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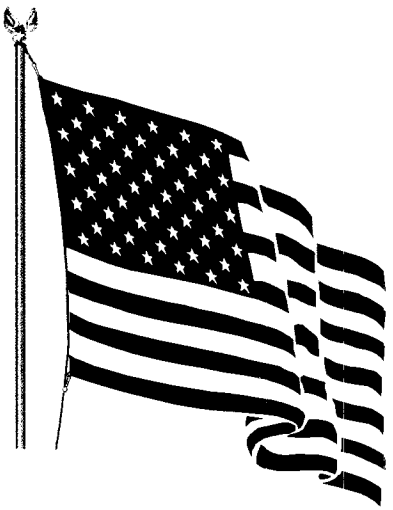

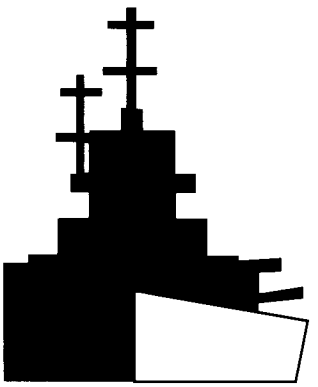

FINAL WORK PLAN FOR SUPPLEMENTAL REMEDIAL INVESTIGATION SAMPLING AT OPERABLE UNIT 2C ALAMEDA POINT ALAMEDA, CALIFORNIA

CTO-0093/0203
May 2007

Submitted to:

Department of the Navy
Base Realignment and Closure
Program Management Office West

1455 Frazee Road, Suite 900
San Diego, California 92108-4310

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Contract No. N68711-95-D-7526

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY

CLEAN 3

FINAL
WORK PLAN FOR SUPPLEMENTAL REMEDIAL INVESTIGATION SAMPLING AT OPERABLE UNIT 2C ALAMEDA POINT ALAMEDA, CALIFORNIA

CTO-0093/0203
May 2007

Prepared by:

BECHTEL ENVIRONMENTAL, INC.
1230 Columbia Street, Suite 400
San Diego, California 92101-8502

Signature: Eric Johansen Date: 4/26/07
Eric Johansen, CTO Leader

Signature: Cathie L. Stumpenhaus Date: 4/30/07
Cathie L. Stumpenhaus, PG 4451

BECHTEL ENVIRONMENTAL, INC.

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NAVFAC Southwest
Ms. Graciela R. Steinway, AQE.GS
1220 Pacific Highway
San Diego, CA 92132-5190

DATE: May 4, 2007
CTO #: 0093
LOCATION: Alameda, California

FROM: Janet L. Argyres
Janet L. Argyres, Project Manager

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Other: (Navy)		P. Russell (1C/1E)	
G. Grace, (1C/1E)		D. Potter (1C/1E)	
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May 4, 2007

Contracting Officer
NAVFAC Southwest
Ms. Graciela R. Steinway, AQE.GS
1220 Pacific Highway
San Diego, CA 92132-5190

Subject: Final Work Plan for Supplemental Remedial Investigation Sampling at Operable Unit OU 2C
Alameda Point, Alameda, California

Dear Ms. Steinway:

Enclosed, please find 7 copies of the Final Work Plan for Supplemental Remedial Investigation Sampling at Operable Unit OU 2C, for Alameda Point, Alameda, California, dated May 2007 along with a CD. As directed by the Navy RPM, we are concurrently transmitting copies to Ms. Anna-Marie Cook of U.S. EPA; Ms. Dot Lofstrom of DTSC; and Mr. Erich Simon of the RWQCB. In addition, we are forwarding copies on behalf of the Navy to the parties listed on the attached transmittal sheet.

If you have any questions, please contact Eric Johansen, CTOL, at (619) 744-3091 or me at (415) 768-9917.

Very truly yours,

Janet L. Argyres
Project Manager

JLA/EJ/lw

Enclosure

SUMMARY

This Work Plan provides a framework and guidance for conducting supplemental remedial investigation (RI) sampling at Operable Unit (OU) 2C at Alameda Point, Alameda, California.

OU-2C consists of Installation Restoration Sites 5, 10, and 12. Previous investigations at these sites indicated the presence of chemicals of potential concern in soil and groundwater. However, further investigation is needed to address identified data gaps, and will require sampling of soil and groundwater to complete the characterization of the nature and extent of contamination and monitoring of groundwater levels to assess the direction of groundwater flow at the western margin of OU-2C and tidal influence between Seaplane Lagoon and OU-2C. Soil and groundwater samples and subslab soil gas samples beneath Building 5 will be collected to assess potential risk to human health and the environment.

The following field activities, designed to meet the supplemental RI objectives, are described in this Work Plan:

- collection and analysis of soil samples from two depth intervals (between the surface and top of the water table) up to 100 direct-push sampling locations
- collection and analysis of soil samples from three depth intervals (between the surface and top of the water table) at up to 97 direct-push sampling locations, including an estimated 44 step-out sampling locations
- collection and analysis of soil samples from four depth intervals at 8 direct-push sampling locations
- collection and analysis of discrete groundwater samples at one depth interval (10 to 15 feet bgs) from 7 direct-push sampling locations (of the 205 total direct-push sampling locations described above)
- collection and analysis of discrete groundwater samples at two depth intervals (10 to 15 feet bgs and 25 to 30 feet bgs) from 34 direct-push sampling locations (of the 205 total direct-push sampling locations described above)
- collection and analysis of a discrete groundwater sample at one depth interval (4 to 8 feet bgs) from two direct-push sampling locations, and at two depth intervals (10 to 15 feet bgs and 25 to 30 feet bgs) from 2 direct-push sampling locations
- collection and analysis of discrete groundwater samples at two depth intervals (10 to 15 feet bgs and 25 to 30 feet bgs) from 10 direct-push step-out sampling locations
- collection and analysis of subslab soil gas samples from 100 locations beneath Building 5
- installation of up to 15 groundwater monitoring wells
- collection and geotechnical analysis of soil samples from one depth interval (10 to 15 feet bgs, 25 to 30 feet bgs, or 60 to 70 feet bgs) at 6 of the 15 groundwater monitoring well locations

- collection and analysis of groundwater samples from up to 15 new and up to 14 existing groundwater monitoring wells
- installation of up to eight piezometers or piezometer pairs for aquifer testing

An RI report will be prepared to present results, conclusions, and recommendations for the site under a separate task order.

In an effort to finalize the RI phase, a key objective of this Work Plan is to work collectively with the regulatory agencies during the planning phase. This Work Plan and attachments include regulator-approved decision flow charts/logic trees to assist the field team in making real-time decisions for additional investigation (e.g., decision rules to step out). At the completion of the scope of work for this supplemental RI sampling, it is anticipated that no additional field activities will be required to complete the RI phase.

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ACRONYMS/ABBREVIATIONS

AOC	area of concern
AST	aboveground storage tank
B(a)P	benzo(a)pyrene
BEI	Bechtel Environmental, Inc.
bgs	below ground surface
BSU	bay sediment unit
CAA	corrective action area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	chemical of concern
COPC	chemical of potential concern
CPT	cone penetrometer test
CSM	conceptual site model
CTO	contract task order
DCA	dichloroethane
DCE	dichloroethene
DNAPL	dense nonaqueous-phase liquid
DTSC	(California Environmental Protection Agency) Department of Toxic Substances Control
EBS	environmental baseline survey
ESL	environmental screening level
°F	degrees Fahrenheit
FWBZ	first water-bearing zone
GAP	generator accumulation point
IR	Installation Restoration (Program)
IWTP	industrial waste treatment plant
µg/L	micrograms per liter
mg/L	milligrams per liter
MSL	mean sea level
NADEP	Naval Aviation Depot
NAS	Naval Air Station

OU	operable unit
OWS	oil/water separator
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PG	Professional Geologist
ppb	parts per billion
PRG	preliminary remediation goal
RAPP	Removal Action Project Plan
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RNS	ribbon nonaqueous-phase liquid sample
SAP	sampling and analysis plan
SEE	steam-enhanced extraction
SPH	six-phase heating
SSHP	site-specific safety and health plan supplement
SVOC	semivolatile organic compound
SWBZ	second water-bearing zone
SWMU	solid waste management unit
TCA	trichloroethane
TCE	trichloroethene
TDS	total dissolved solids
TPH	total petroleum hydrocarbons
U.S. EPA	United States Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound
Water Board	San Francisco Bay Regional Water Quality Control Board

Section 1
INTRODUCTION

This Supplemental Remedial Investigation (RI) Work Plan describes site characterization activities at Operable Unit (OU) 2C at Alameda Point, Alameda, California. Bechtel Environmental, Inc., (BEI) prepared this Work Plan for Base Realignment and Closure Program Management Office West under Contract Task Order (CTO)-0081 of the Comprehensive Long-Term Environmental Action Navy (CLEAN) 3 Program, Contract No. N68711-95-D-7526.

This Work Plan and its supporting attachments describe the objectives, scope, rationale, procedures, and methods that will be used to perform site characterization activities at OU-2C. Figures are provided behind tabs following the text. The location of Alameda Point and OU-2C are presented on Figures 1-1 and 1-2, respectively. The following study areas shown on Figure 1-3 will be investigated at OU-2C:

- 6 evaluation areas requiring further field activities
  - Evaluation Area 1: OU-2C groundwater impacted by volatile organic compounds (VOCs), metals, and cyanide; and potentially impacted by radium-226 and radium-228 beneath Building 5 and by 1,4-dioxane
  - Evaluation Area 2: soil and groundwater in the vicinity of Building 2 (former dry cleaning operations, including Naval Air Station [NAS] generator accumulation point [GAP] 05)
  - Evaluation Area 3: soil beneath the southern portion of Building 5 (plating shop, foundry, etc.)
  - Evaluation Area 4: soil beneath the Aircraft Maintenance Line and adjoining shop area in the northern portion of Building 5
  - Evaluation Area 5: soil south of Building 5
  - Evaluation Area 6: soil east of Building 5
- 13 data gap areas
  - IR Site 5: Buildings 6, 34, 43, 44, 102, 282, 347, 405, 415, 500, and 505
  - IR Site 5: polynuclear aromatic hydrocarbon (PAH) data gap area and former materials storage area south and east of Building 44
  - IR Site 10: Building 400 hangar floor
- 22 solid waste management units (SWMUs)
  - 4 oil/water separators (OWSs) (OWS 005, OWS 006A, OWS 006B, and OWS 010)
  - 1 aboveground storage tank (AST) (AST 005G, removed)
  - 4 solvent distillation units (M-01, M-02, M-05, and M-08)
  - 1 coolant recovery system (M-09)
  - 9 Naval Aviation Depot (NADEP) GAPs (NADEP GAPs 02, 04, 17, 20, 25, 27, 31, 57, and 70)
  - 1 NAS GAP (NAS GAP 01)

- 1 Resource Conservation and Recovery Act [RCRA] area of concern (AOC) (AOC 005; also known as underground storage tanks [USTs] 5-2 and 5-3, both removed)
- 1 RCRA UST (UST[R]-02, also known as USTs 6-1 and 6-2; both removed)

Historical background information provided in this Work Plan was prepared by SulTech, a joint venture of Sullivan Consulting Group and Tetra Tech EM Inc., and was presented in the draft RI Report submitted to the regulatory agencies in July 2005 (SulTech 2005). This background information has been extracted from the 2005 draft RI Report directly into Sections 2, 3, and 4 of this Work Plan, without independent verification by BEI.

1.1 PROJECT PURPOSE

OU-2C consists of Installation Restoration (IR) Sites 5, 10, and 12. Previous investigations at these sites indicated the presence of chemicals of potential concern (COPCs) in soil and groundwater. However, further investigation is needed to address identified data gaps, and will require sampling of soil and groundwater to complete the characterization of the nature and extent of contamination and monitoring of groundwater levels to assess the direction of groundwater flow at the western margin of OU-2C and tidal influence between Seaplane Lagoon and OU-2C. Soil and groundwater samples and subslab soil gas samples beneath Building 5 will be collected to assess potential risk to human health and the environment.

The Navy and other decision makers will use RI results, along with other site-specific information, to support future decisions related to the site. Upon completion of the scope of work described in this Work Plan, it is anticipated that no additional field activities will be required to complete the RI phase.

1.2 SCOPE OF EFFORT

The field activities described in this Work Plan include the following:

- collection and analysis of soil samples from two depth intervals (between the surface and top of the water table) at up to 100 direct-push sampling locations
- collection and analysis of soil samples from three depth intervals (between the surface and top of the water table) at up to 97 direct-push sampling locations, including an estimated 44 step-out sampling locations
- collection and analysis of soil samples from four depth intervals at 8 direct-push sampling locations
- collection and analysis of discrete groundwater samples at one depth interval (10 to 15 feet below ground surface [bgs]) from 7 direct-push sampling locations (of the 205 total direct-push sampling locations described above)
- collection and analysis of discrete groundwater samples at two depth intervals (10 to 15 feet bgs and 25 to 30 feet bgs) from 34 direct-push sampling locations (of the 205 total direct-push sampling locations described above)

- collection and analysis of a discrete groundwater sample at one depth interval (4 to 8 feet bgs) from two direct-push sampling locations, and at two depth intervals (10 to 15 feet bgs and 25 to 30 feet bgs) from two direct-push sampling locations
- collection and analysis of discrete groundwater samples at two depth intervals (10 to 15 feet bgs and 25 to 30 feet bgs) from 10 direct-push step-out sampling locations
- collection and analysis of subslab soil gas samples from 100 locations beneath Building 5
- installation of up to 15 groundwater monitoring wells
- collection and geotechnical analysis of soil samples from one depth interval (10 to 15 feet bgs, 25 to 30 feet bgs, or 60 to 70 feet bgs) at 6 of the 15 groundwater monitoring well locations
- collection and analysis of groundwater samples from up to 15 new and up to 14 existing groundwater monitoring wells
- installation of up to eight piezometers or piezometer pairs for aquifer testing

The specific activities to be conducted for individual study areas are described in detail in Appendix A1 to the Sampling and Analysis Plan (SAP) (Attachment A) and summarized briefly here.

Evaluation Area 1 consists of groundwater beneath OU-2C that has been impacted by chlorinated VOCs, hexavalent chromium and other metals, and cyanide. This area encompasses approximately 36.8 acres located primarily within the boundaries of IR Site 5. Evaluation Area 1 is located to the west of Buildings 6 and 32 and IR Site 12, and also includes the portion of IR Site 10 north of Building 400 (Figure 1-3). The sampling plan for Evaluation Area 1 addresses data gaps associated with:

- the possible presence of 1,4-dioxane;
- the possible presence of radium-226 and radium-228 beneath Building 5;
- levels of VOCs, hexavalent chromium and other metals, and cyanide within source areas and levels of VOCs and metals at the downgradient margin of the plume;
- the direction of groundwater flow at the western (downgradient) margin of the plume and the potential for discharge of contaminants in groundwater at OU-2C to surface water; and
- the potential for VOCs in groundwater beneath Building 5 to migrate to indoor air.

Activities planned to address data gaps include the following:

- installation of up to 15 new groundwater monitoring wells (shallower FWBZ wells M05-13 through M05-16, deeper FWBZ wells L01 through L06, SWBZ well D05-09, and, if needed, wells M05-17 and M05-18 at Building 2, and wells M05-19 and L05-07 to replace wells P-5-1-MW4S through P-5-1-MW4D)

- collection and analysis of groundwater samples from new monitoring wells and up to 13 existing monitoring wells (shallower FWBZ wells M05-01 through M05-03, M05-05, M05-09, plus clustered wells P-5-1-MW4S through P-5-1-MW4D, if present; and SWBZ wells D05-01 through D05-05)
- installation of up to eight piezometers pairs (shallower and deeper FWBZ) with five pairs located between Seaplane Lagoon and OU-2C and three pairs located west of OU-2C
- monitoring of water levels over a 25-hour period in monitoring wells (at up to eight locations west, north, and south of Building 5) and piezometers (at eight locations) to assess tidal influence between Seaplane Lagoon and OU-2C and groundwater flow direction at the western margin of OU-2C
- subslab soil gas sampling on a grid containing 100 sampling points to provide input for risk assessment of volatiles in groundwater beneath Building 5 that may migrate to indoor air

Evaluation Area 2 consists of an approximate 0.9-acre area within the boundaries of EBS Parcel 45A in the northeastern corner of IR Site 5. Evaluation Area 2 includes a segment of the eastern portion of Building 2 that contained a dry cleaning facility and associated NAS GAP 05 (Figure 1-3). The sampling plan for Evaluation Area 2 addresses data gaps associated with the extent and levels of VOCs previously reported in soil and groundwater at this area. Activities planned to address data gaps include installation of seven borings and collection of soil and discrete groundwater samples to be analyzed for VOCs and 1,4-dioxane. If VOCs are present in discrete groundwater samples at concentrations exceeding comparison criteria, two monitoring wells (of the 15 monitoring wells planned for Evaluation Area 1) will be installed and sampled.

Evaluation Area 3 consists of soil beneath the southern portion of Building 5, which formerly housed plating shops, industrial wastewater drains, a foundry and heat treatment area, and a rubber shop (Figure 1-3). The sampling plan for Evaluation Area 3 addresses data gaps associated with:

- VOCs in the soil above the VOC groundwater plume;
- metals (particularly cadmium, chromium, hexavalent chromium, and lead) and cyanide in soil and groundwater along industrial wastewater drains and metals in soil beneath the eastern portion of Building 5;
- the possible presence of SVOCs, PAHs, PCBs, hexavalent chromium, and cyanide (in addition to VOCs and metals) in soil beneath the former foundry and heat treatment area and the former rubber shop; and
- the possible presence of total petroleum hydrocarbons (TPH), SVOCs, PAHs, PCBs, hexavalent chromium and other metals, and cyanide (in addition to VOCs) in soil and groundwater near the former location of AST 005H.

Activities planned to address data gaps include installation of 42 borings for collection of soil samples and collection of discrete groundwater samples from the boring at the former location of AST 005H, at three of the boring locations along the industrial wastewater

lines, and at the former locations of the cyanide and chromium eductor sumps associated with the former plating shop.

Evaluation Area 4 (Aircraft Maintenance Line and adjoining shop area) consists of soil beneath the northern portion of Building 5, which formerly housed activities associated with aircraft painting and maintenance plus an adjoining battery acid shop and paint-mixing area (Figure 1-3). The sampling plan for Evaluation Area 4 addresses data gaps associated with metals previously reported in soil and the possible presence of chemicals in soil and groundwater associated with the former battery acid shop and paint-mixing area. Activities planned to address data gaps include installation of 28 borings for collection of soil samples and collection of discrete groundwater samples from one boring at the former battery acid shop.

Evaluation Area 5 consists of soil beneath the area south of Building 5, which formerly housed Buildings 261 and 348, a wastewater pretreatment area, IWTP 5, and a hazardous waste storage area, and which contains the TPH corrective action areas (CAAs) CAA-5B (transferred to OU-2C) and CAA-5C (Figure 1-3). The sampling plan for Evaluation Area 5 addresses data gaps associated with VOCs in soil above the VOC groundwater plume and hexavalent chromium and other metals, and cyanide (in addition to VOCs) in soil and groundwater in the vicinity of the industrial wastewater lines and Buildings 261 and 348. Activities planned to address data gaps include installation of 20 borings for collection of soil samples and collection of discrete groundwater samples from three borings.

Evaluation Area 6 consists of soil beneath the area east of Building 5, which includes former CAA-5A (transferred to OU-2C) and the locations of USTs and ASTs (Figure 1-3). The sampling plan for Evaluation Area 6 addresses data gaps associated with VOCs, TPH, and PCBs in soil. Activities planned to address data gaps include installation of 9 borings for collection of soil samples.

In the event that analytical results for soil samples from Evaluation Areas 3 through 6 borings indicate the presence of constituents for which no previous groundwater sampling has been conducted, discrete groundwater sampling may be required. The decision logic for additional discrete groundwater sampling is provided in Appendix A1 to Attachment A. In the event that analytical results for discrete groundwater samples are above comparison criteria, additional monitoring wells may be needed. The decision logic for additional monitoring well installation is provided in Appendix A1 to Attachment A.

