomaly Area 3 Supplemental Groundwater Monitoring, Former Marine Corps Air Station, El Toro, California. July, 2007

Reviewer: Mr. John Broderick. Comments dated: 17 September 2007

Comment No.	Section/ Page No.	Comment	Response
SPECIFIC COMMENTS			
1)	Page 11: Recommendations	The memorandum recommends that no additional response action be incorporated in to the remedial investigation/feasibility study for groundwater based on CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act [of 1980]). Although we do not completely agree with the conclusions, we agree that CERCLA response action may not be applicable for this site. However, for the solid waste management unit (landfill), Title 27 requirements are applicable. We request that you initiate detection monitoring for this landfill in accordance with Title 27, California Code of Regulations, Sections 20380 and 20385.	Comment noted. Results presented in this technical memorandum support the conclusion presented in the remedial investigation (RI)/feasibility study (FS) that no groundwater-specific response action is required. A Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response action for the vadose zone at this site is contemplated at this time, and the detection monitoring program specified in Title 27, California Code of Regulations, Sections 20380 and 20385 will be evaluated as Applicable or Relevant and Appropriate Regulations (ARARs) in the RI/FS. Prior to the selection of the vadose zone response action, monitoring consistent with a detection monitoring program was initiated as part of ongoing site-specific groundwater monitoring at the site.

Appendix N
MOA Between DTSC and the DON and Two Sample Environmental Covenants

Memorandum of Agreement Between
The United States Department of the Navy and
The California Department of Toxic Substances Control

Use of Model "Covenant to Restrict Use of Property" at Installations Being Closed and Transferred by the United States Department of the Navy

1. Background

   a. The purpose of this Memorandum of Agreement (MOA) is to formalize the use of two model environmental restriction covenants (attached) that have been drafted during negotiations between representatives of the United States Department of the Navy (DON) and the California Department of Toxic Substances Control (DTSC).

   b. Under CERCLA Sec. 104, as delegated to DON by E.O. 12580, and implemented pursuant to the National Contingency Plan (NCP – 40 CFR Sec. 300 et seq.) and 10 USC Sec. 2701, et seq., the cleanup of hazardous substances, pollutants and contaminants is required to be at a level that protects human health and the environment. As a result, this protection can be achieved at certain sites by the imposition of "institutional controls" (i.e., ICs – legal mechanisms to protect human health and the environment by restricting access or exposure to the contaminants in question) with or without underlying "engineering controls" (i.e., ECs – engineered mechanisms such as a cap on a landfill, designed to physically insure access or exposure to the contaminants in question is prevented). Collectively these ICs and ECs are called "land use controls" (LUCs).

   c. In the case of property being closed and transferred by DON to a nonfederal entity, it is necessary to insure that these LUCs stay in place and are honored by all future owners and occupants of the property in question, for as long as contamination is present at levels that do not permit unrestricted use. One key way such LUCs can be maintained is by DON's retention of sufficient legal title and interest to insure continuing enforcement of the terms of the LUCs. This retention would entail burdening such conveyances of title with deed covenants insuring that the deed transferring such property contain a formal restriction – a restrictive covenant – on the use of the property that will "run with the land," and is enforceable against the "servient estate" (i.e., all future owners of the land) and is retained by the United States, as represented by DON, acting as holder of the "dominant estate." In addition, DON can convey a separate and similar restrictive covenant to DTSC as provided in

Section 2 below.

d. In the State of California, such a restriction on the use of land, to protect human health and the environment is recognized by Section 1471 of the California Civil Code. This statute characterizes such a restrictive covenant as an "environmental restriction" and requires such words to be placed in the title of the document creating such an interest. DON has agreed to include such restrictive language in the deeds it executes where it imposes LUCs as a remedy under applicable law.

e. Similar to CERCLA, State environmental protection laws recognize the availability of using LUCs as remedies to protect human health and the environment. Currently, DTSC's authority under Chapter 6.5 and 6.8 of Division 20 of the California Health and Safety Code, provides statutory avenues to impose LUCs at a cleanup site to insure that the LUCs are honored by future owners. Chapter 6.5 is generally used when the cleanup site in question is one subject to the State's authorities under the hazardous waste facilities law, and Chapter 6.8 is generally used when the cleanup site in question is one subject to the State's equivalent to the federal CERCLA program.

f. In the case of property being closed and transferred to a nonfederal entity by DON where a cleanup remedy has used LUCs as a remedy as described above, DON and DTSC have a mutual interest in insuring that the "environmental restriction" imposed on the land is enforced for however long the protection of public health and the environment requires such restrictions.

g. As a result, DON and DTSC agree that it is in both parties' and the public's interests, that DTSC be in a position to enforce the "environmental restrictions" that the DON will be imposing on these transferring parcels of property. To this end, in addition to retaining the power to enforce protective covenants, DON agrees to convey a separate power to enforce such restrictive covenants to DTSC equivalent to DON's power to enforce any "environmental restrictions" burdening the transferring property by entering into a "Covenant to Restrict Use of Property." Under both Chapter 6.5 and Chapter 6.8, DTSC has the authority to monitor and enforce such "environmental restrictions" conveyed to it by the owner of property on which such an "environmental restriction" has been found necessary. Therefore, in consideration of DON's conveying such an interest, DTSC may implement as appropriate the various statutory authorities it possesses under Chapter 6.5 and Chapter 6.8 (as applicable) to insure these "environmental restrictions" are honored by all future owners and occupants.