Data gap areas consist of Buildings 6, 34, 43, 44, 102, 282, 347, 405, 415, 500, and 505 in IR Site 5, Building 400 in IR Site 10, and an area of PAH contamination south of Building 44, which have been identified by the draft SulTech RI Report (SulTech 2005a) or the regulators as requiring further soil and/or groundwater sampling data in order to characterize any potential contamination (Figure 1-3). These data gap areas represent either various small buildings or portions of buildings, or previous PAH sampling locations which therefore were not defined as evaluation areas. The following borings will be advanced to address the data gap areas:

- three borings for collection of soil samples at Building 6
- one boring for collection of soil and discrete groundwater samples at each of Buildings 34, 43, 44, 102, 282, and 505
- three borings for collection of soil samples at Building 347
- eight borings for collection of soil samples at Building 400
- two borings for collection of soil samples at each of Buildings 405 and 415
- one boring for collection of soil samples at Building 500
- three borings for collection of soil samples at the PAH area

During the preparation of this Supplemental RI Work Plan, the Navy held meetings with regulatory agency representatives in May and June 2006 and a site walk on April 18, 2006 to review each of the 69 SWMUs located within the boundaries of OU-2C. Eighteen SWMUs have received agency concurrence for no further action. Twenty-six SWMUs are proposed for no further action, based on the results of meetings with the agencies. Three SWMUs are being addressed under the Navy's TPH Program. Twenty-two SWMUs have been specifically identified for further sampling under this Work Plan, and 14 of these 22 are located within Evaluation Areas 3, 4, 5, and 6 (Figure 1-3). Activities planned to address SWMU data gaps include installation of one boring at each SWMU for collection of soil and discrete groundwater samples. One additional boring for the collection of soil samples will be advanced at each of the following locations:

- SWMU M-05 at the location of a crack in the concrete identified during the April 2006 site walk
- NADEP GAP 04 in the former painting-mixing area identified during the April 2006 site walk
- NADEP GAP 17, NADEP GAP 27, and NADEP GAP 31, for which there are no historical or planned sampling points within 50 feet

In the event that analytical results for soil samples from a data gap building sampling location, PAH data gap sampling location, or SWMU location are above comparison criteria, step-out soil sampling may be required. The decision logic for additional soil sampling is provided in Appendix A1 to Attachment A. Additionally, step-out discrete groundwater sampling will be considered if results of the planned discrete groundwater sampling are above comparison criteria and are not consistent with the known nature and extent of contamination. The decision logic for additional SWMU discrete groundwater sampling is provided in Appendix A1 to Attachment A. In the event that analytical results for discrete groundwater samples from a data gap building sampling location or SWMU location are above comparison criteria, additional monitoring wells may be needed. The decision logic for additional monitoring well installation is provided in Appendix A1 to Attachment A.

In the event that analytical results for soil (or discrete groundwater, where applicable) samples collected from the perimeter of grid-sampling areas (i.e., Evaluation Areas 3, 4, 5, and 6) indicate the presence of constituents for which no previous sampling has been

conducted, or constituents at concentrations exceeding comparison criteria, step-out soil sampling (or discrete groundwater sampling) may be required. The decision logic for additional (soil/discrete groundwater) sampling will also apply for these sampling locations.

Soil and groundwater sampling locations are presented in Appendix A1 of Attachment A; soil gas sampling locations are presented in the SAP. Newly collected and historical data will be evaluated to interpret the nature and extent of COPCs at OU-2C as well as to evaluate the potential risk to human health and the environment. An RI report will be prepared to present results, conclusions, and recommendations for the site under a separate task order. Figure 1-4 presents a draft outline for the RI report.

During meetings held on May 16 and June 15, 2006, the Navy and the regulatory agencies discussed data gaps as identified by the regulatory agencies during their review of the draft RI Report (SulTech 2005). During these discussions, the Navy and BEI provided a response to the agencies' request for additional sampling within OU-2C. Agency concurrence with the Navy's proposed approach to address each data gap (by either sampling or by demonstrating that adequate data were already available) was received during the June 15, 2006, discussion. A summary of the issues initially identified as data gaps and agency concerns is included in Table F-1 in Attachment F. This table provides the resolution for each issue (e.g., further sampling or no sampling due to adequate existing data). Additionally, issues related to specific media or chemicals that do not represent data gaps are explained in Appendix A1 to the SAP.

Radiological assessment and the removal and/or abandonment of storm sewer lines impacted by historical release of radioactive wastes are being addressed under a separate contract. No supplemental RI field activities will be conducted for the storm drains and associated areas identified under the Radiological Closeout Survey Report (TtEMI 2001a).

A specific concern that storm sewer lines discharging from IR Site 12 are a data gap arises out of a typographical error in the draft RI Report (SulTech 2005) that indicated that storm drains north and south of IR Site 12 discharge to Seaplane Lagoon at Outfall F. As noted in Section 2.3.2 of this document, storm sewers at IR Site 12 discharge to Seaplane Lagoon through Outfall G; the storm sewer lines discharging to Outfall G did not receive radiological wastes.

1.3 ORGANIZATION

This Work Plan has been prepared by BEI using background information prepared by a previous contractor; the following subsections explain the resulting format of this document and describe the Work Plan organization.

1.3.1 Report Organization

This Supplemental RI Work Plan is organized into the following sections and attachments.

- Section 1 presents the purpose of the Work Plan and the scope of activities planned for characterization of OU-2C.

- Section 2 presents a general background discussion for OU-2C, including a description of each study area site in OU-2C.
- Section 3 presents information about previous investigations at OU-2C.
- Section 4 presents references.
- Attachment A is the SAP, which describes the data quality objectives used to systematically plan procedures and processes for implementing the field investigation. The SAP also details the analytical methods and specifies the quality assurance goals for those methods.
  - Section 1.4 of the SAP provides four tables summarizing data quality objectives (DQOs), which were prepared in accordance with the U.S. EPA seven-step DQO process, for evaluation areas (SAP Tables 1-6 and 1-7), OWSs and USTs (SAP Table 1-8), and data gap areas and SWMUs (SAP Table 1-9), respectively.
  - Appendix A1 to the SAP provides area-specific descriptions, histories, and proposed sampling rationales.
  - Appendix A2 to the SAP includes tables (on a compact disk) that summarize previous data collected within each OU-2C area.
- Attachment B is the Data Management Plan, which summarizes the procedures for managing data collected during the field investigation to assure consistent, accurate electronic input and storage of monitoring data.
- Attachment C is the Investigation-Derived Waste Management Plan, which describes how wastes generated during field activities will be handled, stored, and disposed.
- Attachment D is the Site-Specific Safety and Health Plan Supplement (SSHP), which identifies site-specific conditions and potential hazards that may be encountered during field activities. The SSHP also describes the measures that will be implemented to protect the safety and health of workers performing the field activities.
- Attachment E is the Risk Assessment Work Plan, which describes how human-health and ecological risk assessments will be performed. The risk assessments are components of the supplemental RI for OU-2C.
- Attachment F presents the regulatory agencies' comments on the draft RI Report (SulTech 2005) and a table summarizing OU-2C data gaps and the regulatory agencies' concerns. The comments of the agencies on the draft RI Report formed the starting point for this Work Plan.
- Attachment G presents the responses to regulatory agency comments on the draft and draft final Work Plan for Supplementary RI Sampling at OU-2C.
- Attachment H presents the Radiological Work Instruction prepared by New World Technology that will be used to support the field activities at OU-2C.

1.3.2 Format Anomaly

Major portions of Sections 2, 3, and 4 of this Supplemental RI Work Plan document appear in italic type to indicate text (including tables) drawn directly from the SulTech draft RI Report (SulTech 2005). This text has been extracted from the 2005 SulTech report without independent verification and without modification of the format by BEI, except to change figure numbers where appropriate. All text and tables that appear in regular (non-italic) type in these sections have been provided by BEI. After completion of further sampling, the Navy plans to use the new data to update the information in these sections, as appropriate, for inclusion in the revised RI report.

1.4 PROJECT TEAM

Successful implementation of the supplemental RI activities will be a collaborative effort between representatives of the Navy and regulatory agencies, along with the CLEAN Program team. The principal decision makers will be the Navy and its regulatory agency partners. Detailed information about the project team is provided in the SAP (Attachment A), as follows.

- The names, roles, and contact information for the Navy and CLEAN Program team are provided in Table 1-1 of the SAP.
- The overall organization and relationships of the Navy and the team members are illustrated on Figure 1-3 of the SAP.

Regulatory agency representatives include project managers from the United States Environmental Protection Agency (U.S. EPA), the California Environmental Protection Agency Department of Toxic Substances Control (DTSC), and the San Francisco Bay Regional Water Quality Control Board (Water Board). These regulatory agency project managers are responsible for overseeing and monitoring the progress of work and, in conjunction with the Navy, approving decisions and recommendations pertaining to supplemental RI activities at OU-2C.

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Section 2
SITE DESCRIPTION AND BACKGROUND

This section presents a general description of OU-2C and summarizes site description and background information for each of the sites in OU-2C. Appendix A1 to the SAP also includes historical descriptions as they pertain to supplemental RI activities proposed for OU-2C.

Alameda Point is located at the west end of Alameda Island, which lies at the base of a gently westward-sloping plain that extends from the Oakland-Berkeley hills on the east to the shore of the San Francisco Bay on the west (Figure 1-1). OU-2C is located in the central portion of Alameda Point and is comprised of three IR sites including IR Sites 5, 10, and 12 (Figure 1-2).

2.1 ALAMEDA POINT DESCRIPTION AND HISTORY

Originally a peninsula, Alameda Island was detached from the mainland in 1876, when a channel was cut to link San Leandro Bay with San Francisco Bay. The area encompassed by Alameda Point was historically a combination of submerged lands, tideland, and dry land. Alameda Point occupies the flattest portion of Alameda Island, with elevations ranging from sea level to 30 feet above sea level. Most of Alameda Point was gradually filled using hydraulically placed dredge spoils from the surrounding San Francisco Bay, Seaplane Lagoon, and Oakland Channel. The first documented filling of tidal and submerged land began sometime during the 1890s. By 1927, the northern part of what later became Alameda Point had been filled, chiefly with dredge materials from U.S. Army Corps of Engineers projects associated with the Oakland Harbor and other harbors throughout the East Bay.

Before 1930, at least two large industrial sites, a borax processing plant and an oil refinery, were located on the island near what is now the eastern end of Alameda Point. The borax plant operated in the late 1800s to 1903. The refinery was constructed in 1879 and also ceased operations in 1903.

The filled land was partially occupied by the Alameda Airport, a city-owned facility, and Benton Field, a minor U.S. Army Air Corps facility. The U.S. Department of the Army acquired the Alameda Point site from the City and County of Alameda in 1930 and began construction activities in 1931. The Navy acquired title to the land from the Army in 1936 and began building the air station called NAS Alameda in response to the military buildup in Europe before World War II. NAS Alameda was commissioned on November 1, 1940. After the 1941 entry of the United States into the war, more land was acquired adjacent to the air station. Following the end of the war, NAS Alameda returned to its original primary mission of providing facilities and support for fleet aviation activities. Following World War II, NAS Alameda served as a critical component to support Navy activities during the Korean War, the Vietnam War, and Operation Desert Storm (in Kuwait). During its history, NAS Alameda housed approximately 60 military tenant commands for a combined military/civilian work force of over 18,000 personnel.

The Navy began conducting environmental investigations at NAS Alameda in 1982 under the Navy Assessment and Control of Installation Pollutants program, and an initial assessment study assessed the entire base for potential areas where chemicals may have affected soil or groundwater (Ecology & Environment, Inc. 1983). In 1988, the Navy

converted its Navy Assessment and Control of Installation Pollutants Program into the Installation Restoration Program to be more consistent with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and investigations were conducted at Sites 5, 10, and 12 in a phased approach that continued for more than 15 years. Removal actions and treatability studies were also conducted under the CERCLA program.

In addition to CERCLA, Alameda Point also has been regulated under RCRA. RCRA regulations provide for the "cradle-to-grave" tracking of hazardous wastes by establishing recordkeeping requirements for hazardous waste generation, transportation, storage, and disposal. Alameda Point was listed in the May 1992 RCRA database as a large-quantity hazardous waste generator and a treatment, storage, and disposal facility.

In 1993, NAS Alameda was identified for closure. In April 1994, the City and County of Alameda signed a Joint Powers Agreement and established the Alameda Reuse and Redevelopment Authority, which was recognized by the U.S. Department of Defense as the responsible entity for submitting and completing the community reuse plan for NAS Alameda. In 1997, the base closed, and the Navy began the process of property transfer to the City and County of Alameda.

After NAS Alameda was identified for closure, an environmental baseline survey (EBS) (Environmental Resources Management-West, Inc. 1994; International Technology Corporation [IT Corp.] 2001a) was performed to identify the environmental condition of all property affected by base closure, a program began to decommission all underground storage tanks (USTs), and ongoing environmental cleanup programs were coordinated with property conversion and reuse activities. As a part of the program to decommission all USTs, total petroleum hydrocarbons (TPH) contamination was evaluated under the TPH Program and corrective action areas (CAAs) were developed. The corrective action program for these petroleum-impacted areas is overseen by Water Board, in cooperation with DTSC and U.S. EPA.

In July 1999, U.S. EPA listed Alameda Point as a National Priorities List site (U.S. EPA 1999). This listing invokes the remedial requirements of the National Oil and Hazardous Substances Pollution Contingency Plan (U.S. EPA 1991) and requires U.S. EPA's concurrence with uncontaminated property designations. The Navy also was required to negotiate and sign an interagency agreement with U.S. EPA. Navy and U.S. EPA signed the Federal Facility Agreement in 2001.

2.2 SITE DESCRIPTION

OU-2C is located in the central portion of Alameda Point and occupies approximately 53 acres; OU-2C is comprised of IR Sites 5, 10, and 12. The majority of OU-2C is occupied by buildings, with the remaining portions occupied by paved areas and limited areas of open space.

2.2.1 Site 5 – Aircraft Rework Facility

Site 5 is located in the central portion of Alameda Point and contains Building 5, which is also known as the Aircraft Rework Facility and is the most prominent site feature. The

site is located approximately 1,200 feet north of Seaplane Lagoon (Figure 1-2); occupies about 47 acres; and is roughly rectangular in shape. The following paragraphs describe the major features of Site 5, which include Building 5, USTs, ASTs, fuel lines, OWSs, polychlorinated biphenyl (PCB)-containing equipment sites, the storm sewer system, and open space.

Building 5 was erected in two stages: the southern portion (Building 5) was erected in the 1940s, followed some years later by the northern portion (Building 5A). For the purpose of this report, both portions are identified as Building 5. The building was closed in 1993, and is currently vacant; however, its past uses included cleaning, reworking, and manufacturing of metal parts; plating, painting, and tool maintenance operations; and specialty operations, such as the application of radioluminescent paint to aircraft dial faces (Canonie Environmental 1990). The building contained a main paint shop comprised of two paint bays and several smaller paint spray booths. In addition, there was a plating shop with operations involving degreasing; caustic and acid etching; metal stripping and cleaning; and chrome, nickel, silver, cadmium, and copper plating.

Between 1940 through 1972, the wastewaters from all Navy operations at Alameda Point, including those in Building 5, were discharged directly to the nearest surface waters through the storm sewer system. From the beginning of that time period through the early 1960s, radioluminescent painting operations on the second floor of Building 5 discharged paint containing radium-226 into the storm sewer system leading from Building 5 into the Seaplane Lagoon. After 1972 and until 1991, the wastewater from the plating shops was split into two waste streams: one for alkaline tanks and one for cyanide tanks. The wastewater streams were kept separate until the cyanide stream was treated in a cyanide destruction unit. The two waste streams were then rerouted together to a pretreatment plant located near the southwestern corner of the building. Building 5 also housed a hazardous waste storage area, which was closed in 1988; drummed wastes formerly stored in the hazardous waste storage area included spent solvents, waste paints, and waste oils. The area also stored drummed hydraulic fluid and lubricating oils. This area was located outside of Building 5 in the southeastern corner of the site. Building 5 also contained numerous GAPs and other types of RCRA SWMUs.

Lead-acid and nickel-cadmium batteries were serviced in the battery storage area. This area was in the northeastern portion of Building 5. The battery fluids were discharged to a sink in the storage area, and the sink discharged to the base industrial sewer system. Base personnel have indicated that the corrosive fluids deteriorated the piping in the sink and drain that led to the sewer system at Outfalls "F" and "FF".

Building 5 was investigated in 1991 under the Phase 2B and 3 investigation (PRC Environmental Management, Inc. and James M. Montgomery 1992). Since that time, there have been numerous additional investigations (Section 3). In addition to these investigations, past radiological surveys detected radioactive contamination in drain piping at Building 5 that discharged to the storm sewer (PRC Environmental Management, Inc. 1996, Tetra Tech EM Inc. 2002a). Leaks from the storm drain piping inside the building contaminated several indoor areas, including the first floor spray booths and rooms on the second floor (Tetra Tech EM Inc. 2001b). Removal of the

contaminated piping and the associated storm sewer pipelines was completed in 2000 (New World Technology, Inc. 2002). Rooms on the first and second floors were also decontaminated in 2000. Results of the radiological closeout survey indicated that no significant radioactive contamination remains in Building 5 (Tetra Tech EM Inc. 2001a). All final measurements taken during this survey were at or below applicable surface activity limits. As a result, Building 5 was considered for radiological release by the Navy for unrestricted public use, as specified by applicable federal and state guidance and policies (U.S. Nuclear Regulatory Commission 1974, 1992; California Department of Health Services 1988).

The table below summarizes other buildings associated with Site 5.

Parcel	Building	Operation Conducted	Hazardous Material Stored/Used
45A	2	Building 2 was an enlisted personnel barrack that contained a dry cleaning facility. The building was constructed in 1947.	Dry cleaning solvents
46	42	Building 42 was an engineering laboratory, and for fuel testing and electronics testing. The building was constructed in 1941.	None
	102	Building 102 was an ordnance storage area constructed in 1943. Most recently, the building was used as an office space for ordnance supply for the base, and had a small ammunition vault that was constructed entirely of concrete.	Paint, non-halogenated organic compounds, and petroleum hydrocarbons.
47	43	Building 43 was an ammunition overhaul and rework shop constructed in 1941. The building was most recently used for ordnance storage, a recreation area, training area, and office space.	Solvents and petroleum products
48	44	Building 44 was an engineering laboratory and administrative office constructed in 1949. The area was also used as a former test bench for aircraft dials and gauges.	Radioactive materials
48	346	Building 346 was an engineering laboratory and administrative office constructed in 1949. This building is a Quonset hut.	None
49	405	Building 405 was a storage area for hazardous materials and wastes, and a non-chemical shipping area, constructed in 1958. Two aboveground storage tanks used for lubricating oil are located north of Building 405.	Trichlorofluoroethane, tricresyl phosphate, petroleum products, solvents, non-chlorinated organics, halogenated and non halogenated organic compounds, fuel, paint lubricating oils, hydraulic fluids, and asbestos
	589 (demolished)	Building 589 was Industrial Waste Pump Station 4.	None
	614	Building 614 was used as a paint storage facility. Part of the building was a RCRA site. The site was described as a hazardous materials delivery area.	Polyurethane and urethane paints, organic compounds, corrosives, and petroleum products
51A	No Buildings Present	Parcel 51A is an open space north of Hangar 11, in the southwest corner of the parcel.	None
53A	No Buildings Present	Parcel 53A is an entirely paved open space that was used for aircraft and vehicle parking.	None

Parcel	Building	Operation Conducted	Hazardous Material Stored/Used
54	5/5A	Building 5/5A was an aircraft overhaul and rework facility constructed in 1940. Various metal works, painting, plating, and support equipment shops were located in the southern half of the building. The northern half, Building 5A, was used for electrical, structural, aircraft painting bays, and mechanical maintenance of aircraft, Ground Support Equipment repair and maintenance storage, hazardous waste recycling, and administrative office space.	Lubricating oil, hydraulic fluid, methyl ethyl ketone, zinc chromate, paint, sulfuric acid, potassium hydroxide, petroleum products, halogenated organics, paint, corrosives, and heavy metals
	347	Building 347 was a general-purpose manufacturing and repair facility constructed in 1946.	No information is available from the environmental baseline survey.
	560 (demolished)	Building 560 (Electrical Substation #5) was formerly located in the open space.	PCBs
	193 (demolished)	Building 193 was formerly located in the open space, but demolished in 1953.	None
55	261	Building 261 was constructed in 1943. The building was used as a naval aviation depot storage area.	Chromium, cyanide, and kerosene
56	500	Building 500 was constructed between 1958 and 1963 and consisted of office space, a chemical and equipment storage area, and a woodworking shop.	Oil, stains, paints, solvents, and glues.
57	348 (Demolished)	Building 348 was a corrosion control shop constructed in 1960. Activities conducted in Building 348 included steam cleaning of aircraft outer surfaces and parts.	Methylene chloride
	415	Building 415 was constructed in 1956 and consisted of a storage shed and a hazardous waste accumulation area.	Petroleum products, resins, solvents, oils, and lubricants.
57	615	Building 615 was an electrical equipment and parts storage facility constructed in 1982.	Resins and adhesives.
58	34	Building 34 was an electrical substation constructed between 1975 and 1981.	Transformer oils
59	62	Building 62 was a cafeteria and credit union constructed prior to 1947.	Corrosives, paint, and battery water
66	32	Building 32 was a metal treatment shop.	Copper, silver, cyanide, sodium, cadmium, nickel, sulfamate, and chromic acid
67	No Building Present	The parcel is an entirely paved open space.	None

Parcel	Building	Operation Conducted	Hazardous Material Stored/Used
68	6	Building 6 consisted of a repair shop, steam cleaning facility, electromotor shop, storage area, and fire station.	Non-chlorinated cleaner, hydraulic fluid, petroleum products, non halogenated

Parcel	Building	Operation Conducted	Hazardous Material Stored/Used
			organics, halogenated organics, paint, corrosives, and battery acid
69	10	Building 10 was a public works center power plant, constructed in the late 1930s. Activities conducted within Building 10 included steam generation and air compression. Nine above ground storage tanks used for fuel are located on the southern side of the building. Five underground storage tanks that were abandoned in place are associated with Building 10. Additionally, one underground storage tank associated with Building 10 has been removed.	Petroleum products, laboratory chemicals, plant water treatment chemicals, microbiocide, morpholine, and corrosives
186	194	Building 194 was a maintenance storage structure for equipment and drums.	None
	282	Building 282 was a diesel and gasoline station constructed in 1944. Two underground storage tanks containing unleaded gasoline and diesel fuel were located east of Building 282. These tanks have been removed.	Petroleum products
	Structure 556 (Demolished)	Structure 556 was identified as Industrial Waste Pump PS #1/Sewage lift station. Two active underground tanks were associated with Structure 556.	Unknown

Underground Storage Tanks. *The table below lists all existing and removed USTs at Site 5. Three existing USTs (UST 614-1, UST 615-1, and UST 615-2) at Site 5 were emergency overflow tanks that never contained any hazardous substances, as defined by CERCLA or petroleum related wastes.*

Tank Identification Number	SWMU Identification Number	Capacity (Gallons)	Content	Status
UST 2-1	Not applicable	500	Diesel	Removed
UST 5-1	Not applicable	250	Waste Oil	Removed
UST 5-2	Area of concern 005	4,000	Jet Fuel	Removed
UST 5-3	AOC 005	320	Waste Oil and Solvents	Removed
UST 6-1	UST(R)-01	2,500	Petroleum Solvents	Removed
UST 6-2	UST(R)-01	2,500	Petroleum Solvents	Removed
UST 62-1	Not applicable	2,000	Diesel	Removed
UST 261-1	Area of concern 261	800	Kerosene	Removed
UST 261-2	Area of concern 261	800	Kerosene	Removed
UST 261-3	Not applicable	1,500	PD-680	Removed
UST 282-1	Not applicable	7,500	Diesel	Removed
UST 282-2	Not applicable	7,500	Unleaded Gasoline	Removed
UST 614-1	Not applicable	20,000	Emergency Overflow	Existing and Exempt from Regulatory Closure

Tank Identification Number	SWMU Identification Number	Capacity (Gallons)	Content	Status
UST 615-1	UST(R)-19	10,000	Emergency Overflow	Existing and Exempt from Regulatory Closure
UST 615-2	UST(R)-19	5,000	Emergency Overflow	Existing and Exempt from Regulatory Closure
UST 615-3	UST(R)-19	50	Oil and Water	Removed
UST 615-4	Not applicable	80	Waste Oil	Removed

Aboveground Storage Tanks. *The table below lists all existing and removed ASTs at Site 5.*

Tank Identification Number	SWMU Identification Number	Capacity (Gallons)	Content	Status
AST 002	Not applicable	Unknown	Unknown	Existing
AST 005A	AST 005A	8,000	Water and Glycol	Existing and Recommended for No Further Action
AST 005B	AST 005B	8,000	Water and Glycol	Existing and Recommended for No Further Action
AST 005C	AST 005C	8,000	Water and Glycol	Removed
AST 005D	AST 005D	5,000	Liquid Argon	Removed
AST 005E	AST 005E	2,000	Liquid Nitrogen	Existing and Recommended for No Further Action
AST 005F	AST 005F	Unknown	Liquid Nitrogen	Removed
AST 005G	AST 005G	40	Waste Oil	Removed
AST 005H	AST 005H	1,300	1010 Oil	Removed
AST 032	AST 032	Unknown	Propane	Removed
AST 032C	Not applicable	Unknown	Unknown	Existing
AST 261	AST 261	Unknown	Liquid Argon	Removed
AST 405A	Not applicable	1,500	Lube Oil	Removed
AST 405B	Not applicable	1,500	Lube Oil	Removed
AST 500	AST 500	Unknown	Propane	Removed

Fuel Lines. *Fuel line removal work was conducted at Alameda Point from June 1998 to February 1999, May to June 1999, and September to December 2001 (IT Corp. 2001b, 2002b). During the 1998 and 1999 work, 29,634 linear feet of fuel line was removed and 23,788 linear feet of fuel line was abandoned in place by cleaning and grouting the lines. These removed and abandoned fuel lines included some fuel lines located at Site 5 (IT Corp. 2001b, 2002b). Fuel lines suspected to be located along Monarch Street and West Tower Avenue that border Site 5 could not be located and possibly do not exist. As of December 2001, all underground fuel lines at Site 5 have been removed or closed in place (IT Corp. 2002b).*

Oil-Water Separators. *Four OWSs (005, 006A, 006B, and 615) are located at Site 5. OWS 005 is located south of building 5. OWS 006A is located near the southeastern portion of Building 6. OWS 006B is located near the northwestern section of Building 6. OWS 615 is located southeast of building 5 adjacent to UST 615-3.*

Storm Sewer. *Storm sewers are currently located along all sides of Building 5. 18-inch and 24-inch storm sewers are located on the northern side of Building 5. These storm sewers discharge to the Oakland Inner Harbor via outfalls A and B. A 21-inch storm sewer is located on the western side of Building 5, which flows south and discharges to Seaplane Lagoon via outfall F. A section of storm sewer originating from Site 26 to the east, formerly connected to the storm sewer along the western side of Building 5, has been removed. Additionally, an 18-inch storm sewer is located on the southern side of Building 5, which discharges to Seaplane Lagoon via outfall F. On the eastern side of Building 5, the 27-inch reinforced concrete sewer and the 10-inch sewer were cleaned in 1991. A storm sewer lateral to the 10-inch line was inaccessible and could not be cleaned during a 1997 storm cleanup program. These lines flow to outfalls G and H and into Seaplane Lagoon. Storm sewer lines were categorized based on their condition and whether they are located below the groundwater table (Tetra Tech EM Inc. 2000b). Sections of the storm sewer between manholes 15G and 14G and from 13G to the east, east of Building 5, are below the groundwater table, and this storm sewer discharges to Seaplane Lagoon via outfalls G and H. Additionally, the section of the storm sewer between manholes 5F-3 and 5F-2, along the south side of Building 5, is also below the water table. This section discharges to Seaplane Lagoon via outfall F. Along the south border of Site 5, the section of the storm sewer from manholes 4F-4 to 4F-2 is below the water table, and sections of the storm sewer north of Building 5 between manholes 7A and 8A and 6B and 7B are also below the water table.*

Sections of the storm sewer west of Building 5 were removed and replaced as part of the radiological removal action described below. The conditions of the sections of storm sewers east and south of Building 5 are currently unknown and are being addressed under the forthcoming radiological assessment. However, portions of manholes 5F-2 and 5F-3 and 15G and 14G are below the water table, thus they are a potential source of contamination to Seaplane Lagoon because they intersect the OU-wide groundwater contamination.

A storm sewer sediment removal action was completed by the Navy between 1995 and 1997 (IT Corp. 1997; Tetra Tech EM Inc. 1997b). The Navy conducted Phase I of the CERCLA time-critical removal action by vacuum-cleaning sediment and debris from storm sewer catch basins and manholes associated with outfalls A, B, E, H, I, J, K, L, and R.

PCB-Containing Equipment Sites. *All Navy shore activities that generated, treated, stored, or disposed of PCBs were required to inventory or validate all PCBs and PCB items annually, in accordance with Navy procedures and Federal and State regulations. Navy guidelines state that all transformers containing 500 parts per million or more PCBs must be eliminated by October 1998 and all transformers containing 50 parts per million or more of PCBs must be eliminated by October 2003 (Navy 1994). As of October 1998, all equipment containing oil contaminated with PCBs at a concentration greater than 500 parts per million was retrofilled or removed from service. As of August 2001, all equipment containing oil contaminated with PCBs at a concentration greater than 40 parts per million was removed from service and disposed of. No equipment*

containing oil with PCB concentrations exceeding 40 parts per million remains on the property (Tetra Tech EM Inc. 2003a).

Open Space. *Site 5 contains open space consisting of roadways, general vehicle parking lots, container storage areas, storage areas, and vehicle parking areas. Most parking and roadway areas are paved with concrete. The paved parking areas show typical vehicle stains associated with parking spaces.*

Removal Actions. *In late 2001 and early 2002, a cadmium removal action was performed at the former plating shop in Building 5. During the removal action, approximately 1,750 cubic yards of soil was excavated. The excavation was performed in three stages, with confirmation sampling following each stage. The initial excavation was completed to 5 feet bgs, but subsequent focused excavations were completed to approximately 10 feet bgs. Soil excavated during the removal action removed essentially all of the cadmium-contaminated soil to background levels (IT Corp 2002a), as verified by soil sampling results.*

Radiological Contamination. *Within Building 5, radioluminescent paint containing radium-226 was used during the refurbishing of aircraft instrument dials. Radiological surveys within Building 5 detected radioactive contamination on floors, walls, and drain piping (PRC Environmental Management, Inc. 1996; Tetra Tech EM Inc. 2002a). Leaks from the storm drain piping inside the building contaminated several indoor areas, including the first floor spray booths and rooms on the second floor (Tetra Tech EM Inc. 2001a). New World Technology conducted a radiological characterization survey of the storm drain lines in 1997 (New World Technology, Inc. 1998). The radiological survey included exposed and subterranean interior drain lines of Building 5 and storm drain lines from Buildings 5 and 400 and other locations that empty into the Seaplane Lagoon.*

In 1999, a removal action was conducted to remove radiological contamination on floors and walls of the paint booths and adjacent offices together with interior drain piping and storm drains. The removal action also included removing radiological contamination from the storm drain lines outside of Building 5 to manhole 5F. Removal of the contaminated piping and the associated storm sewer pipelines was completed in 2000 (New World Technology, Inc. 2002). Results of a radiological closeout survey completed after removal action indicated that no significant radioactive contamination remained within Building 5 (Tetra Tech EM Inc. 2001a). All final measurements taken during the survey were at or below applicable surface activity limits (Tetra Tech EM Inc. 2001a).

Radiological contamination remains in sections of storm drain lines from manhole 5F down to outfall F at the Seaplane Lagoon, in storm drain line from Building 400 (manhole 4F to manhole 4F3), and in an abandoned section of storm drain that is buried beneath Building 5 (New World Technology, Inc. 2002). Although manholes 4F2 and 4F3 are located in Site 10, radiological contamination in that portion of the storm drain lines will be remediated with the Site 5 storm drain lines. Those sections of remaining storm drain lines that were not addressed in previous removal actions may be a continuing source of radioactive contamination (radium-226) to the Seaplane Lagoon.

The Navy is currently conducting a historical radiological assessment of Alameda Point to document the extent of past radiological operations at specific sites and residual effects the operations may have had on each site. The historical radiological assessment will include past uses and storage of radioactive materials at Alameda Point and previous radiological surveys and removal actions to ensure that Navy is complying with current state and federal radiological standards. This assessment is expected to be completed in summer 2005 and will recommend if remediation of radiological contamination other than the storm drains is needed at Site 5.

2.2.2 Site 10 – Missile Rework Facility

Site 10 is situated south of West Tower Avenue (previously named Avenue F), between Buildings 11 and 12, is approximately 600 feet north of Seaplane Lagoon, and is bordered on the north by Site 5 (Figure 1-2). Site 10 measures approximately 4.3 acres and consists of EBS Parcel 52. Site 10 is considered a developed area and is bordered by intensively developed and paved areas. Building 400 covers approximately 85 percent of Site 10, with approximately 126,000 square feet of floor space, and the remaining 15 percent is paved open space, roads, and parking lots. Typical urban wildlife, such as California ground squirrel (Otospermophilus beecheyi), scrub jays (Aphelocoma californica), and American robins (Turdus migratorius), have been observed in the intensively developed areas but to a lesser extent than in the landscaped and developed areas because less foraging habitat is available. Feral cats also are found in the intensively developed area (Navy 1999).

Site 10 contains Building 400 (Missile Rework Facility) along with the area that supports, surrounds, or is part of the activities that occur in the building. Around 1930, filling began in the area covered by Site 10. Before 1930, Site 10 was completely inundated by San Francisco Bay. Site 10 was formerly an apron open space used for aircraft parking and maneuvering before construction of Building 400 in 1957, when the site was used for missile and aircraft component repair and maintenance operations. Other physical features present at Site 10 include one former UST (400-1); sanitary sewer lines, industrial waste lines, and open space. The site also includes six RCRA sites: M-08, SWMU/GAP 36, SWMU/GAP 37, SWMU/GAP 38, SWMU/GAP 39, and SWMU/GAP 42. Because of possible petroleum product contamination from floating product, a portion of Site 10 is designated as CAA-5C.

Building 400 operated as a missile rework facility between 1957 and 1972. The building began operating as an avionic component rework facility from 1966 to the closure of the building in 1996. Currently, the building is used by a movie production company as office space and a production lot. Past operations that occurred at Building 400 included paint stripping, construction of fiberglass airplane components, airplane parts cleaning and degreasing, silk screening, photographic development, and radioluminescent painting of aircraft dial faces. Industrial wastewater that was produced at Building 400 was discharged into Seaplane Lagoon before 1972. After 1972, wastewater was discharged to an off-site wastewater treatment facility and used chemicals were collected at five collection points throughout the building. Wastes

generated at Building 400 included paint sludges, metal shavings, paint strippers, cleaning solvents, such as trichloroethene (TCE) and carbon tetrachloride, testing fluids, and miscellaneous oil and grease (IT Corp. 2001a).

During the Navy's operations at Alameda Point from the 1950s to base closing, radioluminescent aircraft instrument dials were refurbished with radium-226 in Building 400. Radiological activities took place on the second floor of Building 400. Radium paint was washed down sink drains that led into the storm sewer system leading from Building 400 into the main line and out to Seaplane Lagoon (Tetra Tech EM Inc. 2001a).

Site history indicates that the radium-226 was used and stored on the second floor of Building 400. In 1996, this floor was extensively surveyed for radiological materials (PRC Environmental Management, Inc. 1997b). Equipment found to be contaminated was removed, and hot spots found on the floors were identified and removed (Tetra Tech EM 2001a). Additionally, radiological contamination was identified in the storm drains that service this building, and the piping was removed in 1999 and 2000. A radiological closeout survey was performed in 2001 to determine if any radiological contamination existed at Building 400. The radiological closeout survey demonstrated that no significant contamination remains in Building 400 (Tetra Tech EM 2001a).

Underground Storage Tanks. *One UST and associated piping were previously located at Building 400 (IT Corp. 1997). The 250-gallon UST (400-1) was located on the northeastern side of Building 400 and formerly held diesel fuel. In July 1990, UST 400-1 failed tank tightness testing (Public Works Center 1997). The UST was removed in 1995.*

Aboveground Storage Tanks. *No ASTs are located at Site 10.*

Fuel Lines. *No fuel lines are located at Site 10.*

Oil Water Separator. *No OWSs are located at Site 10.*

Storm Sewer. *Storm sewer lines are currently located along the northern and southern boundaries of Site 10. The storm sewer lines in the vicinity of Site 10 are below the groundwater table. Water that enters the storm sewer system at Site 5 eventually flows into Seaplane Lagoon through outfall system F lines. The 24-inch reinforced concrete sewer line that parallels the northern side of Building 10 and the 15-inch sewer line that parallels the southern side of Building 10 have been identified as radiologically contaminated. The 30-inch reinforced concrete sewer line that discharges south from the middle of Building 10 to Outfall "FF" was cleaned during the storm sewer cleanup program in 1997 (IT Corp. 1997).*

Open Space. *Site 10 is 15 percent paved open space, consisting of roads and parking lots. Most parking and roadway areas are paved with concrete. The paved areas show typical vehicle stains associated with parking spaces.*

Solid Waste Management Units. *Site 10 contains six SWMU sites (M-08, SWMU/GAP 36, SWMU/GAP 37, SWMU/GAP 38, SWMU/GAP 39, and SWMU/GAP 42). M-08 was a portable 15-gallon tank and the other five SWMUs were 5-gallon containers or 55-gallon drums.*

Radiological Contamination. *Similar to Site 5, aircraft instrument dials were refurbished using paint that contained radium-226 as a luminescent agent. This refurbishment resulted in contamination of walls, floors, and drain pipes in work areas used for dial painting. As a result of the radioactive contamination, Navy conducted a removal action in 1999 that included contaminated floor and wall materials, interior waste lines, a radium filter vault, and contaminated soil (New World Technology, Inc. 2002). Following removal activities, a radiological closeout survey was completed (Tetra Tech 2001a). The survey indicated that no significant radioactive contamination remained within Building 400. All final measurements taken during this survey were at or below applicable surface activity limits (Tetra Tech EM Inc. 2001a).*

The Navy is currently conducting a historical radiological assessment of Alameda Point. This document is evaluating past uses and storage of radioactive materials at Alameda Point and previous radiological surveys and removal actions to ensure that Navy is complying with current state and federal radiological standards. This assessment is expected to be completed in summer 2005 and will provide recommendations, as appropriate, for any additional remediation of radioactive contamination that might be needed at Site 10.

2.2.3 Site 12 – Power Plant Facility

Site 12 is situated north of West Tower Avenue between Saratoga and Lexington Streets (formerly named Second and Third Streets) (Figure 1-2). Site 12 measures approximately 2 acres and is roughly rectangular in shape. Building 10 covers approximately 25 percent of Site 12. Site 12 is 25 percent is paved open space consisting of roads and parking lots. Most parking and roadway areas are paved with concrete. The paved areas show typical vehicle stains associated with parking spaces. Typical urban wildlife, such as the California ground squirrel, scrub jays, and American robins, have been observed in the intensively developed areas but to a lesser extent than in the landscaped and developed areas because less foraging habitat is available. Feral cats also are found in the intensively developed area (Navy 1999b).

Site 12 contains Building 10 (Power Plant Facility) along with the area that supports, surrounds, or is part of the activities that occurred in the building. Around 1930, filling began in the area covered by Site 12. Prior to this time, Site 12 was completed inundated by San Francisco Bay. Building 10 is 21,000 square feet in size and was constructed in the late 1930s as the power plant. No buildings or structures are known to have previously existed at Site 12. Activities at Site 12 included the generation of steam and air compression. Little documentation exists on past uses of Building 10. Petroleum products, laboratory chemicals, plant treatment chemicals, microbiocide, morpholine, and corrosives are documented to have been stored in Building 10 (IT Corp. 2001a). Building 10 operated as a power plant from the late 1930s to the closure of the base in 1996. Boilers at the power plant were designed to generate power by using fuel oil. In the early 1970s the use of fuel oil was discontinued and replaced by natural gas with diesel fuel as a backup fuel supply. Currently, the building is vacant.

Other physical features present at Site 12 are 6 USTs, 12 ASTs, 16 transformers (6 of which have been removed), sanitary sewer lines, storm sewer lines, industrial waste sewer lines, one OWS, and open space. Site 12 also includes one RCRA site, SWMU/GAP Site 2. The USTs, ASTs, and storm sewer lines are summarized below.