2. Terms of Understanding:

a. DON and DTSC agree that in all future property transfers to a nonfederal agency, where DON is acting on behalf of the United States as the transferring or disposing agent, the applicable model "Covenant to Restrict Use of Property" attached to this MOU will be used throughout California when the proposed remedy involves imposing an IC (except those "early transfers" where 1) the transferee will perform the cleanup, and 2) the cleanup includes an IC in the remedy, and 3) has executed an order or enforceable agreement with DTSC or has entered into a Sec. 25222.1 agreement with DTSC, that calls for the transferee entering into a "Covenant to Restrict Use of Property" directly with DTSC).

b. DON and DTSC have entered into a number of Federal Facility Agreements and Federal Site Remediation Agreements for DON property. These Agreements generally call for coordination of the DON's satisfaction of its corrective action obligations under the Resource Conservation and Recovery Act (RCRA) and Health and Safety Code section 25200.10 with its responsibilities under CERCLA section 120(l), EO 12580, the Defense Environmental Restoration Program and the NCP. The Agreements recognize that the DON may satisfy some or all of its corrective action obligations through CERCLA response actions. Where such corrective action at hazardous waste management units is being satisfied through CERCLA, Attachment A shall be used. Attachment B is the model which will be used for hazardous waste management facilities not addressed in Federal Site Remediation or Federal Facility Agreements.

c. When issuing Proposed Plans for public comment, DON will attach a copy of this MOU and the appropriate model "Covenant to Restrict Use of Property" so as to assure the public that the specific LUC being proposed will be enforced, in part, by DON's retained power to enforce the deed covenants and conveyance of the power to enforce protective deed covenants to DTSC contemporaneously with the execution of the deed transferring DON's interests to the new owner.

d. In using these models to draft the appropriate "Covenant to Restrict Use of Property," DON's and DTSC's personnel will work collaboratively to develop the specific information applicable to the given site called for by Articles I (Statement of Facts) and IV (Restrictions) of the attached models. A final "Covenant to Restrict Use of Property" that is ready for signature for a given site, will be prepared in time to allow it to be

executed contemporaneously with the execution of the deed transferring DON's non-retained interests in the property to the new owner. In the case of "early transfers" where DON is performing the cleanup after the transfer, and is imposing an LUC at the time of the "early transfer" in support of its ongoing cleanup activities, the Parties recognize that the contents of Articles I and IV of the model covenants for such sites will likely not be as detailed as that suggested in the attached models. The degree of detail contained within the model covenant will be the information available as to the cleanup site, although the covenants must be adequate to protect human health and the environment to allow an early transfer. The form of remedy and any additional associated IC will be more fully developed once the remedy is selected and implemented.

e. The Parties recognize that given the need to tailor the terms of the "environmental restriction" to the remedy that is finally selected after seeking public comment on the Proposed Plan, the terms of the final "Covenant to Restrict Use of Property" may vary greatly from the draft proposal. The Parties recognize that the public should be given specific notice of this fact in the Proposed Plan.

f. The Parties recognize that remedies proposed by the DON will be submitted to DTSC for concurrence. However, there may be unresolved disagreements at some cleanup sites concerning the remedy being proposed by DON including, in particular, the scope and nature of the LUCs, and the terms of any underlying, proposed "Covenant to Restrict Use of Property." In such situations the Parties will use their best efforts to resolve all disputes informally. If the Parties are ultimately unable to resolve the issue in dispute, DON and DTSC reserve any rights they might have to take any action available under applicable state or federal law.

g. Either Party may terminate its involvement in this Agreement by giving thirty (30) days written notice to the other Party. Upon receipt of notice and the expiration of thirty days termination shall occur by operation of law.

Signed: _____ 10 March 2000

F.R. Ruehe
Rear Admiral
United States Navy
Commander Navy Region Southwest

Date

Signed: Edwin F. Lowry 3/10/00

Edwin F. Lowry
Director
Department of Toxic Substances Control

Date

Attachment A: Model Site Mitigation Program "Environmental Restriction Covenant and Agreement"

Attachment B: Model Hazardous Waste Management Program/State Regulated Unit "Environmental Restriction Covenant and Agreement"

Approved as to form:

Date: 9 March 00 By: Mary Kay Fanyan

Approved as to form:

Date: March 16, 2000 By: [illegible]

MODEL SITE MITIGATION PROGRAM

DEED RESTRICTION

RECORDING REQUESTED BY: **[Covenantor's Name]** **[Street Address]** **[City]**, California **[Zip Code]** WHEN RECORDED, MAIL TO: Department of Toxic Substances Control Region ___ **[Street Address]** **[City]**, California **[Zip Code]** Attention: **[Name of Branch Chief]**, Chief **[Branch Designation]**	

SPACE ABOVE THIS LINE RESERVED FOR RECORDER'S USE

COVENANT TO RESTRICT USE OF PROPERTY

ENVIRONMENTAL RESTRICTION

(Re: *[Insert parcel number(s) and name of site property to be restricted.]*)

This Covenant and Agreement ("Covenant") is made by and between the United States of America acting by and through the Department of the Navy ("DON") (the "Covenantor"), the current owner of property situated in *[city]*, County of [ ], State of California, described in Exhibit "A", attached hereto and incorporated herein by this reference (the "Property"), and the State of California acting by and through the Department of Toxic Substances Control (the "Department"). Pursuant to Civil Code section 1471(c), Health and Safety Code Sections 25222.1 and 25355.5 the

Department has determined that this Covenant is reasonably necessary to protect present or future human health or safety or the environment as a result of the presence on the land of hazardous materials as defined in Health and Safety Code ("H&SC") section 25260. In addition, pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104 (42 USC Section 9604), as delegated to the Covenantor by E.O. 12580, ratified by Congress in 10 USC Sec. 2701, et seq., and implemented by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP – 40 CFR Part 300) and implementing guidances and policies, the Covenantor has also determined that this Covenant is reasonably necessary to protect present or future human health or safety or the environment as the result of the presence on the land of hazardous substances, pollutants and contaminants as defined in CERCLA Section 101 (42 USC Section 9601).

The Covenantor and the Department, collectively referred to as the "Parties", therefore intend that the use of the Property be restricted as set forth in this Covenant, in order to protect human health, safety and the environment.

The Covenantor retains sufficient legal title and interest in the subject property to insure continuing enforcement of the protective covenants and agreements contained within this Covenant to Restrict the Use of Property. Further in any subsequent transfers or conveyance of title to nonfederal entities the DON shall burden the property with additional deed covenants that insure that any subsequent deed or transfer contains the protective covenants and right of access and power to conduct monitoring of wastes retained on site. Those covenants and agreements shall be enforceable against the servient estate in that those protective covenants shall run with the land to

all successors and assigns.