Underground Storage Tanks. *The table below lists all existing and removed USTs at Site 12.*

Tank Identification No.	SWMU Identification No.	Capacity (Gallons)	Content	Status
UST 10-1	UST-04	17,000	Fuel Oil	Closed in place
UST 10-2	UST-04	17,000	Fuel Oil	Closed in place
UST 10-3	UST-04	17,000	Fuel Oil	Closed in place
UST 10-4	UST-04	17,000	Fuel Oil	Closed in place
UST 10-5	UST-04	24,000	Fuel Oil	Closed in place
UST 10-6	UST-04	2,500	Unleaded Gasoline	Removed

Aboveground Storage Tanks. *The table below lists all existing and removed ASTs at Site 12. There are no records of releases associated with the 12 diesel ASTs.*

Tank Identification No.	SWMU Identification No.	Capacity (Gallons)	Content	Status
AST 010A	AST 010A	10,000	Fuel oils	Existing and recommend to close in place
AST 010B	AST 010B	12,000	Fuel oils	Existing and recommend to close in place
AST 010C	AST 010C	12,000	Fuel oils	Existing and recommend to close in place
AST 010D	AST 010D	25,000	Fuel oils	Existing and recommend to close in place
AST 010E	AST 010E	12,500	Fuel oils	Existing and recommend to close in place
AST 010F	AST 010F	12,500	Fuel oils	Existing and recommend to close in place
AST 010G	AST 010G	25,000	Fuel oils	Existing and recommend to close in place
AST 010H	AST 010H	25,000	Fuel oils	Existing and recommend to close in place
AST 010I	AST 010I	25,000	Fuel oils	Existing and recommend to close in place
AST 010J	AST 010J	160	Diesel	Existing and recommend to close in place
AST 010K	AST 010K	160	Fuel	Removed and no further action recommended
AST 010L	AST 010L	8,800	Brine Solution (for water treatment)	Existing and no further action recommended

Storm Sewers. *Storm sewers are currently located on the northern and southern sides of Building 10. Storm water runoff that collects in the lines at Site 12 flow into Seaplane Lagoon through Outfall F* (Note from BEI: this should read "Outfall G" because storm drains north and south of IR Site 12 do not drain to Outfall F). *They were not cleaned in 1991 or during the 1997 storm sewer cleanup program (IT Corp. 2001a). Storm sewers located west of Building 10 have, in part, been identified as radiologically contaminated*

under the Alameda Storm Sewer Study Report (Tetra Tech EM Inc. 2000b). However, these sewer lines are associated with Building 5 and are being investigated as part of the ongoing radiological removal actions being conducted at OU-2 (Tetra Tech EM Inc. 2001b).

2.3 PHYSICAL SETTING

This section describes the physical setting and current conditions of Alameda Point. Included is a description of the climate, geology, and hydrogeology. Alameda Island lies at the base of a gently westward-sloping plain that extends from the Oakland-Berkeley Hills in the east to the shore of the San Francisco Bay in the west. Alameda Island is characterized by a low topographic profile, with surface elevations varying from mean sea level (MSL) to approximately 30 feet above MSL. The topography of OU-2C is primarily flat and rises to approximately 11 feet above MSL.

2.3.1 Climate

The San Francisco Bay area is characterized by a Mediterranean climate with mild summer and winter temperatures. The mean annual precipitation at Alameda Island is 23 inches, with most of the precipitation generally occurring from October to April. Mean yearly low and high temperatures are 52 degrees Fahrenheit (°F) and 67 °F, respectively. The wind direction is predominantly from the west or northwest, with rare occurrences of gale-force or greater winds. Heavy fog that sometimes impairs visibility for navigation occurs on an average of 21 days per year (National Weather Service 2001).

2.3.2 Geology

Alameda Point is located along the eastern shore of the central San Francisco Bay, directly west of the City of Oakland. The San Francisco Bay and the area surrounding it occupy a large, regional trough that extends northwest to southeast across the California Coast Ranges. In the subsurface, the San Francisco Bay is approximately coincident with the axis of the bedrock trough, which was formed 1 million to 500,000 years ago by crustal movements associated with two active faults, the Hayward Fault to the east and the San Andreas Fault west of San Francisco (Figuers 1998). The trough was filled with a sequence of coalescing alluvial fans consisting of lenses of sand, silt, and gravel eroded from the surrounding hills. During interglacial periods, the Pacific Ocean entered the basin, which resulted in wide deposition of estuarine muds (Figuers 1998).

Today, regional geologic conditions in the San Francisco Bay Area reflect this depositional history and consist of up to approximately 1,000 feet of interbedded and alternating alluvial and estuarine deposits overlying crystalline bedrock of the Franciscan Complex. The major formations underlying the San Francisco Bay Area from oldest to youngest are (1) Franciscan Complex, (2) Alameda Formation, (3) Yerba Buena Mud, (4) San Antonio Formation, (5) Merritt Sand Formation, (6) Young Bay Mud, and (7) Artificial Fill.

The geology of Alameda Point presented below is based on interpretation of the occurrence of unconsolidated, Quaternary-aged units encountered in subsurface

investigations completed to date. The description begins with the uppermost units encountered at the surface down to bedrock and is divided into the western, central, and southeastern geologic regions. Geologic cross sections were prepared for OU-2C and the cross section lines are shown on Figure 2-1.

Artificial Fill. *The artificial fill is the upper-most unit and underlies most of Alameda Point. It ranges in thickness from 0 to 30 feet. The artificial fill is thickest in the western portion and generally decreases in thickness eastward across Alameda Point. The varying thickness of the artificial fill results from natural variations in the surface topography of the estuary before artificial filling activities began in the late 1800s. As a result of the fill process, the artificial fill is thinnest in the tidal flats and thickens westward toward areas where San Francisco Bay was filled. The artificial fill consists of sediments that were dredged from the surrounding San Francisco Bay and the Oakland Inner Harbor. Although the composition of the artificial fill varies, it generally consists of silty sand or sand with minor inclusions of clay or gravel or both. Sediments comprising the artificial fill are similar to Merritt Sand deposits, which comprise the sediments of San Francisco Bay and Oakland Inner Harbor. The artificial fill encountered at OU-2C is shown on Figures 2-2 and 2-3.*

Bay Sediment Unit (BSU). *The BSU, which consists of Holocene-aged estuarine (tidal flat) deposits, is the youngest, naturally occurring unit at Alameda Point. The BSU is equivalent to the Young Bay Mud (Figuers 1998). The BSU is about 40 feet thick in the western portion of Alameda Point, thinning and pinching out in the southeastern region at the former shoreline of Alameda Island (Figure 2-1). The BSU is encountered at a depth of about 25 feet bgs in the western portion of Alameda Point and at a depth of about 5 feet bgs in the eastern portion of Alameda Point. The BSU is made up of tidal flat deposits consisting of varying degrees of fine- and coarse-grained material that grade westward, away from the former shoreline and into finer-grained subtidal deposits. The BSU consists of gray to black silt and clay with discontinuous, poorly graded, silty and clayey sand layers. In some parts of the western region of Alameda Point, the lower portion of the BSU is predominantly gray to black sand. The BSU encountered at OU-2C is shown on Figures 2-2 and 2-3.*

A layer with high organic content, called the "marsh crust" typically marks the top of the BSU throughout the eastern portion of Alameda Point. The marsh crust is a layer of contaminated sediment that was formed by the discharge of petroleum waste from two gas plants and an oil refinery. This waste migrated over much of the surface of the surrounding marshlands and was deposited through tidal actions under what would later become the Alameda Annex and the eastern portion of Alameda Point. Further west, at Alameda Point, the waste was deposited on tidal flats now known as the former subtidal area. Fill material dredged from the Oakland Inner Harbor and surrounding the San Francisco Bay was placed on these areas from as early as 1887 to as late as 1975, encapsulating the former subtidal area and marsh crust under the fill. Areas where the marsh crust is known to exist are subject to excavation restrictions known as the Marsh Crust Ordinance that limits the extent of excavations to designated threshold depths (City of Alameda 2000).

Merritt Sand. *Over most of Alameda Point, the Merritt Sand underlies the BSU. The Merritt Sand is encountered at depths ranging from 40 feet bgs in the western portion of Alameda Point to surface outcrops in the southeastern portion of Alameda Point. At Alameda Point, the Merritt Sand is made up of brown, fine- to medium-grained, poorly graded sand. Bivalve shells and shell hash are observed in parts of the Merritt Sand, indicating some marine reworking during the most recent sea level rise. The Merritt Sand ranges from 8 feet to 60 feet thick across Alameda Point. The Merritt Sand encountered at OU-2C is shown on Figures 2-2 and 2-3.*

San Antonio Formation (upper unit). *At Alameda Point, the upper member of the San Antonio Formation generally uncomformably underlies the Merritt Sand and consists of interbedded layers of gray sand and clay, ranging from 10 to 40 feet thick in the eastern portion and from 7 to 70 feet thick in the central portion of Alameda Point. A persistent layer containing shells and sand is present near the top of the formation. The San Antonio Formation is present over most of Alameda Point but is absent where a paleochannel crosses the northern half of the central and western portions of Alameda Point. Greenish-gray clay layers within the upper member of the San Antonio Formation may not be regionally continuous. An organic-rich layer containing plant debris or peat is occasionally present at the base of the formation.*

A paleochannel (former stream channel cut through existing sediments then filled with younger sediments) underlying Alameda Point is located along an east-west trending axis through the middle of Alameda Point. The paleochannel was cut through the Merritt Sand and into the upper unit of the San Antonio Formation. Then it was filled with the encroaching BSU, which consisted of low-permeability silts and clays with discontinuous layers of poorly graded sands. Those poorly graded sands become continuous and thicker in the western region of Alameda Point.

Yerba Buena Mud (San Antonio lower unit). *Yerba Buena Mud is up to 50 feet thick at the west end of Alameda Point and thins to the east but does not pinch out. The top of the Yerba Buena Mud occurs at elevations of 50 to 100 feet below MSL. The top of the Yerba Buena Mud dips approximately 2 degrees to the southwest under Alameda Point (Rogers and Figuers 1991).*

Alameda Formation. *The Alameda Formation underlying Alameda Point ranges from approximately 250 feet thick at the western edge of Alameda Point to approximately 850 feet thick at the east end. In the central portion of Alameda Point, the formation is about 600 feet thick; the upper layers of estuarine clays and silts are similar to those deposited in the San Francisco Bay (Rogers and Figuers 1991).*

Franciscan Complex. *Most of the installation overlies the western side of the bedrock trough. Bedrock of the Franciscan Complex underlies Alameda Point at elevations ranging from approximately 400 to 950 feet below MSL. The bedrock surface under Alameda Point dips to the east-southeast at an angle of approximately 1 degree (Rogers and Figuers 1991). The axis of the bedrock depression in the San Francisco Bay Area is oriented northwest to southeast and is coincident with the eastern part of Alameda Point.*

2.3.3 Hydrogeology

Groundwater occurs as an unconfined aquifer within the artificial and natural unconsolidated deposits underlying Alameda Point, at depths ranging from approximately 6 feet bgs in the southeastern portion of Alameda Point to approximately 10 feet bgs in the central and western portions. Groundwater also occurs under semiconfined and confined conditions at Alameda Point, in areas where the BSU functions as an aquitard.

The subsections below describe the hydrostratigraphy, or system of aquifers, and intervening aquitards underlying Alameda Point; the regional subdivisions at Alameda Point; and groundwater flow at Alameda Point. The water-bearing units encountered at Alameda Point were named based on their sequence in the subsurface; the aquitards are named based on the formation they are in.

2.3.3.1 LOCAL HYDROSTRATIGRAPHY

Five local hydrostratigraphic units are identified at Alameda Point. Water-bearing units include the first water-bearing zone (FWBZ) (Newark Aquifer) and the second water-bearing zone (SWBZ) (confined Newark Aquifer). The FWBZ and the SWBZ are separated by the BSU (Newark Aquitard). The occurrence of the SWBZ depends on the presence of the BSU, which acts as an aquitard separating the FWBZ and the SWBZ. The water-bearing units are underlain by the Yerba Buena Aquitard (Irvington Aquitard). The hydrostratigraphic units at Alameda Point are described (beginning at the top) below.

First Water-Bearing Zone

The FWBZ is an unconfined aquifer that occurs within the uppermost permeable units at Alameda Point, primarily the artificial fill materials, if present, or the Merritt Sand and the Upper San Antonio Formation in areas where the artificial fill and BSU are absent. Groundwater in most of the FWBZ at Alameda Point is fresh, but may be brackish (slightly saline) in areas near the San Francisco Bay shoreline.

The FWBZ in the artificial fill occurs mainly in the western and central parts of the installation, and in a portion of the southeastern area. The FWBZ in the artificial fill extends vertically to the base of the fill, except in localized zones, where more permeable materials occur in the upper part of the underlying BSU. In that case, the permeable part of the BSU functions as part of the FWBZ. In other areas where the BSU consists of low permeability materials, it acts as a confining layer below the FWBZ in the artificial fill.

The FWBZ is subdivided into upper and lower units in areas where the BSU functions as part of the FWBZ. The portion of the FWBZ in the artificial fill is referred to as the upper FWBZ, and the portion in the BSU is referred to as the lower FWBZ. The upper FWBZ consists of a thin layer of artificial fill and the upper portion of the Merritt Sand, and the lower FWBZ consists of the lower portion of the Merritt Sand and the upper San Antonio Formation.

In the southeastern portion of the installation, where the BSU does not occur in a continuous layer, the FWBZ occurs primarily in the artificial fill (where present), the Merritt Sand Formation, and the underlying Upper San Antonio Formation. In those areas, the FWBZ extends vertically to the top of the Yerba Buena Mud (Lower San Antonio Formation), which acts as a confining layer below the FWBZ.

There is no connection between the shallow aquifer systems in artificial fill materials on Alameda Island and the Oakland mainland because Oakland Inner Harbor bisects the Merritt Sand unit. The Merritt Sand unit on Alameda Island is hydraulically isolated from mainland aquifers.

Bay Sediment Unit Aquitard

The BSU functions as an aquitard in areas where it is present and consists of fine-grained, low-permeability materials. In other areas, where it consists of higher-permeability materials, the BSU forms the lower portion of the FWBZ.

Second Water Bearing Zone

The SWBZ is a semiconfined and confined aquifer that occurs within the Merritt Sand and the Upper San Antonio Formation. The SWBZ is found only in the portions of Alameda Point where the overlying BSU is both present and consists of low-permeability materials, so it acts as a confining unit for the SWBZ. The SWBZ extends to the top of the Yerba Buena Mud, which functions as a confining unit below the SWBZ. The SWBZ is present near the shoreline in the southeastern portion of Alameda Point. Groundwater in SWBZ at Alameda Point is brackish to saline.

Yerba Buena Mud Aquitard

The Yerba Buena Mud functions as an aquitard that underlies Alameda Point. The top of the Yerba Buena Mud was encountered in some borings drilled at Alameda Point, but no borings advanced during the RI have drilled through the entire unit. Based on available data, the Yerba Buena Mud Aquitard underlying Alameda Point is approximately 50 to 90 feet thick. As a result, the Yerba Buena Mud Aquitard most likely is continuous beneath Alameda Point, which limits or prevents hydraulic communication between the FWBZ and SWBZ and the underlying Alameda Aquifer.

The Yerba Buena Mud Aquitard underlying the Oakland Inner Harbor is approximately 50 to 110 feet thick. The presence of the aquitard prevents mixing of fresh water in the Alameda Formation with saline water in the more shallow aquifers (Subsurface Consultants, Inc. 1998).

Alameda Aquifer

The Alameda Aquifer is a confined, regional drinking water aquifer that occurs in the Alameda Formation (Tetra Tech EM Inc. 2000a). This aquifer is the installation equivalent of the regional Centerville Aquifer. The Alameda Aquifer is confined by the overlying Yerba Buena Mud Aquitard. The Alameda Formation yields fresh water (Hickenbottom and Muir 1988). Additionally, the Alameda Formation most likely is isolated hydraulically from overlying saline aquifers based on pumping tests conducted

in the Alameda Formation, during which no response was measured in overlying units (Hydro-Search, Inc. 1977).

2.3.3.2 REGIONAL HYDROSTRATIGRAPHY

Alameda Point has been divided into three regions based on geologic and hydrogeologic similarities: the southeastern, western, and central regions. The hydrostratigraphy of each of these regions is described below.

Southeastern Region Hydrostratigraphy

In the southeastern region of Alameda Point, the BSU is discontinuous, thin, or is absent. The BSU does not occur east of the former shoreline. Where the Bay Sediment Aquitard occurs, the FWBZ is within a thin layer of artificial fill and the SWBZ is in the Merritt Sand and the Upper San Antonio Formation. Where the Bay Sediment Aquitard does not occur, the FWBZ is within a thin layer of artificial fill, but primarily in the Merritt Sand, and the Upper San Antonio Formation, which together are approximately 65 to 80 feet thick.

Central Region Hydrostratigraphy

In the western and central region of Alameda Point, the FWBZ occurs primarily in the artificial fill materials. The saturated thickness of the FWBZ ranges from less than 10 feet in the central regions to over 30 feet in the western region. In the western region, the upper portion of the BSU consists entirely of silt and clay. However, in the southern part of the central region, the upper portion of the BSU contains interbedded silt and sand that allows that portion of the BSU to be included in the FWBZ.

The SWBZ occurs within the Merritt Sand and the Upper San Antonio Formation in the western region and the central region. The SWBZ in these regions are confined locally and contained in the lower portion of the BSU, the Merritt Sand Formation (where present), and the Upper San Antonio Formation.

The SWBZ is underlain by the Yerba Buena Mud aquitard, which is approximately 60 feet thick in the western region and the central region of Alameda Point.

2.3.4 Water Quality

Groundwater beneath Alameda Point was evaluated for potential beneficial uses in 2000 (Tetra Tech EM Inc. 2000a). U.S. EPA's "Guidelines for Groundwater Classification Under the U.S. EPA Groundwater Protection Strategy" are used to classify groundwater as Class I, II, or III (U.S. EPA 1988a). Class I groundwater is an irreplaceable source of drinking water or is ecologically vital. Class II groundwater is a current or potential source of drinking water that has other beneficial uses. Class III groundwater is not a potential source of drinking water and is of limited beneficial use. U.S. EPA classifies groundwater having an existing or potential use as a drinking water supply (Class I or II) using the following criteria: a total dissolved solids (TDS) concentration less than 10,000 milligrams per liter (mg/L) and a minimum well yield of 150 gallons per day. Under California State Water Resources Control Board Resolution No. 88-63, all

groundwater is considered potentially suitable for municipal or domestic supply, unless the TDS content exceeds 3,000 mg/L or a well cannot provide a sustainable yield of 200 gallons per day (State Water Resources Control Board 1988). The state identifies other potential beneficial uses of groundwater, including industrial service and industrial supply, agricultural supply, and freshwater replenishment (Water Board 1995).

At Alameda Point, fresh groundwater occurs in the FWBZ (Tetra Tech EM Inc. 1997b). Based on federal TDS and yield criteria, the FWBZ in the central and southeastern portion of Alameda Point is a Class II aquifer, making it a potential drinking water source. However, in a letter from Anna-Marie Cook, U.S. EPA, to Patricia McFadden, Department of the Navy, the U.S. EPA stated the following (U.S. EPA 2000):

"Based on the shallow depth of the aquifer in this area [central portion], the likelihood of salt water intrusion (based on groundwater flow direction) if any significant pumping takes place, and the fact that no wells currently exist within or close to this area, it seems unlikely that groundwater in this area will be a potential source of drinking water in the future. EPA would concur with non-MCL cleanup levels for this area on condition that any contaminated groundwater beneath Sites 5, 6, 8, 10 and 12 is remediated to levels such that the threats posed by such exposures as inhalation (groundwater vapors into soils and from soils to residences), dermal contact, and those associated with irrigation use are eliminated, and any significant ongoing degradation of the groundwater from contaminant migration is prevented."

TDS results from 19 monitoring wells screened in the FWBZ ranged from approximately 110 mg/L in Site 5 monitoring well M10-03 to 5,100 mg/L in Site 5 monitoring well M05-01. The TDS results indicate the water in the FWBZ at OU-2C ranges from fresh to slightly brackish.

The SWBZ primarily consists of water that is fresh to brackish, with specific conductance readings ranging from less than 500 micromhos per centimeter to greater than 3,000 micromhos per centimeter. TDS were measured in OU-2C monitoring wells in 1994 (PRC Environmental Management, Inc. 1996). TDS results in monitoring wells screened in the SWBZ ranged from 30,000 mg/L in monitoring well D05-01 (at Site 5) to 51,000 mg/L in monitoring well D12-01 (at Site 12). The TDS results indicated water in the SWBZ at OU-2C ranges from brackish to saltwater and should not be considered for domestic use.

Over pumping of groundwater extraction wells drilled into the Merritt Sand on Alameda Island before the turn of the century resulted in saltwater intrusion and closure of many production wells. Since 1990, only minor pumping of groundwater from the aquifer underlying Alameda Island has occurred (Figuers 1998).

2.4 ECOLOGICAL SETTING

This section discusses the ecological habitats and rare, threatened, or endangered species at OU-2C.

2.4.1 Ecological Habitats

The following ecological habitats occur within a 1-mile vicinity of OU-2C.

- Barren habitat occurs at OU-2C as bare soil, paved areas, and buildings; and on adjacent land at Alameda Point and in the Cities of Oakland and Alameda as roads, parking areas, buildings, and runways.
- Urban habitat occurs on adjacent land at Alameda Point and in the Cities of Oakland and Alameda as ornamental shrubs, trees, and landscaped areas.
- Nonnative grassland habitat occurs on Alameda Point to the west of OU-2C.
- Estuarine habitat occurs in portions of San Francisco Bay, such as the Oakland Inner Harbor to the north of Alameda Point, Seaplane Lagoon to the south of OU-2C, and the main San Francisco Bay to the south of Alameda Point.

Barren habitat generally offers little value to wildlife; it may serve as a corridor between other habitats or as a place of brief resting, but is not a significant place of shelter.

Urban habitat generally supports few wildlife species due to human disturbances and limited vegetation. Vegetation includes grass lawns, ornamental trees, and landscaped shrubs. Typical animal representatives of the urban habitat include the house finch (*Carpodacus mexicanus*), house sparrow (*Passer domesticus*), American robin (*Turdus migratorius*), red-winged blackbird (*Agelaius phoeniceus*), scrub jays (*Aphelocoma californica*), California ground squirrel (*Spermophilus beecheyi*), and feral cats. In addition, raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and Virginia opossum (*Didelphis virginiana*) may occur occasionally.

Nonnative grassland habitat offers shelter, forage, and nesting opportunities for a variety of animal species. The northern harrier (*Circus cyaneus*), killdeer (*Charadrius vociferus*), California horned lark (*Eremophila alpestris actia*), and burrowing owl (*Athene cunicularia*) are avian species that nest in the grassland habitat of Alameda Point. Avian predators occurring in the grassland habitat include the red-tailed hawk (*Buteo jamaicensis*), northern harrier, American peregrine falcon (*Falco peregrinus anatum*), white-tailed kite (*Elanus leucurus*), and American kestrel (*Falco sparverius*). Prey species occurring in the grassland habitat include the rock dove (*Columba livia*), mourning dove (*Zenaida macroura*), black-tailed hare (*Lepus californicus*), rabbit (*Sylvilagus floridanus*), and California ground squirrel. Raccoon, striped skunk, and Virginia opossum may forage in the grassland region. Small areas of scrub habitat occur within the grassland habitat.

Estuarine habitat of San Francisco Bay exists in the intertidal and subtidal zones along the shoreline of Alameda Point and nearby areas. To the north of Alameda Point is the San Francisco Bay waterway known as the Oakland Inner Harbor. An embayment known as Seaplane Lagoon is located south of OU-2C. The main body of San Francisco Bay is adjacent to the southern margin of Alameda Point. Predominant vegetation includes eelgrass (*Zostera marinara*), various marine algae, and phytoplankton. The estuarine habitat supports numerous invertebrates, including polychaete worms, amphipod crustaceans, clams, snails, and crabs. Representative fish species include

topsmelt, anchovy, surfperch, and gobies. Numerous other fish species are also present. Fish and invertebrates occurring in the estuarine habitat represent a food source for many birds, including the California least tern, California brown pelican (*Pelecanus occidentalis californicus*), western grebe (*Aechmophorus occidentalis*), and western snowy plover (*Charadrius alexandrinus nivosus*).

2.4.2 Threatened, Endangered, and Of-Concern Species

Special-status species for the screening-level ecological risk assessment are those plant and animal species that are classified as threatened, endangered, or species-of-concern by state or federal agencies, and that are known to occur or have the potential to occur in the terrestrial or aquatic habitats in the vicinity of OU-2C (CDFG 2004a,b; 2006a,b). Table 2-1 provides a list of these special-status species for Alameda Point. Local environmental impact reports were used to determine the likelihood of these species occurring at or in the vicinity of Alameda Point (LSA 2001, WRT 2002). Because of the barren and disturbed habitat at OU-2C, the listed species are unlikely to occur at the site.

Point Reyes bird's-beak (*Cordylanthus maritimus palustris*), a small annual herb that grows along the fringe of coastal salt marshes, is a federally listed endangered species and has not been reported at Alameda Point since 1917. According to historical records, the grassland and scrub plant species Santa Cruz tarplant (*Holocarpha macradenia*), Kellogg's horkelia (*Horkelia cuneata sericea*), Contra Costa goldfields (*Lasthenia conjugens*), and Adobe sanicle (*Sanicula maritima*) have also not been observed in the area for many years. It is therefore unlikely that these species will occur at Alameda Point. In fact, none of the plant species on state or federal lists were reported in vegetation surveys at Alameda Point in 1995 and 1997 (TtEMI 2003b).

Steelhead (*Oncorhynchus mykiss*) and Chinook salmon (*Oncorhynchus tshawytscha*) traverse the San Francisco Bay during migration from the ocean to the Sacramento River delta and freshwater rivers and streams (USACE et al. 1998). Green sturgeon (*Acipenser medirostris*) occur primarily in the northern portion of San Francisco Bay (San Pablo and Suisun Bays) and spawn in the rivers (USACE et al. 1998). Steelhead, salmon, and sturgeon may occasionally occur in the vicinity of Alameda Point.

The Alameda whipsnake (*Masticophis lateralis euryxanthus*) occurs primarily in scrub habitat and occasionally in grassland habitat. The Alameda whipsnake has not been observed at Alameda Point and is unlikely to occur there due to limited habitat.

Steller sea lion (*Eumetopias jubatus*) have been recorded in the area near Alameda Point, but are not expected to occur regularly. The salt marsh harvest mouse and salt marsh wandering shrew (*Sorex vagrans halicoetes*) inhabit salt marshes, but neither has been observed at Alameda Point. No salt marsh harvest mice were reported during a biological survey in 1995 (TtEMI 2003b). The San Francisco dusky-footed woodrat (*Neotoma fuscipes annectens*) and Alameda Island mole (*Scapanus latimanus parvus*) are unlikely to occur at OU-2C, based on infrequent sightings in the past. The California mastiff bat (*Eumops perotis californicus*) and Townsend's western big-eared bat (*Corynorhinus townsendii townsendii*) may occur at Alameda Point and may forage in the vicinity of OU-2C.

Table 2-1
Special-Status Species Occurring or Potentially Occurring in the Habitats of Alameda Point

Scientific Name	Common Name	Status
Plants		
Cordylanthus maritimus palustris	Point Reyes bird's-beak	CNPS-1B
Holocarpha macradenia	Santa Cruz tarplant	FT/SE
Horkelia cuneata sericea	Kellogg's horkelia	CNPS-1B
Lasthenia conjugens	Contra Costa goldfields	FE/CNPS-1B
Sanicula maritima	Adobe sanicle	SR
Fish		
Acipenser medirostris	Green sturgeon	FSC/CSC
Eucyclogobius newberryi	Tidewater goby	FE/CSC
Hypomesus transpacificus	Delta smelt	FT/ST
Oncorhynchus mykiss	Steelhead	FT/CSC
Oncorhynchus tshawytscha	Chinook salmon, winter run	FE/SE
Spirinichus thaleichthys	Longfin smelt	FSC/CSC
Reptiles		
Masticophis lateralis euryxanthus	Alameda whipsnake	FT/ST
Mammals		
Corynorhinus townsendii townsendii	Townsend's western big-eared bat	FSC/CSC
Eumetopias jubatus	Steller sea lion	FT
Eumops perotis californicus	California mastiff bat	FSC/CSC
Neotoma fuscipes annectens	San Francisco dusky-footed woodrat	FSC/CSC
Reithrodontomys raviventris	Salt marsh harvest mouse	FE/SE
Scapanus latimanus parvus	Alameda Island mole	FSC/CSC
Sorex vagrans halicoetes	Salt marsh wandering shrew	FSC/CSC
Birds		
Athene cunicularia	Burrowing owl	FSC/CSC
Charadrius alexandrinus nivosus	Western snowy plover	FT/CSC
Circus cyaneus	Northern harrier	CSC
Elanus leucurus	White-tailed kite	FSC/CFP
Eremophila alpestris actia	California horned lark	CSC
Falco columbarius	Merlin	CSC
Falco peregrinus anatum	American peregrine falcon	FSC/SE
Geothlypis trichas sinuosa	Salt marsh common yellowthroat	FSC/CSC
Lanius ludovicianus	Loggerhead shrike	FSC/CSC
Laterallus jamaicensis coturniculus	California black rail	FSC/ST

(table continues)

Table 2-1 (continued)

Scientific Name	Common Name	Status
Birds (continued)		
Melospiza melodia pusillula	Alameda song sparrow	FSC/CSC
Pelecanus occidentalis californicus	California brown pelican	FE/SE
Phalacrocorax auritus	Double-crested cormorant	CSC
Rallus longirostris obsoletus	California clapper rail	FE/SE
Sterna antillarum browni	California least tern	FE/SE

Acronyms/Abbreviations:
1B – plants rare, threatened, or endangered in California and elsewhere
CFP – California Department of Fish and Game – fully protected
CNPS – California Native Plant Society
CSC – California special-concern species
FE – federally listed – endangered
FSC – federal special-concern species
FT – federally listed – threatened
SE – California state listed – endangered
SR – California state listed – rare
ST – California state listed – threatened

Several sea birds, shore birds, and salt marsh birds such as the western snowy plover, California least tern, double-crested cormorant, California brown pelican, California clapper rail, California black rail (*Laterallus jamaicensis coturniculus*), salt marsh common yellowthroat, and Alameda song sparrow occur or may potentially occur at Alameda Point. However, the shore birds and marsh birds are not expected to occur at OU-2C because they prefer a salt marsh habitat. The sea birds such as cormorant, pelican, and tern may forage for fish in the bay at Oakland Inner Harbor or Seaplane Lagoon. Several birds occur in the grassland or scrub habitat in areas adjacent to OU-2C; these birds include the northern harrier, merlin, burrowing owl, California horned lark, loggerhead shrike (*Lanius ludovicianus*), white-tailed kite, and American peregrine falcon. These avian species may occasionally occur at OU-2C.

2.5 CONCEPTUAL SITE MODEL

Conceptual site models (CSMs) were prepared for each IR site within OU-2C. The CSMs for IR Sites 5, 10, and 12 are presented on Figures 2-4, 2-5, and 2-6, respectively.

The following subsections prepared by BEI present a summary of the findings from previous investigations that have been used to develop a model of the nature and extent of contamination at OU-2C and to identify data gaps to be addressed prior to completing the RI report. A brief description of each of the previous investigations that produced these findings is provided in Section 3.

2.5.1 Potential Soil Contamination

Between 1991 and 2004, more than 1,000 soil samples were collected from approximately 450 locations throughout the 53 acres of OU-2C and analyzed for one or more of the following: VOCs, TPH, semivolatile organic compounds (SVOCs) (including PAHs), pesticides, PCBs, metals, hexavalent chromium, and cyanide (PRC and JMM 1992, 1993; TtEMI 2002c, 2003b; PRC and MW 1996a, 1996b; IT 2001a; BEI 2004). To identify an initial list of the chemicals of interest in soil to be addressed by this Work Plan (i.e., chemicals present at levels that may represent a risk to human health or the environment), chemical concentrations were compared to regulatory criteria and Alameda Point–specific comparison criteria. Regulatory comparison criteria included residential soil preliminary remedial goals (PRGs) and Water Board environmental screening levels (ESLs) for TPH. Alameda Point–specific comparison criteria included the Alameda Point benzo(a)pyrene equivalent screening criterion (620 µg/kg) for PAHs and the Alameda Point background data set 95th percentile concentrations for metals. For the more than 1,000 soil samples previously collected at OU-2C only, the following chemicals were reported at concentrations exceeding the comparison criteria in soil samples collected in the vadose zone (less than 7.5 feet bgs):

- six VOCs (benzene; 1,1-dichloroethane [DCA]; 1,2-dichloroethene [DCE]; ethylbenzene; trichloroethene [TCE]; and tetrachloroethene [PCE]) at concentrations exceeding PRGs in one or more of 12 samples
- TPH at concentrations exceeding the ESL criteria for residential use in 27 soil samples
- PAHs with a calculated benzo(a)pyrene equivalent concentration exceeding the Alameda Point screening criterion for residential use in five samples
- the SVOC bis(2-ethylhexyl)phthalate at a concentration exceeding its residential soil PRG in one sample
- the PCB Aroclor 1260 at a concentration exceeding its residential soil PRG in one sample
- six metals (arsenic, cadmium, chromium, iron, lead, and thallium) at concentrations exceeding both Alameda Point background levels and residential soil PRGs in one or more of 27 samples from areas not subsequently excavated

Other than in areas excavated for metals or TPH contamination, chemicals exceeding comparison criteria have been reported in very few soil samples, including:

- chlorinated VOCs in 12 of 333 samples,
- benzene in 3 of 403 samples,
- PAHs in 5 of 612 samples,
- PCBs in 1 of 86 samples, and
- metals in 27 of 291 samples.

However, data gaps remain concerning some chemicals and some potential source areas, including the following:

- nature and extent of VOCs in soil at the location of former dry cleaning operation in Building 2
- southern portion of Building 5
  - any presence of VOCs in vadose zone soil above the VOC plume
  - extent of metals at concentrations exceeding comparison criteria in soil beneath eastern portion of building
  - any presence of 1,4-dioxane, hexavalent chromium, and cyanide in soil beneath the southwestern portion of building
  - any presence of hexavalent chromium and other metals and cyanide in soil along former industrial wastewater sewer lines that originated from plating operations
  - any presence of hexavalent chromium and other metals and cyanide in soil at the former locations of the cyanide and chromium eductor sumps associated with the former plating shop
  - any presence of TPH, SVOCs, and metals in soil related to the former AST (data gap identified during April 18, 2006, site walk)
  - any presence of chemicals in soil indicative of operations at the former foundry area and rubber shop (data gap identified during April 18, 2006, site walk)
- Aircraft Maintenance Line and adjoining shop area (northeastern and north central portions of Building 5)
  - extent of metals in soil at concentrations exceeding comparison criteria
  - any presence of chemicals in soil at concentrations exceeding comparison criteria at utility vault and aircraft tie-down features (data gap identified during April 18, 2006, site walk)
  - any presence of chemicals in soil at concentrations exceeding comparison criteria at the former battery acid shop (data gap identified during April 18, 2006, site walk)
- south of Building 5
  - any presence of VOCs in soil
  - extent of metals in soil at concentrations exceeding comparison criteria near former Building 398
  - any presence of hexavalent chromium and other metals and cyanide in soil along former industrial wastewater sewer lines that originated from plating operations
  - extent of VOCs, hexavalent chromium, and cyanide in soil at the former location of Building 398

- extent of VOCs, TPH, and PCBs in soil east of Building 5
- extent of PAHs in soil west of previous sampling location 030-S05-009 and north of previous sampling location C3S005B048
- any presence of chemicals in soil at concentrations exceeding comparison criteria at Buildings 6, 34, 43, 44, 102, 282, 347, 400, 405, 415, 500, or 505
- any presence of chemicals in soil at concentrations exceeding comparison criteria at 22 SWMUs, including OWSs

2.5.2 Groundwater Contamination

Groundwater investigations between 1991 and the present have identified chlorinated VOCs, hexavalent chromium and other metals, and cyanide in groundwater within OU-2C at IR Site 5 west of Lexington Avenue (Evaluation Area 1 for this Work Plan). Groundwater contamination appears to be limited to sources associated with Building 5. Specifically, the number of chemicals that have been reported at concentrations above comparison criteria in groundwater at IR Site 5 east of Lexington Avenue, at IR Site 10 south of West Tower Avenue, and at IR Site 12 is limited. Approximately 100 groundwater samples have been collected previously at OU-2C outside of Evaluation Area 1, and only the following chemicals were reported at concentrations exceeding comparison criteria:

- four VOCs (1,1-DCA; 1,1-DCE; TCE; and vinyl chloride) at concentrations exceeding MCLs in seven samples
- TPH at concentrations exceeding the ESL criterion (100 μg/L) in 16 groundwater samples (8 of these samples were collected within CAA-5C at Building 400)
- arsenic at concentrations exceeding the federal MCL (10 μg/L) in 19 groundwater samples
- aluminum, antimony, cadmium, chromium (total), hexavalent chromium, lead, nickel, and thallium at concentrations exceeding MCLs in one to three groundwater samples.

Metals reported in groundwater at OU-2C at concentrations exceeding comparison criteria within the boundaries of Evaluation Area 1 (IR Site 5 west of Lexington Avenue) include aluminum, antimony, arsenic, barium, cadmium, chromium, lead, mercury, nickel, and thallium. Arsenic is naturally occurring and its presence is attributed to background conditions at OU-2C. Arsenic tends to mobilize under reducing groundwater conditions, which are present at OU-2C. Most of the metals were reported fewer than 10 times at concentrations exceeding comparison criteria, and they were not considered risk drivers in OU-2C groundwater. The OU-2C RI report will address all metals reported in groundwater and will identify which metals may represent a release. The OU-2C RI report will include a statistical comparison of metals concentrations for OU-2C to the Alameda Point background data set. The RI report will also address all metals concentrations for individual samples that exceed the Alameda Point background 95th percentile to assess whether there has been a release, regardless of whether the OU-2C data set for a given metal is comparable to background.

Chlorinated VOCs in groundwater at OU-2C were initially identified in 1991 during the NAS Alameda RI/FS Phase 2B and 3 investigation (PRC and JMM 1992) when shallow (screened at 10 to 15 feet bgs) FWBZ monitoring wells were installed as follows:

- five wells around Building 5 (IR Site 5)
- three wells around Building 400 (IR Site 10)
- four shallow monitoring wells at around Building 10 (IR Site 12)

A limited number of VOCs were reported in groundwater samples from these wells; five of these VOCs were reported at concentrations exceeding MCLs, including 1,1-DCA; 1,1-DCE; 1,2-DCE; TCE; and vinyl chloride. One or more of these five VOCs were reported in wells located near the southeastern side of Building 5 (well M05-04, located east of the foundry and heat treatment area), south of Building 5 (well M05-03, near the plating shop wastewater pretreatment area, and well M10-01, between Building 5 and Building 400), near the northeastern corner of Building 5 (well M05-05), and near the western side of Building 5 (well M05-02). No VOCs were reported in groundwater from well M05-01 near the northwestern corner of Building 5 or in groundwater from wells M12-01, M12-03, or M12-04 at IR Site 12. Only chloroform (commonly associated with chlorinated drinking water) was reported in groundwater from wells M10-02 and M10-03 at IR Site 10. One VOC (1,2-DCE at a concentration below MCLs) was reported in groundwater from well M12-02 at IR Site 12.

Groundwater flow direction in the FWBZ is toward the north and west across Building 5, which places wells M05-01, M05-02, and M05-05 at downgradient locations from potential source areas within and east of Building 5. In 1991, cyanide was also reported in well M05-03 at a concentration below the MCL (PRC and JMM 1992). Figure 2-7 presents two groundwater elevation maps for OU-2C. Under the BGMP, water levels were measured at low tide in spring 2006 for wells throughout Alameda Point, which included 27 FWBZ wells and 9 SWBZ wells at OU-2C in April 2006 (ITSI 2006). The BGMP groundwater elevations (in feet above mean sea level [MSL]) for April 2006 are shown on Figure 2-7, with black contours representing the water table elevation in the FWBZ and blue contours representing the potentiometric groundwater elevation in the SWBZ. A more detailed water table elevation contour was prepared using water level data collected in summer 2001 as part of the design investigation for Plume 5-1 (Innovative Corporation 2002). This map shows groundwater elevations (in feet above mean low low sea level, which is approximately 6 feet below MSL) for the FWBZ for Evaluation Area 1 only.

Subsequent investigations in 1992 during the NAS Alameda RI/FS additional sampling at IR Site 5 (PRC and JMM 1993) and the installation and sampling of additional FWBZ wells in 1994 and 1995 during the NAS Alameda RI/FS follow-on sampling (PRC and MW 1996a,b; TtEMI 1999) identified potential VOC source areas at the location of the former plating shop within Building 5 (well M05-10), east of Building 5 at the location of a possible former solvent tank (well M05-07), and south of Building 5 (wells M05-03 and M05HW-01). During these investigations, three additional chlorinated VOCs were reported at concentrations exceeding MCLs, including 1,2-DCA; 1,1,1-trichloroethane

(TCA); and PCE. In 1992, cyanide and hexavalent chromium were also identified at concentrations exceeding MCLs in discrete groundwater samples collected from the plating shop area inside Building 5 (PRC and JMM 1993).