ARTICLE I

STATEMENT OF FACTS

1.01 The Property, totaling approximately [acres] [square yards] is more particularly described and depicted in Exhibit "A", attached hereto and incorporated herein by this reference. ***[Exhibit "A" must include the legal description of the property used by the county recorder. This must include the particular description of the boundaries of the area to be subject to a particular use restriction. If the property does not already have a legal description (it generally will not if it is a portion of a larger piece of property) a survey will be required.]*** The Property is located in the area now generally bounded by ***[Include narrative description of the area; this will typically be street names: e.g., Main Street on the north, Maple Street on the east, etc.]*** County of [ ], State of California.

1.02 ***[Use this paragraph if imposing additional restrictions on a portion of the Property, for example on a capped portion, or if for any other reason it is necessary to precisely identify any portion of the property, such as an area with groundwater monitoring wells. The purpose of this paragraph is to give the precise location of such areas where use restrictions generally will apply. Renumber following paragraphs accordingly.]*** A limited portion of the Property is more particularly described in Exhibit "B" which is attached and incorporated by this reference ("Capped Property") as defined below ***[or "(other identified) Property"]***. ***[Exhibit B must include a legal description of the exact area(s) being restricted***

and any necessary diagram(s). This will generally require a legal survey and engineering drawing for the Cap or other area to be further restricted.] The [Capped *(or other description)*] Property is located in the area now generally bounded by [ ]. ***[Include language that generally describes the Capped or other identified Property.]*** The [Capped *(or other identified)* Property is also more specifically described as encompassing [ ] County Assessor's Parcel No.(s) [ ].

1.03 ***[Briefly describe the remedial measures implemented at the Property, including, if applicable, installation of a cap and construction and ongoing operation and maintenance of a groundwater treatment system, in order to identify the remaining contaminants and physical remedial measures on the Property that necessitate this deed restriction. This paragraph should also briefly discuss the regulatory context for the DON facility. Reference should be made to any applicable Federal Facility Agreement (FFA) or Federal Facility Site Remediation Agreement(FFSRA) and any corrective action obligations under RCRA or Chapter 6.5 of Division 20 of the Health and Safety Code covered by the FFA or FFSRA. This paragraph should refer to, and give the approval date for, the RAP, ROD, RAW or other decision document that selected the remedial measures at the Property and required this Covenant.]***

SAMPLE [For a facility which has an FFA or FFSRA and hazardous waste management units]: The DON and the Department entered into a Federal Facility Agreement (FFA) on [date]. Pursuant to that FFA, the DON may satisfy some or all of its corrective action obligations under the Resource Conservation and Recovery Act

(RCRA)(42 USC 6901 et seq)or California Health and Safety Code sectin 25200.10 through CERCLA response actions. ***{Proceed to additional SAMPLES as appropriate.]***

SAMPLE [For a property with remaining contamination, but no cap, O&M, or other ongoing response activities]: The Property is [a portion of a site] being remediated pursuant to a Record of Decision (ROD) pursuant to the Defense Environmental Restoration Program (DERP), 10 U.S.C. section 2701 et seq, and CERCLA; and a Remedial Action Plan (RAP) pursuant to Chapter 6.8 of Division 20 of the H&SC, under the oversight of the Department. The ROD/RAP provides that a deed restriction be required as part of the site remediation, because lead, which is a hazardous substance, as defined in H&SC section 25316, and a hazardous material as defined in H&SC section 25260 remains at depths of 10 feet or more below the surface of the Property. The DON circulated the ROD/RAP, for public review and comment. The ROD/RAP was approved by the DON and concurred in by the Department on [date], pursuant to which the Property was excavated to a depth of 10 feet, graded, then backfilled with clean soil.

SAMPLE [For a property with ongoing operation and maintenance of a monitoring or treatment system and/or cap. The exact provisions of this paragraph will vary depending upon the facts of the particular site or facility. The paragraph below is illustrative of the kind of information that should be included. Note specifically there is reference to a signed Operation and Maintenance Agreement.]: [Covenantor] ***[or party responsible for the activity, if different from***

Covenantor] is remediating the Property under the supervision and authority of the Department. The Property is [a portion of a site] being remediated pursuant to a Record of Decision (ROD) pursuant to the Defense Environmental Restoration Program (DERP), 10 U.S.C. section 2701 et seq; and a Remedial Action Plan (RAP) pursuant to Chapter 6.8 of Division 20 of the H&SC. Because hazardous substances, as defined in H&SC section 25316, which are also hazardous materials as defined in H&SC section 25260, including volatile organic compounds, total petroleum hydrocarbons, chlorinated benzenes and polychlorinated biphenyls, remain in the soil and groundwater in and under portions of the Property, the Remedial Action Plan provides that a deed restriction be required as part of the site remediation. The DON circulated the ROD/RAP for public review and comment. The ROD/RAP were approved by the DON and concurred in by Department on [*date*]. Remediation includes installing and maintaining a synthetic membrane cover ("Cap") over the Capped Property. The Cap consists of a low permeability synthetic membrane and other associated layers, as more particularly described in the engineering drawing attached as Exhibit "B" hereto. The response action also includes the installation and operation of: (1) a passive gas collection system on the Capped Property which removes volatile organic compounds migrating upward from under the Cap, (2) a vapor extraction system, which remediates certain volatile organic compound-impacted soils, and (3) groundwater monitoring wells ("Monitoring Wells"). The location of the gas collection system, vapor extraction system, and Monitoring Wells are shown on Exhibit "B". ***[This exhibit will have been identified in paragraph 1.02.]*** The operation and maintenance of the Cap, gas collection system, vapor extraction system, and Monitoring Wells is pursuant to an Operation and

Maintenance Manual incorporated into the Operation and Maintenance Agreement between [Covenantor] ***[or name of other entity]*** and the Department dated [ ]. ***[If an O&M Agreement has not been signed, the approval date for the O&M Manual or Plan should be referenced.]***

1.04 ***[This paragraph should set out specific information about the risk assessment findings relevant to the contaminants of concern remaining at the property, essentially the basis for the restrictions imposed by this covenant. The Restrictions in Paragraphs 4.01, and any requirement for Soil Management Activity and any Prohibited Activity must be linked to the contaminants and risk assessment as discussed in this paragraph. The following paragraph is given for purposes of illustration. Each site will have different facts; those should be developed in a manner similar to the sample paragraph given here. Land use must be consistent with the approved RAW, RAP or ROD and the health risk assessment.]***