Chlorinated solvents and their chemical breakdown products (1,1-DCA; 1,2-DCA; 1,1-DCE; 1,2-DCE; PCE; 1,1,1-TCA; TCE; and vinyl chloride) were reported in groundwater across IR Site 5. Benzene has also been reported in groundwater and is likely related to leaking USTs formerly present at OU-2C that were used to store petroleum products. VOCs present at concentrations exceeding 10,000 (micrograms per liter) µg/L were reported in three areas (all within IR Site 5):

- Plume 5-1: source may be a possible former solvent tank (TtEMI 1999) at the eastern margin of Building 5
- Plume 5-3: source is likely the former degreasing operations in the former plating shop area
- Plumes 5-2 and 5-4: source may be the former foundry and heat treatment area at the southeastern margin of Building 5

The area south of Building 5 may also be a source area; this area was formerly occupied by plating shop wastewater pretreatment units (near well M05-03), an industrial wastewater treatment facility (IWTP 5), a former hazardous waste storage area (near well M05HW-01), and various activities that may have used VOCs.

Monitoring wells were installed in the SWBZ in 1994 at the following locations (PRC and MW 1996a):

- near the northwestern corner of Building 5 (well D05-01)
- east of Building 5 in the Plume 5-1 area (well D05-02)
- west of Building 5 (well D05-03)
- south of Building 400 (well D10A-01)
- east of Building 10 (well D12-01)

In 1994, chlorinated VOCs were reported only in groundwater from well D05-02 (1,2-DCE; TCE; and vinyl chloride) and well D12-01 (1,1,1-TCA and chloroform); following initial sampling, VOCs were below detection limits with the exception of occasional detections of benzene and vinyl chloride at concentrations below MCLs. Well D05-02 was abandoned as part of the six-phase heating (SPH) DNAPL removal activity for Plume 5-1 and replaced with wells D05-05 and D05-06 in 2004 (Shaw 2006). SWBZ wells were also installed in 2004 west and east of the Plume 5-1 area (wells D05-04 and D05-07, respectively) and east of the Plume 5-2/5-4 area (well D05-08). No VOCs have been reported in any of the newly installed SWBZ wells. However, in 2001 and 2002, during the NAS Alameda RI/FS supplemental data gap sampling (TtEMI 2001c, 2002c), vinyl chloride was reported in SWBZ well D05-03 at the western margin of OU-2C at concentrations exceeding the MCL (0.5 µg/L).

The nature of groundwater contamination by chlorinated VOCs has been characterized; however, data gap issues remain for other chemicals, including the possible presence of 1,4-dioxane and the extent of hexavalent chromium and cyanide at concentrations exceeding MCLs. The compound 1,4-dioxane is a common additive to chlorinated solvents used in degreasing activities like those conducted at the former plating shop in Building 5; however, analysis for this chemical has not been conducted. Radium was discharged into the storm drain system from the former radioluminescent dial-painting operations in Building 5; analysis has not been conducted for radium-226 and radium-228. The horizontal extent of the chlorinated VOC plume in the shallower and deeper FWBZ and the vertical extent of chlorinated VOCs to depths of 40 feet have been characterized, except for data gaps related to the following:

- the limits of VOCs at concentrations exceeding MCLs at the western margin of the plume in the shallower and deeper FWBZ and the SWBZ
- the direction of groundwater flow at the western, downgradient margin of OU-2C
- the direction of plume migration off-site, if any, at the western, downgradient margin of OU-2C
- concentrations of VOCs immediately downgradient of the source area for Plume 5-1 beneath the interior of Building 5
- concentrations of VOCs in the deeper FWBZ at the northeastern corner of Building 5
- concentrations of VOCs in groundwater at the former location of dry cleaning operations at Building 2
- the impact of VOCs in groundwater on the indoor air risk pathway for Building 5 as represented by concentrations of VOCs in subslab soil gas
- any presence of chemicals in groundwater at concentrations exceeding comparison criteria at Building 34, 43, 44, 102, 282, or 505
- any presence of chemicals in groundwater at concentrations exceeding comparison criteria at any of 22 SWMUs, including OWSs

Section 3
PREVIOUS INVESTIGATIONS

This section presents a brief description of the purpose and scope of investigations previously performed at OU-2C. Detailed descriptions of these investigations are available in the SulTech draft RI Report (SulTech 2005). Analytical results from previous investigations that are relevant to the supplemental RI sampling activities proposed for OU-2C have been reviewed and are presented in Appendix A1 to the SAP.

The following environmental investigations and removal actions were conducted in accordance with CERCLA at Alameda Point from 1988 until the present:

- *Phase 2B and 3 investigation in 1991*
- *additional work at Sites 4 and 5, 1992*
- *follow-on investigation, CTO 260, 1994*
- *follow-on investigation, CTO 280, 1994*
- *environmental baseline survey investigations*
- *storm sewer investigations*
- *geochemical profiling to define chlorinated solvent plumes, 1997 and 1998*
- *electrokinetic pilot-scale treatability study, 1999*
- *supplemental remedial investigation data gaps sampling, 2001*
- *Sites 5 and 14 removal action site closeout report, 2002*
- *chlorinated solvent plume definition and dense nonaqueous-phase liquid treatability studies*
- *basewide polynuclear aromatic hydrocarbon investigation, 2003*
- *basewide groundwater monitoring, 1997, 1998, 1999, 2001, 2002, 2003, and 2004*
- *tidal influence study*
- *total petroleum hydrocarbon investigations*
- *Resource Conservation and Recovery Act investigations*
- *radiation investigations*
- DNAPL source removal action, 2004

Historic sampling locations for soil and groundwater are shown on Figures 3-1 and 3-2, respectively.

3.1 PHASE 2B AND 3 INVESTIGATION IN 1991

Sampling for this investigation was performed as described in the "Remedial Investigation/Feasibility Study Work Plan and Sampling Plan" (Canonie Environmental 1990). The objective of the work plan was to determine if soil and groundwater were contaminated in areas identified as potential waste release sites (Canonie Environmental

1990). Many potential waste release sites were first identified during the initial assessment study conducted in 1983 (Ecology & Environment, Inc. 1983). The report also identified high levels of chemical oxygen demand, chromium, iron, phenol, and zinc in paint bay process waters. Historically, these contaminants were used during the paint stripping or conversion coating operations. No subsurface soil or groundwater data were collected during the initial assessment study.

Other potential release sites are identified in the work plan and sampling plan (Canonie Environmental 1990). The waste release areas are generally identified as buildings, tank locations, and other areas where activities could have contaminated soil and groundwater. As more information has become available through additional investigations, site boundaries have expanded to encompass groundwater plumes.

The purpose of this investigation was to determine if soil and groundwater contamination exists at Sites 5, 10, and 12. The investigation focused on the industrial, sanitary, and storm sewers, and included collecting soil and groundwater samples and installing groundwater monitoring wells and performing groundwater monitoring (PRC Environmental Management, Inc. [PRC] and James M. Montgomery [JMM] 1992).

3.2 ADDITIONAL SAMPLING AT SITES 4 AND 5, 1992

This follow-on work was based on the results of the sampling conducted at the perimeter of Building 5 during the Phase 2B and 3 investigation conducted in 1991 (PRC and JMM 1992). For this investigation, five areas in or around Building 5 were identified for further investigation: the plating shop, selective plating shop, wastewater treatment area, former hazardous waste storage area, and battery storage area (PRC and JMM 1993).

3.3 FOLLOW-ON INVESTIGATION, CONTRACT TASK ORDER 260, 1994

The objective of this investigation was to fill data gaps from previous investigations by collecting additional chemical, geological, and hydrogeologic information, with the goal of assessing the nature and extent of soil and groundwater contamination to prepare an RI and feasibility study (PRC and Montgomery Watson [MW] 1996a). Previous investigations indicated elevated concentrations of SVOCs and VOCs in groundwater. Field activities consisted of collecting soil samples and nonpoint source samples of manhole catch basins; performing cone penetrometer testing (CPT); collecting direct-push groundwater samples and HydroPunch® samples; installing wells, including deep monitoring wells and a reference boring; and performing four quarters of groundwater monitoring.

The objective of the CPT and direct-push groundwater sampling program was to evaluate the lithology and hydrogeologic characteristics below a depth of 15 feet, to assess the thickness of the SWBZ, and to obtain a groundwater sample from the permeable zone within the SWBZ at each location.

3.4 FOLLOW-ON INVESTIGATION, CONTRACT TASK ORDER 280, 1994

During the 1994 follow-on investigation under CTO 280, additional field work was conducted at Sites 5 and 10 to further assess the nature and extent of chemicals in soil and groundwater detected during winter and spring 1994 (PRC and MW 1996b). The field work included performing CPTs, collecting HydroPunch® samples and shallow soil samples, installing shallow monitoring wells, collecting quarterly groundwater samples, and installing piezometers.

3.5 ENVIRONMENTAL BASELINE SURVEY INVESTIGATIONS

Site 5 consists of Parcels 23C, 28A, 29A, 30A, 45A, 46, 48, 49, 50A, 50B, 51A, 51B, 53A, 54, 55, 56, 57, 58, 59, 66, 67, 68, 186, 190A, and 204A. Site 10 consists of Parcel 52 while Site 12 consists of Parcel 69. As a part of the EBS, these parcels were investigated under the Phase 2A and 2B investigations and a storm sewer investigation.

3.5.1 Phase 1

The primary objectives of this phase were to identify Community Environmental Response Facilitation Act-eligible parcels and to classify parcels into area types in accordance with the "Base Realignment and Closure Cleanup Plan." Based on this evaluation, Subparcel 45A and Parcels 51, 53, 66, 67, 68, and 186 were designated as Base Realignment and Closure Area Type 7, which indicates "areas that are unevaluated or that require further action." Parcels classified in this category have data gaps that require additional inspection, site history investigation, and/or sampling. Sub-parcels 23A, 28A, 29A, 30A, 50A, 50B, 53a and Parcels 46, 48, 49, 54, 55, 56, 57, 58, 59, 190A, 204A were designated as Base Realignment and Closure Area Type 6, which includes "areas of known contamination where required response actions have not yet been implemented" (Environmental Resources Management-West, Inc. 1994).

3.5.2 Phase 2A

Based on data gaps identified at the site, soil and groundwater were sampled during the EBS. Subparcel 45A and Parcels 49, 51, 52, 54, 55, 56, 57, and 68 were investigated and sampled during the Phase 2A of the EBS (IT Corp. 2001a). No samples were taken at Subparcels 23A, 28A, 29A, 30A, 50A, 50B, 53A, 190A, 204A and Parcels 46, 48, 56, 58, 66, 67, and 186.

3.5.3 Phase 2B

Subparcel 45A and Parcels 52, 57, 59, 51, and 53 were sampled during Phase 2B of the EBS.

3.5.4 Phase 2C

Only Parcel 57 was sampled during the Phase 2C of the EBS. The primary goal of this EBS investigation was to investigate the impact on subsurface and groundwater related

to former underground storage tanks (UST) 261-1, 261-2, and 261-3. EBS Phase 2C samples were located across Parcel 57 gradient and near former locations of USTs and fuel lines.

3.6 STORM SEWER INVESTIGATIONS

Investigations of storm sewer sediments and storm sewer corridors were proceeding in 1995 at the same time as the Phases 2A and 2B sampling activities (IT Corp. 2001a). These storm sewer investigations were designed to address contaminants in and adjacent to the storm sewer lines.

A storm sewer sediment removal action was completed by the Navy between 1995 and 1997 (IT Corp. 1997; Tetra Tech 1997b). The Navy conducted Phase I of the CERCLA time-critical removal action by vacuum-cleaning sediment and debris from storm sewer catch basins and manholes associated with outfalls A, B, E, H, I, J, K, L, and R.

In 2000, the Navy conducted a storm sewer study. The primary objective of this investigation was to identify storm sewer sections that were damaged, located below the water table (submerged), and subject to infiltration of contaminated groundwater (Tetra Tech 2000). The data collected would be used to prioritize storm sewer sections for repair to minimize infiltration of contaminated groundwater and its subsequent transport to the Bay.

3.7 GEOCHEMICAL PROFILING TO DEFINE CHLORINATED SOLVENT PLUMES, 1997 AND 1998

Past investigations identified the presence of chlorinated solvents in subsurface soil and groundwater at several locations around Building 5 (OGISO Environmental 1997; Tetra Tech and Einarson, Fowler, and Watson 1998). Quarterly groundwater monitoring around the site has identified elevated levels of 1,1,1-TCA, 1,1-DCE, 1,2-DCA, 1,2-DCE, chloroethene, and TCE. The objective was to define the vertical and lateral extent of chlorinated solvents under and around Building 5.

At 26 sampling locations across the northern one-third of the building, grab groundwater samples were collected from various depths down to 20 feet bgs. The grab groundwater samples were analyzed for VOCs. Seven soil cores were also advanced at six locations. The screening level data evaluated for this investigation reported volatile aromatic hydrocarbons (benzene, toluene, ethylbenzene, and xylenes) and 12 additional volatile chlorinated hydrocarbons. A large (and older) solvent plume was fully delimited northeastward away from Building 5. A second plume was also characterized along the south side of Building 5. This plume is smaller in size, and is also fully delineated. Finally, a third plume was identified and thought to be migrating away from a former plating shop location near the center of Building 5. (OGISO Environmental 1997).

3.8 ELECTROKINETIC PILOT-SCALE TREATABILITY STUDY, 1999

The specific objective of the electrokinetic pilot-scale treatability study was to treat chromium-contaminated soil and groundwater at Site 5 (Tetra Tech 1999). The

technology was applied from December 1997 to June 1998 on chromium-contaminated soil located beneath Building 5 (the former Aircraft Rework Facility Plating Shop). Previous investigations indicated that salts containing chromium (III) and hexavalent chromium (chromium VI)—such as chromic acid, dichromate, and chromate anions—were deposited into the soil under the Plating Shop during chromium plating operations that occurred at the site from 1942 to 1990.

3.9 SUPPLEMENTAL REMEDIAL INVESTIGATION DATA GAPS SAMPLING, 2001

The objectives of data gaps sampling at Site 5 were to (1) delineate chlorinated VOC plumes in groundwater, (2) investigate storm sewer pathways, and (3) collect soil gas and soil samples to support vapor intrusion modeling in the baseline human health risk assessment (Tetra Tech 2001c, 2002c). As the data for Site 5 were evaluated, it became apparent that characterization of the lateral limits of the groundwater contamination plume was insufficient. Subsequently, the Navy implemented the data gaps sampling program in 2001 and 2002. The overall objects of data gap sampling at Site 5 were to investigate chlorinated solvents in groundwater at Building 5.

To verify the vertical extent of VOC contamination in the FWBZ, groundwater samples were collected by a direct-push method from the top of the FWBZ and at the base of the fill at 28 locations. Groundwater samples were analyzed for VOCs and TPH using a mobile laboratory. The delineation of VOC plumes addressed the chlorinated VOCs near the northeast corner of Building 5 and on the north side of Building 400 in Site 10. The lateral and vertical boundaries of the VOC plumes were defined to maximum contaminant levels, except for one location in the northwest corner of Site 5. TPH plumes are commingled with chlorinated VOCs; therefore, TPH contamination will be managed under the CERCLA program.

An investigation was conducted to detect and define the limits of dense nonaqueous-phase liquid (DNAPL) contamination at Site 5. Ribbon nonaqueous-phase liquid samples (RNS) were installed at potential source locations where DNAPL was suspected but no monitoring wells were located. During RNS installation, soil from the borings was tested for the physical presence of DNAPL using a phase-separation shake test. In addition, groundwater samples were collected from each soil boring after removal of RNSs. In locations where DNAPL was suspected and monitoring wells (M05-04 and M05-07) were already in place, multi-level, passive diffusion bag samplers were used for the collection of depth-discrete samples from the screened interval of the wells. RNS and passive diffusion bag sample data and phase separation shake tests did not indicate the presence of DNAPL at Site 5; therefore, no additional characterization for DNAPLs was necessary. However, *the results of confirmation groundwater samples collected from RNS borings indicated the potential presence of DNAPLs.*

Soil gas samples were collected from groundwater contaminant plume areas at depths below the ground surface. Soil gas samples were collected using a direct-push, soil vapor probe and a slow-purge, vacuum-monitored induction system. Soil gas samples were collected from eight locations and analyzed for chlorinated VOCs; benzene,

toluene, ethylbenzene, and xylene; and total recoverable petroleum hydrocarbons. Measurable concentrations of VOCs were detected in soil gas above the contaminant plume in groundwater.

Objectives for the investigation of inorganic contamination in soil and groundwater related to the plating shop at Site 5 were (1) determine the extent of cadmium-and chromium-contaminated soil in the plating shop to support potential removal actions, (2) determine whether hexavalent chromium is present at concentrations of concern in soil and groundwater at the plating shops, and (3) evaluate whether cyanide is present at concentrations of concern in groundwater at the Building 5 plating shop. Subsurface soil samples were collected from 18 locations. Samples were submitted to a fixed laboratory for analysis of cadmium, total chromium, hexavalent chromium, cyanide, and pH. Additional samples for cadmium in soil and cyanide in groundwater at Site 5 were collected in subsequent rounds of step-out sampling. A metals removal action was conducted during data gap sampling. Confirmation samples were collected during the removal action to verify that remaining soil is below action levels. Therefore, no further removal action is warranted. Elevated metal concentrations have not been detected in groundwater at the plating shop; therefore, no further action is required for groundwater.

During the storm sewer investigation, storm sewer bedding material samples were collected from locations S05-DGS-VE-01 and S05-DGS-VE-02 to determine the potential infiltration of contaminated groundwater into the storm sewers and to evaluate the bedding material as a potential pathway. Samples were analyzed at an on-site mobile laboratory. Based on this investigation, the hydraulic conductivities of the bedding material samples were comparable to the offset soil samples; therefore, the bedding material pathways were not evaluated further.

3.10 SITES 5 AND 14 REMOVAL ACTION SITE CLOSEOUT REPORT, 2002

A cadmium removal action was performed at the former plating shop in Building 5 and approximately 1,750 cubic yards of soil was excavated. The excavation was performed in three stages, with confirmation sampling following each stage. Tetra Tech performed data gaps sampling before the excavation to delineate the limits of cadmium-impacted soil and to define the limits of the removal action. Pre-excavation activities included removal of the wooden decking and supporting timbers placed atop the depressed concrete floor of the plating shop. The partial mezzanine located in the east side of the plating shop was also removed. (IT Corp. 2002a). The plating shop walls and electrical equipment were also removed prior to the excavation.

The initial excavation was completed to 5 feet bgs, but subsequent focused excavations were completed to approximately 10 feet bgs to remove elevated cadmium concentrations detected during confirmation sampling.

Based on the small area affected at Site 5, the removal action alternative selected and described in the engineering evaluation/cost analysis was soil excavation and land

disposal (Tetra Tech 2001a). The small size of the affected area allowed the removal of essentially all cadmium-contaminated soil to background levels, as verified by soil sampling results. Additionally, results of the final round of confirmation soil sampling indicated that all cadmium-impacted soil with concentrations exceeding the U.S. EPA PRG had been removed, except for the hot spot previously detected under the south plating shop wall (sample S05-EXC-SWS1-1). This location could not be excavated without compromising the structural integrity of the building (IT Corp. 2002a).

3.11 CHLORINATED SOLVENT PLUME DEFINITION AND DENSE NONAQUEOUS-PHASE LIQUID TREATABILITY STUDIES

In 2000, the Navy conducted a surfactant-enhanced subsurface remediation treatability study at Building 5 in Site 5. The purpose of the study was to demonstrate enhanced removal of DNAPL from the subsurface. The Navy conducted a site investigation to finalize the location of the treatability study cell test area and to determine the pre-test DNAPL volume using soil coring and Pre-Partitioning Interwell Tracer Test. Soil core samples were collected throughout the study area and a DNAPL volume was estimated. Following the site investigation, the Navy conducted surfactant-enhanced subsurface remediation for DNAPL removal by completing surfactant injection. Following the surfactant injection, a site investigation was conducted to determine the post-test DNAPL volume using soil coring and Post-Partitioning Interwell Tracer Test. The post-test soil cores were drilled within 2 feet of the selected pre-study soil sampling locations at depth intervals identical to the pre-coring locations. The Post-Partitioning Interwell Tracer Test was conducted using the same protocol as the Pre-Partitioning Interwell Tracer Test to determine the post test DNAPL mass. The soil coring and Post-Partitioning Interwell Tracer Test results showed excellent mass removal (over 97 percent). The results exceeded the project goal of 95 percent DNAPL removal (Surbec-ART Environmental 2000).