SAMPLE: As detailed in the Final Health Risk Assessment ***[or other appropriate document]*** as proposed by the Covenantor and approved by the Department on [***date***], all or a portion of the surface and subsurface soils within 10 feet of the surface of the Property contain hazardous substances, as defined in H&SC section 25316, which include the following metal contaminants of concern in the ranges set forth below: arsenic (0.3 to 38.1 parts per million ("ppm"), beryllium (2.6 ppm), copper (4.6 to 756 ppm, and nickel (7.3-105 ppm). In addition, there are low pH soils. Based on the Final Risk Assessment the Department and the Covenantor have

concluded that use of the Property as a residence, hospital, school for persons under the age of 21 or day care center would entail an unacceptable cancer risk to the users or occupants of such property operated or occupied. The Department and the Covenantor have further concluded that the Property, as remediated, and operated or occupied subject to the restrictions of this Covenant, does not present an unacceptable threat to human safety or the environment, if limited to ***[as applicable:*** commercial and industrial, parks, open space,***[or other appropriate]]*** use.

SAMPLE: [Note: Groundwater restrictions in Paragraph 3.04 must be based on a discussion of what contaminants are found in groundwater at the site, and what the drinking water standards are.]

Groundwater at the Property is found 15 to 20 feet below ground surface. Contaminants in the groundwater include benzene (50- 123 ppm), chromium (75- 213 ppm) and TCE (350-780 ppm). California drinking water standards are benzene at 0.08 ppm, chromium at 30 ppm and TCE at 5 ppm. The Department and the Covenantor concludes that the groundwater presents an unacceptable threat to human health and safety absent an environmental restriction to eliminate exposure to such levels of groundwater.

ARTICLE II

DEFINITIONS

2.01 Department. "Department" means the State of California by and through the Department of Toxic Substances Control and includes its successor agencies, if

any.

2.02 Owner. "Owner" shall include the Covenantor's successors in interest, and their successors in interest, including heirs and assigns, during his or her ownership of all or any portion of the Property.

2.03 Occupant. "Occupant" means Owners and any person or entity entitled by ownership, leasehold, or other legal relationship to the right to occupy any portion of the Property.

2.04 Covenantor. "Covenantor" shall mean the United States acting through the Department of the Navy (DON).

ARTICLE III

GENERAL PROVISIONS

3.01 Restrictions to Run with the Land. This Covenant sets forth protective provisions, covenants, restrictions, and conditions (collectively referred to as "Restrictions"), subject to which the Property and every portion thereof shall be improved, held, used, occupied, leased, sold, hypothecated, encumbered, and/or conveyed. These Restrictions are consistent with the separate restrictions placed in the deed by and in favor of the Covenantor, conveying the Property from the Convenantor to its successor in interest described above. Each and every Restriction: (a) runs with the land in perpetuity pursuant to H&SC sections 25222.1 25355.5(a)(1)(C) and Civil Code section 1471; (b) inures to the benefit of and passes with each and every portion of the Property; (c) shall apply to and bind all subsequent Occupants of the Property; (d) is for the benefit of, and is enforceable by the Department; and (e) is imposed upon the entire Property unless expressly stated as applicable only to a specific portion thereof.

3.02 Binding upon Owners/Occupants. Pursuant to H&SC sections 25222.1, 25355.5(a)(1)(C), this Covenant binds all Owners of the Property, their heirs, successors, and assignees, and the agents, employees, and lessees of the owners,

heirs, successors, and assignees. Pursuant to Civil Code section 1471(b), all successive owners of the Property are expressly bound hereby for the benefit of the Department.

3.03 Written Notice of Hazardous Substance Release. The Owner shall, prior to the sale, lease, or rental of the Property, give written notice to the subsequent transferee that a release of hazardous substances has come to be located on or beneath the Property, pursuant to Health and Safety Code section 25359.7. Such written notice shall include a copy of this Covenant. *[This last sentence is optional, to be used at sites where it is important that buyers and tenants be specifically aware of the ongoing remediation and their obligations.]*

3.04 Incorporation into Deeds and Leases. The Restrictions set forth herein shall be incorporated by reference in each and all deeds and leases for any portion of the Property.

3.05 Conveyance of Property. The Owner shall provide notice to the Department not later than thirty (30) days after any conveyance of any ownership interest in the Property (excluding mortgages, liens, and other non-possessory encumbrances). The Department shall not, by reason of this Covenant alone, have authority to approve, disapprove, or otherwise affect a conveyance, except as otherwise provided by law, by administrative order, or by a specific provision of this Covenant.

ARTICLE IV

RESTRICTIONS

[The following examples are intended to be illustrative. Not all of them will be

applicable. The restrictions for a particular property should have a direct relationship to what the Health Risk Assessment said was appropriate for use at the site. The restrictions must also protect the integrity and physical accessibility of, and legal rights of access to, any ongoing remediation facilities at the site.]

4.01 Prohibited Uses. The Property shall not be used for any of the following purposes: ***[Note: These prohibitions must be based on the appropriate decision documents as set forth in Paragraphs 1.03 and 1.04]***

[Sample provisions:]

(a) A residence, including any mobile home or factory built housing, constructed or installed for use as residential human habitation.

(b) A hospital for humans.

(c) A public or private school for persons under 21 years of age.

(d) A day care center for children.

4.02. Soil Management ***[Note: The basis for the soil restrictions must be in Paragraphs 1.03 and 1.04]***

[Sample provisions]

(a) No activities that will disturb the soil [at or below [ ] feet below grade] (e.g., excavation, grading, removal, trenching, filling, earth movement or mining) shall be allowed on the Property without a Soil Management Plan and a Health and Safety Plan approved by the Department.

(b) Any contaminated soils brought to the surface by grading, excavation, trenching or backfilling shall be managed in accordance with all applicable provisions of

state and federal law.

(c) The Owner shall provide the Department written notice at least fourteen (14) days prior to any building, filling, grading, mining or excavating in the Property [more than [ ] feet below the soil surface] [which will remove more than [ ] cubic yards of soil].

4.03 Prohibited Activities. ***[This paragraph will not be applicable to all sites. If not used, renumber accordingly. If there are groundwater restrictions, the basis must be in Paragraphs 1.03 and 1.04]*** The following activities shall not be conducted at the Property:

[Sample provisions]

(a) Raising of food (agricultural products intended for human consumption or use, including but not limited to food, cattle, fibers, including cotton).

(b) Drilling for [drinking irrigation] water, oil, or gas [without prior written approval by the Department].

[or] (b) Extraction of groundwater for purposes other than site remediation or construction dewatering.

[The following paragraphs are samples of restrictions that may be applicable when there is a cap, vapor and/or gas collection system, and/or groundwater monitoring system.]

4.04 Non-Interference with Cap [and Vapor Extraction System (VES)] and [Groundwater Capture System (GCS)].

[Sample provisions:]

(a) Activities that may disturb the Cap (e.g. excavation, grading, removal, trenching, filling, earth movement, or mining) shall not be permitted on or within _____ feet of the Capped Property without prior review and approval by the Department. ***[Similar restrictions may be appropriate for other ongoing remediation systems.]***

(b) All uses and development of the Capped Property shall preserve the integrity **[** ***(if appropriate:)*** **and physical accessibility]** of the Cap. ***[Extend to other systems as appropriate.]***

(c) The Cap shall not be altered without written approval by the Department.

(d) The Owner shall notify the Department of each of the following: (i) the type, cause, location and date of any damage to the Cap and (ii) the type and date of repair of such damage. Notification to the Department shall be made as provided below within ten (10) working days of both the discovery of any such disturbance and the completion of any repairs. Timely and accurate notification by any Owner or Occupant shall satisfy this requirement on behalf of all other Owners and Occupants. ***[Extend to other systems as appropriate.]***

4.05 Access for Department. The Department shall have reasonable right of entry and access to the Property for inspection, monitoring, and other activities consistent with the purposes of this Covenant as deemed necessary by the Department in order to protect the public health or safety, or the environment.

ARTICLE V

ENFORCEMENT

5.01 Enforcement. Failure of the Owner or Occupant to comply with any of the

Restrictions specifically applicable to include grounds for the Department to require that the Owner modify or remove any improvements ("Improvements" herein shall mean all buildings, roads, driveways, and paved parking areas), constructed or placed upon any portion of the Property in violation of the Restrictions. Violation of this Covenant by the Owner or Occupant may result in the imposition of civil and/or criminal remedies including nuisance or abatement against the Owner or Occupant as provided by law. The State of California shall have all remedies as provided at in California Civil Code Section 815.7 as that enactment may be from time to time amended.

ARTICLE VI

VARIANCE AND TERMINATION

6.01 Variance. The Owner, or with the Owner's consent, any Occupant, may apply to the Department for a written variance from the provisions of this Covenant. Such application shall be made in accordance with H&SC section 25233. The Department will grant the variance only after finding that such a variance would be protective of human, health, safety and the environment.

6.02 Termination. The Owner, or with the Owner's consent, any Occupant, may apply to the Department for a termination of the Restrictions or other terms of this Covenant as they apply to all or any portion of the Property. Such application shall be made in accordance with H&SC section 25234. No termination or other terms of this Covenant shall extinguish or modify the retained interest held by the United States.

ARTICLE VII

MISCELLANEOUS

7.01 No Dedication Intended. Nothing set forth in this Covenant shall be

construed to be a gift or dedication, or offer of a gift or dedication, of the Property, or any portion thereof to the general public or anyone else for any purpose whatsoever.

7.02 Recordation. The Covenantor shall record this Covenant, with all referenced Exhibits, in the County of [name of county] within ten (10) days of the Covenantor's receipt of a fully executed original.

7.03 Notices. Whenever any person gives or serves any Notice ("Notice" as used herein includes any demand or other communication with respect to this Covenant), each such Notice shall be in writing and shall be deemed effective: (1) when delivered, if personally delivered to the person being served or to an officer of a corporate party being served, or (2) three (3) business days after deposit in the mail, if mailed by United States mail, postage paid, certified, return receipt requested:

To Owner: *[include name and address of Owner and name of person to receive service]*

To Department: *[title and address of Regional Branch Chief.]*

Any party may change its address or the individual to whose attention a Notice is to be sent by giving written Notice in compliance with this paragraph.

7.04 Partial Invalidity. If any portion of the Restrictions or other term set forth herein is determined by a court of competent jurisdiction to be invalid for any reason, the surviving portions of this Covenant shall remain in full force and effect as if such portion found invalid had not been included herein.

7.05 Statutory References. All statutory references include successor provisions.

IN WITNESS WHEREOF, the Parties execute this Covenant.

Covenantor: ***[name of Covenantor]***

By: _____

Title: ***[signatory's name and title]***

Date: _____

Department of Toxic Substances Control

By: _____

Title: ***[signatory's name and title]***

Date: _____

Approved as to form:

Date: 9 March 00 By: Mary Kay Fanger

Approved as to form:

Date: March 16, 2000 By: Arnold M Thomas

Ratification of Document endorsed 3-2-00

STATE OF CALIFORNIA)
)
COUNTY OF _____)

On this _____ day of _____, in the year _____,

before me _____, personally appeared

_____,

personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is /are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

WITNESS my hand and official seal.

Signature _____

MODEL HAZARDOUS WASTE MANAGEMENT PROGRAM

DEED RESTRICTION

RECORDING REQUESTED BY:
[Covenantor's Name]
[Street Address]
[City], California **[Zip Code]**

WHEN RECORDED, MAIL TO:

Department of Toxic Substances Control
Region ___
[Street Address]
[City], California **[Zip Code]**
Attention: **[Name of Branch Chief]**, Chief
[Branch Designation]

SPACE ABOVE THIS LINE RESERVED FOR RECORDER'S USE

COVENANT TO RESTRICT USE OF PROPERTY

ENVIRONMENTAL RESTRICTION

(Re: *[Insert parcel number(s) and name of site property to be restricted.]*)

This Covenant and Agreement ("Covenant") is made by and between the United States of America acting by and through the Department of Navy or "DON" (the "Covenantor"), the current owner of certain property situated in *[city]*, County of _____, State of California, described in Exhibit "A", attached hereto and incorporated herein by this reference (the "Property"), and the State of California acting by and through the Department of Toxic Substances Control (the "Department"). Pursuant to Civil Code section 1471(c), the Department has determined that this Covenant is reasonably necessary to protect present or future human health or safety or the environment as a

result of the presence on the land of hazardous materials as defined in Health and Safety Code ("H&SC") section 25260. In addition, pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104 (42 USC Section 9604), as delegated to the Covenantor by E.O. 12580, ratified by Congress in 10 USC Sec. 2701, et seq., and implemented by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP – 40 CFR Part 300) and implementing guidances and policies, the Covenantor (DON) has also determined that this Covenant is reasonably necessary to protect present or future human health and safety and the environment as the result of the presence on the land of hazardous substances, pollutants and contaminants as defined in CERCLA Section 101 (42 USC Section 9601).