The evaluation of the results of the Surbec study was based on inadequate horizontal and vertical subsurface characterization and used monitoring well sampling results rather than HydroPunch groundwater samples collected from discrete intervals to characterize post-test concentrations of VOCs in groundwater. This resulted in an apparent effectiveness that was much greater than the actual effectiveness of surfactant-enhanced mass removal. The conclusions based on post-test soil sampling and the Post-Partitioning Interwell Tracer Test (which indicated that the mass removal was excellent and exceeded 97 percent) were in error. VOC concentrations in groundwater were actually two to three orders of magnitude greater than those used to evaluate the Surbec study (Cook, pers. com. 2007).

In December 2003, Shaw Environmental & Infrastructure, Inc. submitted final project plans to conduct a DNAPL source removal action at Site 5. The following tasks were completed for this removal action.

- *Refine the lateral and vertical definition of each of the plumes listed by the engineering evaluation and cost analysis (Tetra Tech 2001b)*
- *Detail the stratigraphy within each of the plume areas*

- *Perform a boiling temperature six-phase heating pilot test at Site 5*
- *Design a full-scale mass removal application of six-phase heating to achieve the project objectives*
- *Operate the mass removal systems until the project objectives are achieved*
- *Remove or properly abandon all mass removal appurtenances*

The existence of mobile DNAPL within the plume at Site 5 triggered the implementation of an additional task referred to as physical DNAPL removal. This task consisted of installing a series of temporary wells in a triangular grid and periodically removing DNAPL from those wells. The data generated from tasks 1 through 4 led to the following conclusions:

1. *The lateral extent of the DNAPL plume within Building 5 was smaller and the vertical extent greater than originally thought*
2. *Mobile DNAPL was in a limited area within the plume under Building 5*
3. *DNAPL removal via six-phase heating within the two plumes at Site 5 was technically and economically practical in the upper 20 feet*
4. *Electrode design and spacing must be modified in order to control heating time and to increase heating efficiency (Shaw 2003c)*

The project plans describing the removal of DNAPL were to be limited to a maximum depth of 20 feet bgs. DNAPL would be removed from the two plumes in stages. Each stage, or heating sequence, would heat an area between 8,000 and 14,000 square feet. Five or six heating cells would be expected required for each heating sequence. Each heating cell would consist of six electrodes arranged in a hexagonal pattern with an additional electrode at its center. Each heating sequence would continue until an interpretation of the data obtained during the operation indicates it prudent to terminate the stage (Shaw 2003c). The result of the DNAPL source removal was to be presented in a forthcoming report. (See Section 3.18.)

The steam-enhanced extraction (SEE) technology developed in the late 1980s at the University of California at Berkeley was used to remove DNAPL waste oil containing chlorinated hydrocarbons from the subsurface at IR Site 5. The treatment was intended to reduce chlorinated solvent concentrations and petroleum hydrocarbon concentrations in groundwater and soil, respectively, to levels comparable to the upgradient groundwater concentration in the treatment zone. After the application of SEE at Building 5, the concentrations of extractable petroleum hydrocarbons in groundwater and soil in the treatment zone were reduced by an order of magnitude compared to the upgradient plume area. The study concluded that SEE was a feasible *in situ* technique for IR Site 5 (BERC 2000).

3.12 BASEWIDE POLYNUCLEAR AROMATIC HYDROCARBON INVESTIGATION, 2003

The objective of the PAH study was to collect sufficient PAH data to calculate EPCs for risk assessments at CERCLA sites (Bechtel Environmental, Inc. 2002). The historical PAH data collected at Sites 5, 10, and 12 were used to estimate the mean and standard deviation of benzo(a)pyrene (B[a]P)-equivalent concentrations to determine the appropriate number of samples to collect at each site. At Site 5, 126 soil borings were advanced. At Site 10, 4 soil borings were advanced, while at Site 12, 8 soil borings were advanced. These soil borings were advanced using direct-push sample methods. Samples were collected separately between ground surface and 0.5 feet bgs, 0.5 feet and 2 feet bgs, 2 feet and 4 feet bgs, and 4 feet and 8 feet bgs.

At Site 5, PAHs (expressed as B[a]P) were detected in 475 of the 558 soil samples; 18 of these 475 soil samples had a B(a)P-equivalent concentration that exceeded the human health screening criterion of 620 micrograms per kilogram used in the report. At Site 10, PAHs (expressed as B[a]P) were detected in 4 of the 19 soil samples taken at the site; only one sample had a B(a)P-equivalent concentration that exceeded the human health screening criterion used in the report. At Site 12, PAHs (expressed as B[a]P) were detected in all 36 soil samples taken at the site; only eight of these 36 soil samples had B(a)P-equivalent concentration that exceeded the human health screening criterion used in the report.

3.13 BASEWIDE GROUNDWATER MONITORING, 1997, 1998, 1999, 2001, 2002, 2003, AND 2004

Forty-eight monitoring wells (1MW6S, 1MW7S, 2MW8S, 400MJ-MW1, 400MJ-MW2, 400MW-MW3, D05-01, D05-02, D05-03, M05-01, M05-02, M05-03, M05-04, M05-05, M05-06, M05-07, M05-08, M05-09, M05-10, M05-11, M05-12, M05BS-01, M05HW-01, M08-07, M117-E, M12-01, P-5-1-MWD1, P-5-1-MWD2, P-5-1-MWD3, P-5-1-MWD4, P-5-1-MWD5, P-5-1-MWI1, P-5-1-MWI2, P-5-1-MWI3, P-5-1-MWI4, P-5-1-MWI5, P-5-1-MWS1, P-5-1-MWS2, P-5-1-MWS3, P-5-1-MWS4, P-5-1-MWS5, D10A-01, M10-01, M10-02, M10-03, D12-01, D12-03, and D12-04) in Sites 5, 10, and 12 were sampled quarterly or semiannually (Shaw 2003a, 2003b, 2004; PRC 1996b; Tetra Tech 1997a, 1998b). Groundwater samples were analyzed for VOCs, TPH, metals, anions, sulfide, alkalinity, and dissolved gases.

Analytical data were compared to historical results and to the State of California maximum contaminant levels (Title 22 California Code of Regulations). Based on validation findings, analytical data were valid and usable for project decisions.

3.14 TIDAL INFLUENCE STUDY

The purposes of this tidal influence study were (1) to assess the magnitude of tidal influence on the first and second water-bearing zones and the first Merritt Sand Aquifer underlying Alameda Point, (2) to establish groundwater flow directions and gradients

where possible, and (3) to provide additional data to supplement the previous tidal influence investigations (PRC 1993, 1995).

Hourly water-level measurements were taken during a 24-hour period in selected monitoring wells located throughout the facility. Water levels were monitored using pressure transducers connected to electronic data recorders. Of the 23 monitoring wells and piezometers included in this study, 10 wells were located at the southwestern corner of the air station (Site 2, a wetlands area), two wells and four piezometers were located in the central part of the air station (near Site 5 and the Seaplane Lagoon), and two wells were located in the southeast corner of the air station (near sites 3, 4, 9, 11, and 16). Water levels in San Francisco Bay were monitored every 15 minutes during the study at two tidal wells located at the north and south sides of the air station (in the Oakland Inner Harbor and in the Seaplane Lagoon. The monitoring wells and piezometers are shown on Figure 3-2.

The monitoring wells and piezometers studied in Site 5 under this tidal investigation were D05-02, D10A-01, PEZ-17-01, PEZ-17-02, PEZ-17-03, and PEZ-17-04. This study reported monitoring wells D05-02, D10A-01, PEZ-17-02, and PEZ-17-03 were tidally influenced.

The monitoring wells and piezometers in Sites 5 and 10 were located in the SWBZ. The groundwater fluctuations measured in monitoring wells D05-02 and D10A-01 decreased with increasing distance from the Seaplane Lagoon and corresponded with tidal cycles. Groundwater flows outward, toward the Seaplane Lagoon, from monitoring well D10A-01 during both high and low tides with a steeper gradient toward the Seaplane Lagoon during low tide. The estimated hydraulic gradient toward the bay is 0.0012 at high tide and 0.0033 at low tide. Groundwater flow between D10A-01 and D05-02 is inland during both high and low tide, but gradients are very low. At high tide, the estimated gradient in the vicinity of D10A-01 is 0.0007 northward and approximately 0.0002 northward at low tide, or essentially flat. In the central portion of Alameda Point, a storm drain that runs near Site 5 (and near monitoring well D05-02) into the Seaplane Lagoon may provide a preferential path for groundwater flow and allow tidal influence to extend inland farther than would be expected (PRC 1997a).

3.15 TOTAL PETROLEUM HYDROCARBON INVESTIGATIONS

Even though TPH is not a CERCLA contaminant, soil and groundwater were sampled at various locations across Site 5 for TPH, which includes all TPH-fractions (TPH as diesel, gasoline, jet fuel, or motor oil) and TPH-associated constituents (benzene, toluene, ethylbenzene, and xylenes and lead). [A summary of the results of the TPH investigations conducted at OU-2C are included in Appendix A1 of the SAP.]

3.15.1 Underground Storage Tanks

Seventeen USTs (2-1, 5-1, 5-2, 5-3, 6-1, 6-2, 62-1, 261-1 through 261-3, 282-1, 282-2, 614-1, and 615-1 through 615-4) were located at Site 5. Site 10 is located in the central portion of Alameda Point, south of Site 5, and contains Building 400. The one UST located at Site 10 is described as follows. Site 12 is located in the central portion of

Alameda Point, southeast of Site 5, and contains Building 10. The table below lists the USTs at Site 12.

3.15.2 Aboveground Storage Tanks

Seventeen ASTs (002A, 002B, 005A, 005B, 005C, 005D, 005E, 005F, 005G, 005H, 032, 032C, 261, 405A, 405B, 500, and IWTP 5) were located at Site 5. ASTs 005A, 005B, 005C, 005D, 005E, 005F, 005G, 005H, 032, 261, and 500 were regulated as SWMUs. Of the ASTs at Site 5, only AST 005G was recommended for further action (IT Corp. 2001a). Twelve ASTs (010L, 010A, 010B, 010C, 010D, 010E, 010F, 010G, 010H, 010I, 010J, and 010K) were located at Site 12. All ASTs listed for Site 12 are regulated as SWMUs (IT Corp. 2001a).

3.15.3 Oil/Water Separators

Four OWSs (005, 006A, 006B, and 615) are located at Site 5. OWS 005 is located south of Building 5 and associated with IWTP 5 and was closed by DTSC (DTSC 1999). OWS 006A is located near the southeastern portion of Building 6, north of a fuel line. OWS 006B is located near the northwestern section of Building 6, near a grease trap adjacent to the west wing of the machine shop. Both OWSs 006A and 006B were recommended for further investigations (IT Corp. 2001a). OWS 615 is located southeast of Building 5 adjacent to UST 615-3 and was closed by DTSC (DTSC 2001). One OWS (010) is located at Site 12. OWS 010 is located in Building 10 near the southwestern corner. This OWS has been recommended for further investigation (IT Corp. 2001a).

3.15.4 Fuel Line Summary

Fuel line removal work was conducted at Alameda Point from June 1998 to February 1999, May to June 1999 (IT Corp. 2001b), and September to December 2001 (IT Corp. 2002b). During the 1998 and 1999 work, 29,634 linear feet of fuel line was removed, and 23,788 linear feet of fuel line was abandoned in place by cleaning and grouting the lines. These removed and abandoned fuel lines included some fuel lines located at Site 5 and 10. Fuel lines were not removed or abandoned at Site 12 (IT Corp. 2001b, 2002b).

Fuel lines suspected to be located along Monarch Street and West Tower Avenue, and that border Sites 5, 10, and 12, could not be located and likely do not exist. As of December 2001, all underground fuel lines at Site 5, 10, and 12 had been removed or closed in place (IT Corp. 2002b).

3.16 RESOURCE CONSERVATION RECOVERY ACT INVESTIGATIONS

A RCRA Facility Assessment was conducted at Alameda Point in 1992 to identify SWMUs and areas of concern, and to evaluate the need and scope of a RCRA Facility Investigation. Eighty-five SWMUs and areas of concern were identified in the RCRA Facility Assessment. The Navy continues to conduct investigations related to closure of RCRA-permitted facilities.

A RCRA Facility Investigation for Alameda Point was implemented through coordination of existing environmental programs, namely under CERCLA, the TPH Program, and as part of the EBS. Many results of the RCRA Facility Assessment and RCRA Facility Investigation-related activities at Alameda Point are summarized in the EBS report. RCRA-permitted facilities IWTP 5 (DTSC 1999) and Hazardous Waste Storage Unit, at the southeast corner of Building 5, have been closed (DTSC 2001).

3.17 RADIATION INVESTIGATIONS

The Navy documented prior final status surveys of portions of Buildings 5 and 400 in the "Radiation Survey Report, Naval Air Station Alameda, California, Final" (PRC 1996, 1997b). This report contained descriptions of the resurvey of radiologically impacted areas previously identified, the survey of newly scoped areas identified as a result of the 1997 work, and areas potentially impacted as a result of removal actions involving Building 5 and 400 sewer and industrial wastewater systems. The Navy reported that areas known or suspected to contain radioactive contamination included (1) the bearing shop in Building 5 (former radium paint use area), (2) the small parts paint shop in Building 5, and (3) areas in Building 400 around Room 204.

The exposed and subterranean interior drain lines of Building 5 were surveyed for radioactive contamination in 1997. Additionally, storm drains from Buildings 5 and 400 and other locations emptying to the Seaplane Lagoon were surveyed for radioactive contamination (New World Technology 2002).

From October 1998 through April 2000, the Navy performed a radiological closeout survey at Alameda Point for Buildings 5 and 400 (Tetra Tech 1998a). The radiological closeout survey was performed to demonstrate that residual radioactive materials associated with Navy activities were present at levels that satisfy criteria established by the Navy Radiological Affairs Support Office, the U.S. Nuclear Regulatory Commission, and the California Department of Health Services. Based on their history and operations, Buildings 5 and 400 were not subject to license requirements under the Atomic Energy Act; therefore, they were not subject to former license termination procedures. However, the field measurement data were compared to residual radioactivity contamination criteria established by the U.S. Nuclear Regulatory Commission and the California Department of Health Services Radiological Health Branch for decommissioning licensed facilities (U.S. Nuclear Regulatory Commission 1974; California Department of Health Services 1988). Methods used in the radiological closeout survey were consistent with guidance described in the "Manual for Conducting Radiological Surveys in Support of License Termination" (U.S. Nuclear Regulatory Commission 1992) and the "Multi-Agency Radiation Survey and Site Assessment Manual" (U.S. EPA 1997), as modified in the "Final Status Radiation Survey and Field Sampling Work Plan" (Tetra Tech 1998c) and "Addendum Confirmation Radiation Survey and Field Sampling Work Plan" (Tetra Tech 2002a). The surveys were designed assuming that the radionuclides of interest were radium-226 or strontium-90, for which the most restrictive limits have been established (Tetra Tech 2001d).

Areas with residual radioactive contamination were removed or documented by the Navy or a Tetra Tech subcontractor. After decontamination, areas of the buildings were surveyed for alpha or beta-gamma surficial contamination or gamma radiation. Areas previously identified with radioactive contamination exceeding established limits underwent Class I surveys. Adjacent areas underwent Class 2 surveys. Class 3 area surveys for gamma emissions proceeded in the other areas of Building 5 to ensure that no Class 1 or Class 2 areas had been missed in the previous classification of areas of the building. In addition, swipe tests for removal radioactivity were performed in Building 5 in Rooms 4, 223, 227, 234, and under the spray booths on the first floor.

Results of the radiological closeout survey demonstrated that no significant radioactive contamination remains in Buildings 5 and 400. Results of all final measurements taken during this survey were at or below applicable surface activity limits.

Although the radiological close-out survey for Buildings 5 and 400 were intended to document that these buildings may be considered for release by the Navy for unrestricted public use, as specified by applicable federal and state guidance and polices (U.S. Nuclear Regulatory Commission 1974, 1992; DHS 1988), final acceptance was never received by the U.S. EPA or California DHS. The Draft Historical Radiological Assessment still lists these buildings as impacted and requiring further surveys or investigations.

As a result of radium-impacted storm drain removal activities conducted in 1999, an abandoned storm drain line was discovered beneath Building 5. Survey of this line revealed radioactive contamination (TtEMI 2002b). The approximate location of this abandoned line and the location of a formerly active storm drain line and laterals are included on a figure in Appendix A1 to Attachment A. Due to the presence of the abandoned line and the historical discharge of radium-contaminated materials to storm drains beneath Building 5, the Radiological Work Instruction (Attachment H) addresses this issue and the precautions that will be taken prior to subsurface sampling.

A storm drain radiological removal action is being planned. Preparation of the work plan and the removal activities will be conducted by another Navy contractor. The primary objectives are 1) to research and investigate all previous storm and sewer line removal work in OU-2C, including IR Site 5 and Building 400 and storm drain lines from Building 5 to Seaplane Lagoon, which was done by New World Technology in the fall of 1998 and spring of 1999 (New World Technology 2002), and 2) to complete a time-critical removal action (TCRA) action memorandum and work plan, along with all removal of the storm and sewer lines with radiological contamination in the OU and reconstruction of the storm drain system. The end result of this TCRA at impacted sites will be a final status survey (FSS) document. The FSS will provide the documentation needed to confirm that radiological contamination has been remediated to levels that satisfy criteria established by the Navy Radiological Affairs Support Office (RASO), U.S. EPA, and the California DHS. For radiological contamination associated with storm drains and sewers, the FSS will provide the documentation for the Navy to obtain RASO, U.S. EPA, and DHS concurrence on the release of OU-2C for unrestricted public use as

specified by applicable federal and state guidance and policies (NRC 1974, 1992; DHS 1988).

3.18 DNAPL SOURCE REMOVAL ACTION, 2004

A full-scale mass removal action using SPH with vapor extraction was completed for DNAPL source removal at Plume 5-1, IR Site 5. The removal action began on July 8, 2004, and was completed on November 5, 2004 (Shaw 2006). The objective was to remove sufficient contaminant mass to permanently reduce the total concentrations of chemicals of concern (COCs) to below 10,000 parts per billion (ppb) within the horizontal extent of Plume 5-1, to a maximum depth of 20 feet bgs. The SPH technology was proven effective in pilot-scale testing at Plume 5-1 (Shaw 2003d). The removal action was conducted in accordance with the final Removal Action Project Plans (RAPP) for IR Sites 4 and 5 DNAPL and Dissolved Source Removal Action (IT 2002c), the Amendment to the RAPP for installation of well points for DNAPL extraction (IT 2002d), and the RAPP Addendum (Shaw 2003c).

The application of SPH was successful in treating the targeted Plume 5-1, an area of approximately one-third acre. The COCs (predominantly 1,1,1-TCA and TCE, and the degradation products from these compounds) were mobilized into the vadose zone as a vapor by heating the soil and groundwater via SPH and were then removed by vapor extraction. More than 3,000 pounds of VOCs were recovered over the 15-week SPH treatment. Groundwater concentrations in the treatment zone above 20 feet bgs were reduced from an average initial total COC concentration (sum of concentrations of ten chlorinated VOCs: 1,1-DCA; 1,2-DCA; 1,1-DCE; cis-1,2-DCE; trans-1,2-DCE; PCE; 1,1,1-TCA; 1,1,2-TCA; TCE; and vinyl chloride) of approximately 49,000 µg/L to less than 120 µg/L.

Prior to the full-scale SPH application, the total COC concentrations in seven treatment zone monitoring wells ranged from an average of 300 µg/L to 240,000 µg/L. The highest concentrations were for 1,1,1-TCA (205,000 µg/L). Four months after completion of the SPH operation, the highest COC concentrations in treatment zone monitoring wells was 1,414 µg/L in well 1MW6S, while concentrations in all other wells were either below the detection limit of 1 µg/L or less than 20 µg/L. All monitoring wells sampled during the SPH application showed total COC concentration reductions to values well below the removal action goal of 10,000 ppb and therefore met the removal action objective (Shaw 2006).

The bulk of the equipment from the Plume 5-1 removal action is being reinstalled in the Plume 5-3 plume area. SPH treatment for the Plume 5-3 area will begin in 2006 (Shaw 2006).