The Covenantor and the Department, collectively referred to as the "Parties", therefore intend that the use of the Property be restricted as set forth in this Covenant, in order to protect human health, safety and the environment.

The Covenantor retains sufficient legal title and interest in the subject property to insure continuing enforcement of the protective covenants and agreements contained within this Covenant to Restrict the Use of Property. Further in any subsequent transfers or conveyance of title to nonfederal entities the DON shall burden the property with additional deed covenants that insure that any subsequent deed or transfer contains the protective covenants and right of access and power to conduct monitoring interest contained herein and of wastes retained on site. Those covenants and agreements shall be enforceable against the servient estate in that those protective covenants shall run with the land to all successors and assigns.

ARTICLE I

STATEMENT OF FACTS

1.01 The Property, totaling approximately [acres] [— square yards] is more particularly described and depicted in Exhibit "A", attached hereto and incorporated herein by this reference. *[Exhibit "A" must include the legal description of the property used by the county recorder. This must include the particular description of the boundaries of the area to be subject to a specific use restriction. A survey may be required].* The Property is located in the area now generally bounded by *[include narrative description of the area; this will typically be street names: e.g. Main Street on the north, Maple Street on the east, etc.]* County of [ ], State of California.

1.02 *[Use this paragraph if imposing additional restrictions on a portion of the Property, for example on a capped portion, or if for any other reason it is necessary to precisely identify any portion of the property, such as an area with groundwater monitoring wells. The purpose of this paragraph is to give the precise location of such areas where use restrictions will apply. Renumber following paragraphs accordingly]* A limited portion of the Property is more particularly described in Exhibit "B" which is attached and incorporated by this reference ("Capped Property" or "[*other identified*] Property"). *[Exhibit B must include a legal description of the exact area(s) being restricted and any necessary diagram(s). This will generally require a legal survey and engineering drawing for the Cap or other area to be further restricted.].* The [Capped or {other identified}] Property is located in the area now generally bounded by _____. *[include language that generally describes the Capped or other identified Property]* The

[Capped or {other identified}] Property is also more specifically described as encompassing xxxx County Assessor's Parcel numbers —.

1.03 *[Briefly describe the regulatory oversight of the facility by the Department and the CERCLA decisions including any applicable Federal Facility Agreement (FFA) or Federal Facility site Remediation Agreement (FFSRA) and implementing activities of the Covenantor, the remedial activities that have occurred at the Property, including, if applicable, installation of a cap and construction and ongoing operation and maintenance of a groundwater treatment system. This paragraph should refer to the Closure Report or other decision document such as a ROD which approved the remedial activities at the Property and required this Covenant. The paragraph needs to identify the contaminants and physical remedial measures on the Property which necessitate this deed restriction.]*

Since [*date*] the Department [*or*, the Department's predecessor in interest (California Department of Health Services)] authorized this [treatment], [storage], [disposal] facility ("Facility") pursuant to an [interim status document] [permit]. Under this authorization the Site was a hazardous waste facility, regulated by the Department, subject to the requirements of the California Hazardous Waste Control Law ("HWCL"), at Health and Safety Code ("H&S Code") section 25100 et seq., and the federal Resource Conservation and Recovery Act ("RCRA"), at 42 U.S.C. section 6901 et seq. Pursuant to the closure requirements of the HWCL, including H&S Code section 25246 and post-closure notices provisions of Title 22 California Code of Regulations [section 66265.119(b) for interim status hazardous waste facilities] [*or* 66264.119(b) for permitted hazardous waste facilities]] [*or, if restrictions required for permit:* corrective

action requirements of the HWCL, including H&S Code Section 25200.10] the Department is requiring this Covenant as part of the [facility closure] [corrective action] [permitting] of the facility. The Department circulated a [Closure Plan] [Remedial Measures Study] [*other appropriate document*], which contained a Final Health Risk Assessment [and/or Remedial Goals document], together with a draft [Environmental Impact Report] [Negative Declaration] pursuant to the California Environmental Quality Act, Public Resources Code section 21000 et seq for public review and comment from [*date*] to [*date*]. Because hazardous wastes, which are also hazardous materials as defined in Health and Safety Code sections 25117 and 25260, including [list hazardous wastes] remain in the [soil] and [groundwater] at the Property, the [Closure Plan] [Remedial Measures Study] provided that a deed restriction would be required as part of the facility remediation. The Department approved the [Closure Plan] [Remedial Measures Study] [*other appropriate document*] together with the [*environmental document*] on [*date*].

Pursuant to these documents, the Property was [*describe remedial actions taken which relate to what is left on the property. This description must include installation of any physical remedial measures. The description must identify what contaminants remain on the Property.*]

SAMPLE: Hazardous wastes, which are also hazardous materials as defined in H&S Code sections 25117 and 25260, and are CERCLA hazardous substances, pollutants or contaminant, including xxxx and yyyy, remain in the soil and groundwater at the Property. Remediation includes installing and maintaining a synthetic membrane cover ("Cap") over the Capped Property. The Cap consists of a low permeability

synthetic membrane and other associated layers over the hazardous wastes and materials, as more particularly described in the engineering drawing attached as Exhibit "B" hereto. The Remedial Measure also includes the installation and operation of: (1) a passive gas collection system ("GCS") on the Capped Property which removes miscellaneous gas/vapors migrating upward from under the Cap, (2) a vapor extraction system ("VES"), which remediates certain volatile organic compound-impacted soils, and (3) groundwater monitoring wells ("Monitoring Wells"). The location of the GCS, VES and Monitoring Wells are shown on the map attached as exhibit "--". The operation and maintenance ("O&M") of the Cap, GCS, VES, and Monitoring Wells is pursuant to an O&M Manual incorporated into the O&M Agreement between [Covenantor] *[or name of other entity]* and the Department dated September 20, 1995. *[If an O&M Agreement has not been signed, the approval date for the O&M Manual or Plan should be referenced]*

1.04 *[This paragraph should set out specific information about the risk assessment findings relevant to the contaminants of concern remaining at the property, essentially the basis for the restrictions imposed by this covenant. The Restrictions in Paragraphs 4.01, and any requirement for Soil Management Activity and any Prohibited Activity must be linked to the contaminants and risk assessment as discussed in this paragraph. The following paragraph is given for purposes of illustration. Each site will have different facts; those should be developed in a manner similar to the sample paragraph given here. You must consult with the assigned toxicologist about what are the appropriate land uses.]*

SAMPLE: As detailed in the Final Health Risk Assessment *[or other appropriate*

document] as proposed by the Covenantor and approved by the Department on *[date]*, all or a portion of the surface and subsurface soils within 10 feet of the surface of the Property contain hazardous wastes and hazardous materials, as defined in H&S Code section 25117 and 25260, which include one or more of the following metal contaminants of concern in the ranges set forth below: arsenic (0.3 to 38.1 parts per million ("ppm"), beryllium (2.6 ppm), copper (4.6 to 756 ppm, and nickel (7.3-105 ppm). In addition, there are low pH soils. Based on the Final Risk Assessment the Department and the Covenantor have concluded that use of the Property as a residence, hospital, school for persons under the age of 21 or day care center would entail an unacceptable cancer risk to the users or occupants of such property. The Department and the Covenantor have further concluded that the Property, as remediated, and operated or occupied subject to the restrictions of this Covenant, does not present an unacceptable threat to human safety or the environment, if limited to *[as applicable:* commercial and industrial use, parks, open space, [or other appropriate] use*]*.

SAMPLE [Note: Groundwater restrictions in Paragraph 3.04 must be based on a discussion of what contaminants are found in groundwater at the site, and what drinking water standards are.]: Groundwater at the Property is first found at 15 to 20 feet below ground surface. Contaminants in the groundwater include benzene (50- 123 ppm), chromium (75- 213 ppm) and TCE (350-780 ppm). California drinking water standards are benzene at .08 ppm, chromium at 30 ppm and TCE at 5 ppm. The Department and the Covenantor concludes that the groundwater presents an unacceptable threat to human health and safety absent an environmental restriction to eliminate exposure to such levels of groundwater.

ARTICLE II

DEFINITIONS

2.01 Department. "Department" shall mean the State of California by and through the California Department of Toxic Substances Control and shall include its successor agencies, if any.

2.02 Owner. "Owner" shall include the Covenantor's successor's in interest, and their successors in interest, including heirs and assigns, during his or her ownership of all of any portion of the Property.

2.03 Occupant. "Occupant" shall mean Owners and any person or entity entitled by ownership, leasehold, or other legal relationship to the right to occupy any portion of the Property.

2.04 Covenantor. "Covenantor" shall mean the United States acting through the Department of the Navy (DON).

ARTICLE III

GENERAL PROVISIONS

3.01 Restrictions to Run With the Land. This Covenant sets forth protective provisions, covenants, restrictions, and conditions (collectively referred to as "Restrictions"), upon and subject to which the [Property] [Capped Property] [Restricted Property] and every portion thereof shall be improved, held, used, occupied, leased, sold, hypothecated, encumbered, and/or conveyed. These Restrictions are consistent with the separate restrictions placed in the deed by and in favor of the Covenantor, conveying the Property from the Covenantor to its successor in interest described above. Each and every one of the Restrictions: (a) shall run with the land in perpetuity pursuant to H&SC sections 25202.5, and 25202.6, and Civil Code section 1471; (b) shall inure to the benefit of and pass with each and every portion of the Property; (c) shall apply to and bind all subsequent Occupants of the Property; (d) are for the benefit of, and shall be enforceable by the State of California; and (e) are imposed upon the entire Property unless expressly stated as applicable only to a specific portion thereof.

3.02 Binding Upon Owners/Occupants. Pursuant to Health and Safety Code section 25202.5(b), this Covenant shall be binding upon all of owners of the land, their heirs, successors, and assignees, and the agents, employees, and lessees of the owners, heirs, successors, and assignees. Pursuant to Civil Code section 1471(b), all successive owners of the Property are expressly bound hereby for the benefit of the covenantee(s) herein.

3.03 Written Notice of Hazardous Substance Release. The Owner shall, prior to the sale, lease, or rental of the Property, give written notice to the subsequent

transferee that a release of hazardous substances has come to be located on or beneath the Property, pursuant to Health and Safety Code section 25359.7. Such written notice shall include a copy of this Covenant. *[This last sentence is optional, to be used at sites where it is important that buyers and tenants be specifically aware of the ongoing remediation and their obligations]*

3.04 Incorporation into Deeds and Leases. The Restrictions set forth herein shall be incorporated by reference in each and all deeds and leases for any portion of the Property.

3.05 Conveyance of Property Covenantor agrees that the Owner shall provide notice to the Department not later than thirty (30) days after any conveyance of any ownership interest in the Property (excluding mortgages, liens, and other non-possessory encumbrances). The Department shall not, by reason of this Covenant alone, have authority to approve, disapprove, or otherwise affect such conveyance. *[This paragraph is optional, to be used, for example, at sites with groundwater treatment systems that will require access by the Department and by the entity responsible for O&M.]*

ARTICLE IV

RESTRICTIONS

[The following examples are intended to be illustrative. Not all of them will be applicable. The restrictions for a particular property should have a direct relationship to what the Health Risk Assessment said was ok/appropriate for use at the site. The toxicologist must be involved with drafting the Restrictions. The restrictions must also protect the integrity of, and access to, any ongoing remediation facilities at the site.]

4.01 Prohibited Uses. The Property shall not be used for any of the following purposes: *[Note: These prohibitions must be based on the facts and Health Risk Assessment as set forth in Paragraph 1.04]*

[sample provisions]

(a) A residence, including any mobile home or factory built housing, constructed or installed for use as residential human habitation.

(b) A hospital for humans.

(c) A public or private school for persons under 21 years of age.

(d) A day care center for children.

4.02 Soil Management *[Note: The basis for the soil restrictions must be in Paragraph 1.04]*

[sample provisions]

(a) No activities which will disturb the soil *[at or below xxx feet below grade]* (e.g., excavation, grading, removal, trenching, filling, earth movement or mining) shall be permitted on the Property without a Soil Management Plan and a Health and Safety Plan submitted to the Department for review and approval.

(b) Any contaminated soils brought to the surface by grading, excavation, trenching or backfilling shall be managed in accordance with all applicable provisions of state and federal law.

(c) The Owner will provide the Department written notice at least fourteen (14) days prior to any building, filling, grading, mining or excavating in the Property [more than feet below the soil surface] [which will remove more than cubic yards of soil].

4.03 Prohibited Activities. *[This paragraph will not be applicable to all sites. If*

not used, renumber accordingly. If there are groundwater restrictions, the basis must be in Paragraph 1.04] The following activities shall not be conducted at the Property: *[sample provisions]*

(a) No raising of agricultural products intended for human consumption or use, including but not limited to food,cattle, fibers including, cotton) shall be permitted on the property.

(b) No drilling for *[*drinking/IRRIGATION *]* water, oil, or gas shall be permitted on the Property *[*without prior written approval by the Department*]. [or]* (b) No groundwater shall be extracted on the Property for purposes other than site remediation or construction dewatering. *[The following paragraphs are samples of restrictions that may be applicable when there is a cap, vapor and/ or gas collection system, and/or groundwater monitoring system.]*

4.04 <u>Non-Interference with Cap [and VES] and [GCS]</u>.

[sample provisions]

(a) No activities which will disturb the Cap (e.g. excavation, grading, removal, trenching, filling, earth movement, or mining) shall be permitted on or within _____feet of the Capped Property without prior review and approval by the Department. *[Similar restrictions may be appropriate for other ongoing remediation systems.]*

(b) All uses and development of the Capped Property shall preserve the integrity of the Cap. *[Extend to other systems as appropriate.]*

(c) Any proposed alteration of the Cap shall require written approval by the Department.

(d) The Owner shall notify the Department of each of the following: (i) The

type, cause, location and date of any disturbance to the Cap which could affect the ability of the Cap to contain subsurface hazardous wastes or hazardous materials in the Capped Property, and (ii) the type and date of repair of such disturbance. Notification to the Department shall be made as provided below within ten (10) working days of both the discovery of any such disturbance(s) and the completion of any repairs. Timely and accurate notification by any Owner or Occupant shall satisfy this requirement on behalf of all other Owners. *[Extend to other systems as appropriate.]*

4.05 Access for Department. The Department shall have reasonable right of entry and access to the Property for inspection, monitoring, and other activities consistent with the purposes of this Covenant as deemed necessary by the Department in order to protect the public health and safety and the environment.

ARTICLE V

ENFORCEMENT

5.01 Enforcement. Failure of the Owner or Occupant to comply with any of the Restrictions specifically applicable to it shall be grounds for the Department, by reason of this Covenant, to require that the Owner modify or remove any improvements ("Improvements" herein shall include all buildings, roads, driveways, and paved parking areas, constructed or placed upon any portion of the Property constructed in violation of the Restrictions). Violation of this Covenant by the Owner or Occupant may result in the imposition of civil and/or criminal remedies including nuisance or abatement against the Owner or Occupant as provided by law. The State of California shall have all remedies as provided in California Civil Code, Section 815.7, as that enactment may

be from time to time amended.

ARTICLE VI

MODIFICATION AND TERMINATION

6.01 Modification. Any Owner or, with the Owner's written consent, any Occupant of the Property or any portion thereof may apply to the Department for a written modification from the provisions of this Covenant. Such application shall be made in accordance with H&S Code section 25202.6. The Department will grant the modification only after finding that such a modification would be protective of human health, safety and the environment.

6.02 Termination. Any Owner, and/or, with the Owner's written consent, any Occupant of the Property, or any portion thereof, may apply to the Department for a termination of the Restrictions or other terms of this Covenant as they apply to all or any portion of the Property. Such application shall be made in accordance with H&S Code section 25202.6. The Department will grant the termination only after finding that such a termination would be protective of human health, safety and the environment. No termination of the Restrictions or other terms of this Covenant shall extinguish or modify the retained interest held by the United States.

ARTICLE VII

MISCELLANEOUS

7.01 No Dedication Intended. Nothing set forth in this Covenant shall be construed to be a gift or dedication, or offer of a gift or dedication, of the Property, or any portion thereof to the general public or anyone else for any purpose whatsoever.

7.02 Recordation In accordance with HSC Section 25235, the Department will record this Covenant, with all referenced Exhibits, in the County of [name of county] within ten (10) days of the Department's receipt of a fully executed original.

7.03 Notices. Whenever any person gives or serves any notice ("Notice" as used herein includes any demand or other communication with respect to this Covenant), each such Notice shall be in writing and shall be deemed effective: (1) when delivered, if personally delivered to the person being served or to an officer of a corporate party being served, or (2) three (3) business days after deposit in the mail, if mailed by United States mail, postage paid, certified, return receipt requested:

To Owner: *[include name and address of Owner and name of person to receive service]*

To Department: *[include name, address, and appropriate name of Department person to be served]*

Any party may change its address or the individual to whose attention a notice is to be sent by giving written notice in compliance with this paragraph.

7.04 Partial Invalidity. If any portion of the Restrictions or other term set forth herein is determined by a court of competent jurisdiction to be invalid for any reason, the surviving portions of this Covenant shall remain in full force and effect as if such portion found invalid had not been included herein.

7.05 Statutory References. All statutory references include successor provisions.

IN WITNESS WHEREOF, the Parties execute this Covenant.

"Covenantor"

Date:_____ By:_____

"Department"

Date:_____ By:_____

Approved as to form:

Date: 9 March 00 By: M X Fayer

Approved as to form:

Date: March 16, 2000 By: Harold M Thomas

Ratification of Document endorsed 3-2-00

STATE OF CALIFORNIA)
)
COUNTY OF _____)

On this _____ day of _____, in the year _____,

before me _____, personally appeared

_____,

personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is /are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

WITNESS my hand and official seal.

Signature _____