Section 4
REFERENCES

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Work Plan for OU-2C

Figure 1-1

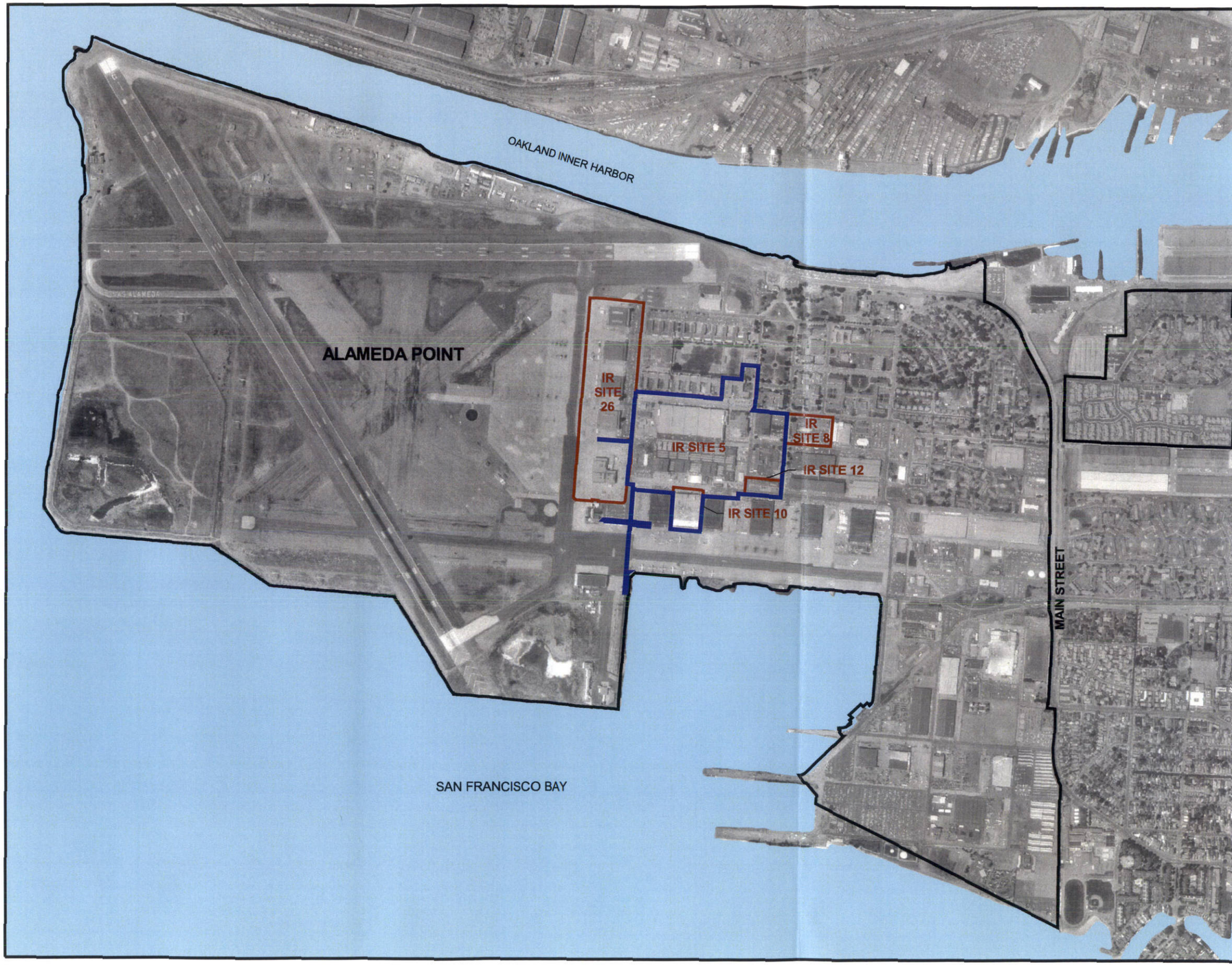
Alameda Point Regional Map

Alameda, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 5/10/06
File No.: 081R14601
Job No.: 23818-081
Rev No.: A



LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- NAVY ONSHORE PROPERTY BOUNDARIES
- WATER

NOTES:

IR – INSTALLATION RESTORATION (PROGRAM)

OU – OPERABLE UNIT

N

1200 0 1200 Feet

Work Plan for OU-2C

Figure 1-2

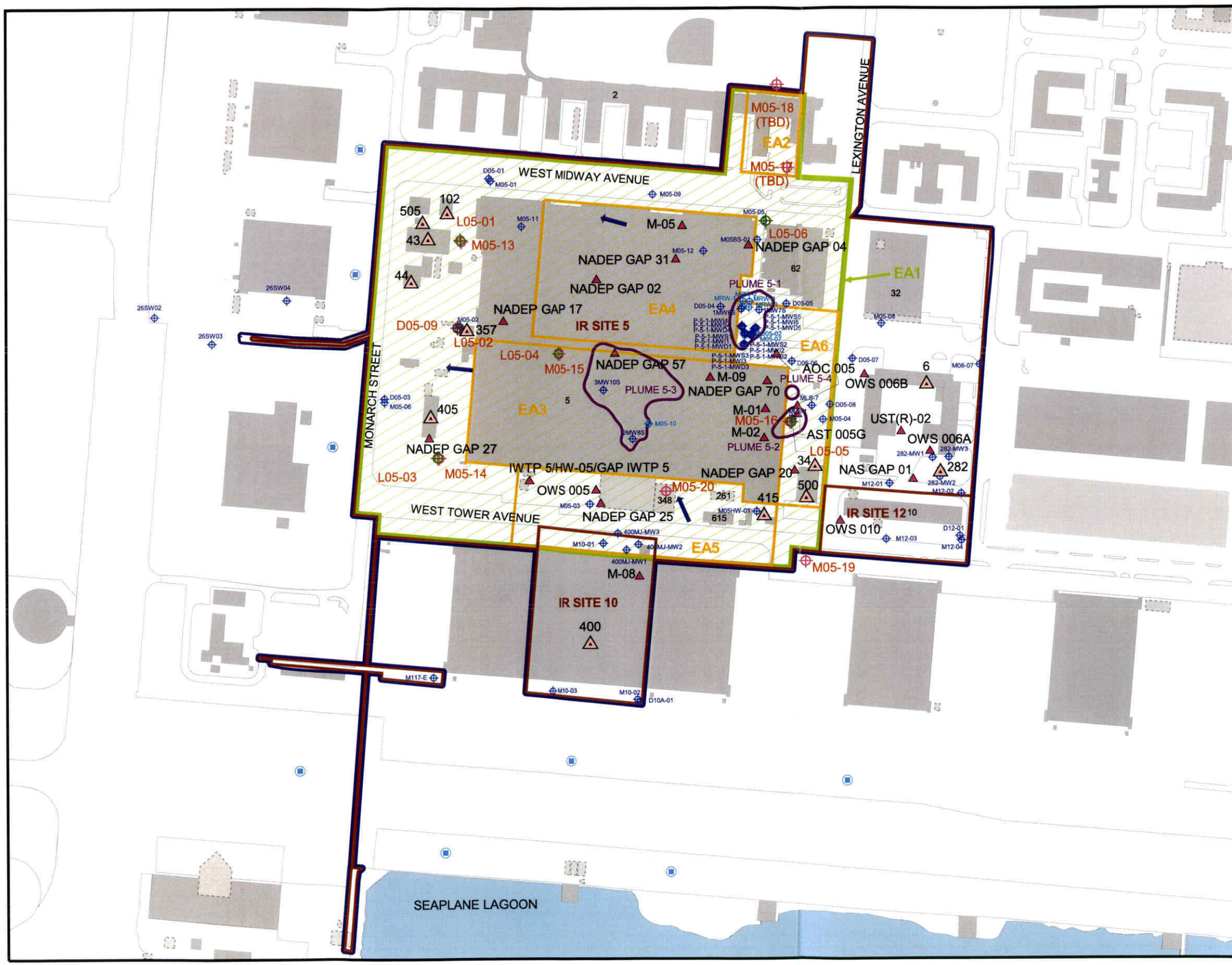
Site Location Map

Alameda, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 5/10/06
File No.: 081L14604
Job No.: 23818-081
Rev No.: A



LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- ROAD OR PAVED AREA
- BUILDING OR STRUCTURE (PRESENT)
- BUILDING OR STRUCTURE (REMOVED)
- GROUNDWATER FLOW DIRECTION (FIRST WATER-BEARING ZONE)
- 10,000 µg/L VOC CONCENTRATION CONTOUR
- AREA 1 BOUNDARY (GROUNDWATER)
- AREAS 2–6 BOUNDARIES (SOIL)
- EXISTING MONITORING WELL WITH WELL ID
- ABANDONED (OR SCHEDULED TO BE ABANDONED) MONITORING WELL WITH WELL ID
- PROPOSED SHALLOWER FIRST WATER-BEARING ZONE MONITORING WELL LOCATION
- PROPOSED DEEPER FIRST WATER-BEARING ZONE MONITORING WELL LOCATION
- PROPOSED SECOND WATER-BEARING ZONE MONITORING WELL LOCATION
- PROPOSED PIEZOMETER LOCATION
- 400 DATA GAP AREA AND BUILDING NUMBER
- NADEP GAP 08 SWMU AND IDENTIFICATION

N

NOTES :

AOC – AREA OF CONCERN
AST – ABOVEGROUND STORAGE TANK
EA – EVALUATION AREA
EBS – ENVIRONMENTAL BASELINE SURVEY
GAP – GENERATOR ACCUMULATION POINT
IR – INSTALLATION RESTORATION (PROGRAM)
IWTP – INDUSTRIAL WASTE TREATMENT PLANT
µg/L – MICROGRAMS PER LITER
NADEP – NAVAL AIR DEPOT
NAS – NAVAL AIR STATION
OU – OPERABLE UNIT
OWS – OIL-WATER SEPARATOR
RCRA – RESOURCE CONSERVATION AND RECOVERY ACT
SWMU – SOLID WASTE MANAGEMENT UNIT
TBD – TO BE DETERMINED
UST – UNDERGROUND STORAGE TANK
UST(R) – RCRA-IDENTIFIED UNDERGROUND STORAGE TANK
VOC – VOLATILE ORGANIC COMPOUND

300 0 300 Feet

Work Plan for OU-2C

Figure 1-3

Study Areas Location Map

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 4/9/07
File No.: 093Q15390
Job No.: 23818-093
Rev No.: C

I. Report

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I. Report (continued)

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I. Report (continued)

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III. TABLES (continued)

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6-8 Receptor Risks for Risk Drivers (Occupational), Reasonable Maximum Exposure – Cal/EPA

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	E2	SURVEY DATA
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H	SOIL GAS	
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K	ANALYTICAL DATA TABLES	
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M	HUMAN-HEALTH RISK ASSESSMENT	
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	SOIL FIGURES
	DETAILED SOIL FIGURES (IF ANY)
	GROUNDWATER FIGURES
	INDIVIDUAL VOC PLUME MAPS

Acronyms/Abbreviations:

AST – aboveground storage tank
bgs – below ground surface
CAA – corrective action area
Cal/EPA – California Environmental Protection Agency
CTR – California Toxics Rule
DNAPL – dense nonaqueous-phase liquid
EDC – economic development conveyance
IDW – investigation-derived waste
IR – Installation Restoration (Program)
IWTP – industrial waste treatment plant
MCL – maximum contaminant level
NRWQC – National Recommended Water Quality Criteria
OU – operable unit
PCB – polychlorinated biphenyl
PRG – preliminary remediation goal
RCRA – Resource Conservation and Recovery Act
RI – remedial investigation
SWMU – solid waste management unit
TPH – total petroleum hydrocarbons
U.S. EPA – United States Environmental Protection Agency
UST – underground storage tank
VOC – volatile organic compound

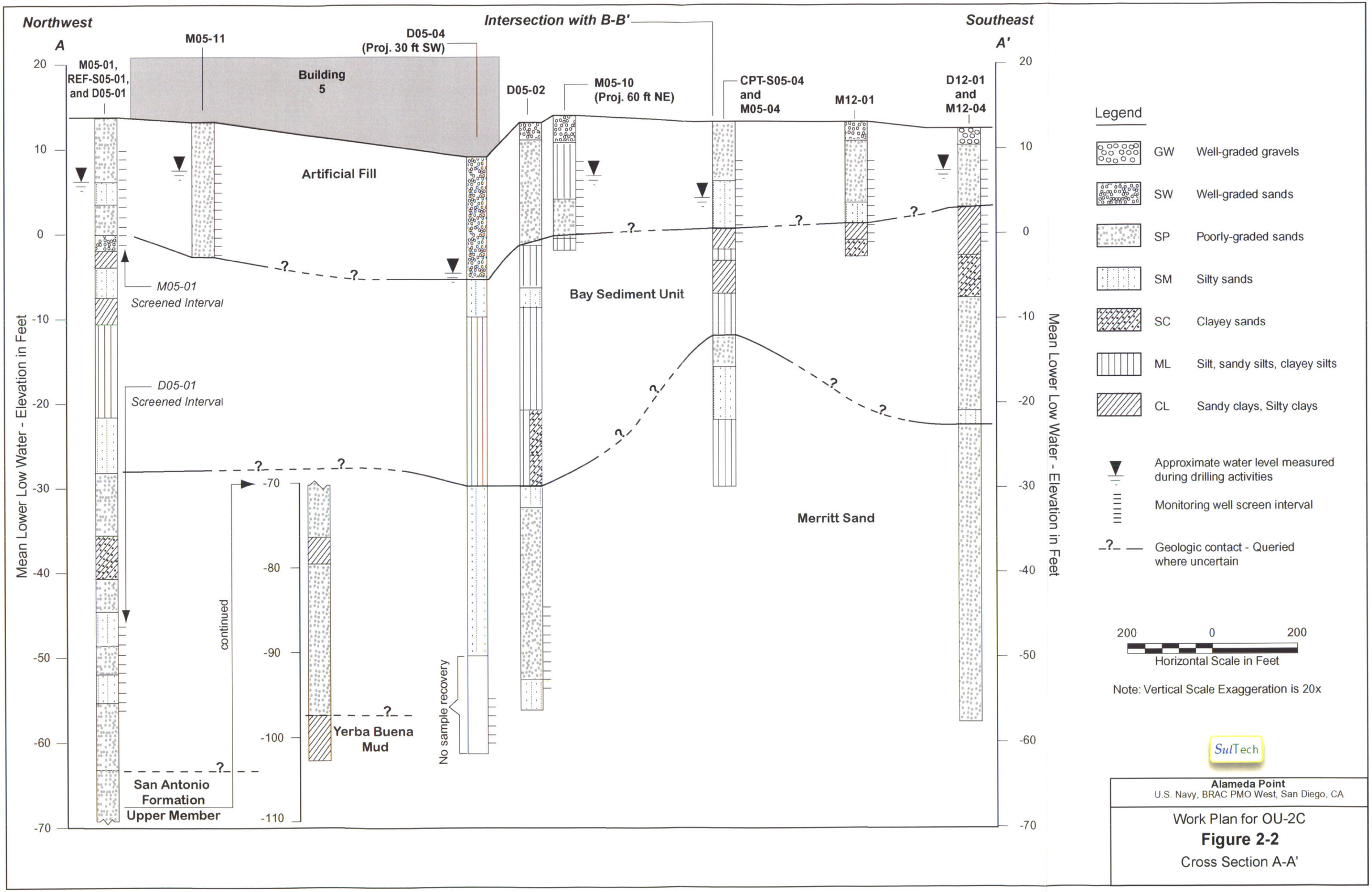
Alameda Point
U.S. Navy, BRAC PMO West, San Diego, CA

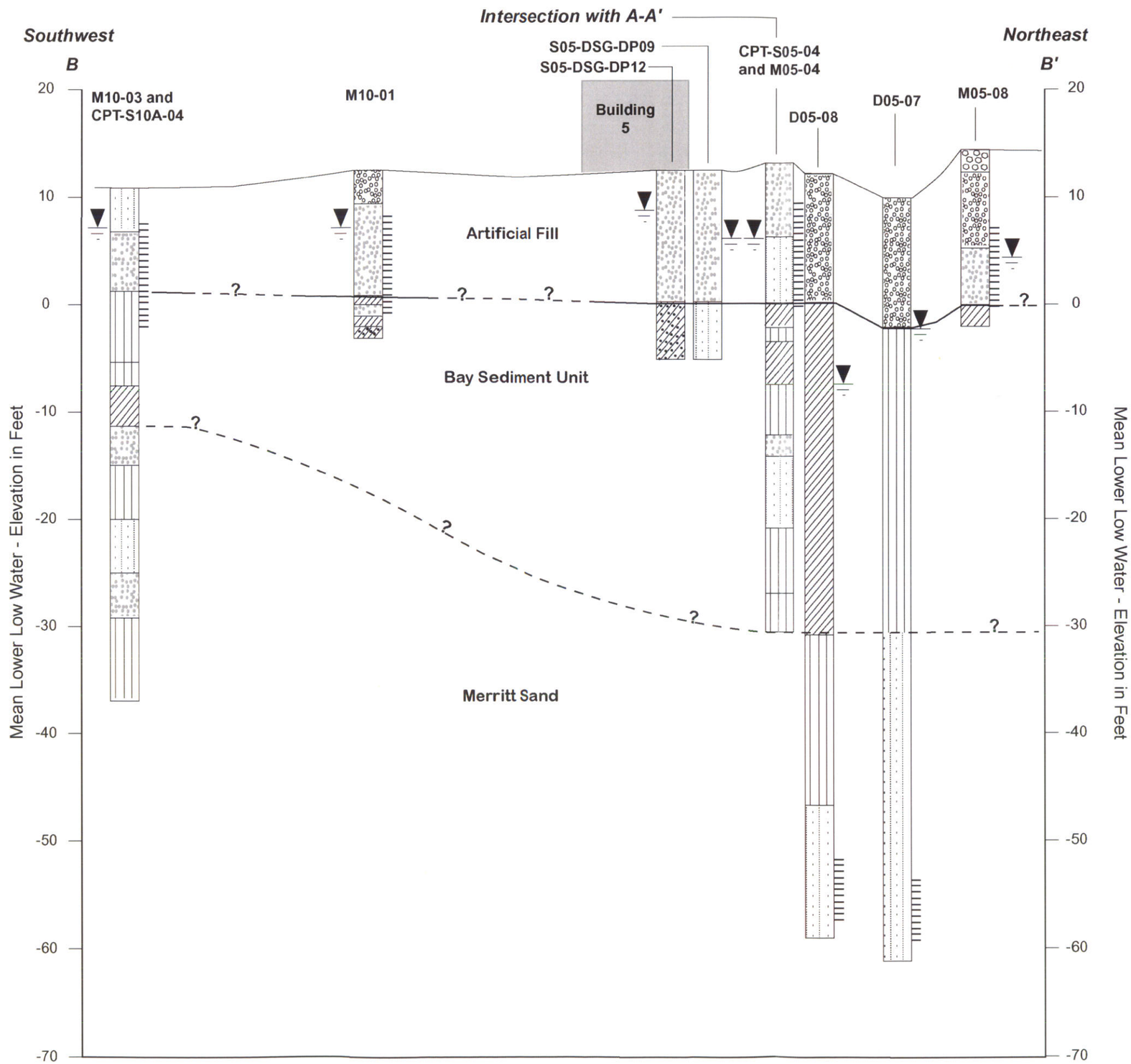
Work Plan for OU-2C

Figure 2-1

Cross Section Location Map

2005-06-23 U:\almda_sa\GIS\Projects\OU2C\RI\Site Location\Cross Section A-A'.mxd SulTech Michelle Angeles


Northwest
A
Intersection with B-B'
Southeast
A'
M05-01, REF-S05-01, and D05-01
M05-11
D05-04 (Proj. 30 ft SW)
Building 5
D05-02
M05-10 (Proj. 60 ft NE)
CPT-S05-04 and M05-04
M12-01
D12-01 and M12-04
Artificial Fill
Bay Sediment Unit
Merritt Sand
M05-01 Screened Interval
D05-01 Screened Interval
continued
Yerba Buena Mud
No sample recovery
San Antonio Formation Upper Member
Mean Lower Low Water - Elevation in Feet
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
Legend
GW Well-graded gravels
SW Well-graded sands
SP Poorly-graded sands
SM Silty sands
SC Clayey sands
ML Silt, sandy silts, clayey silts
CL Sandy clays, Silty clays
Approximate water level measured during drilling activities
Monitoring well screen interval
Geologic contact - Queried where uncertain
200 0 200
Horizontal Scale in Feet
Note: Vertical Scale Exaggeration is 20x
SulTech
Alameda Point
U.S. Navy, BRAC PMO West, San Diego, CA
Work Plan for OU-2C
Figure 2-2
Cross Section A-A'



Legend

GW	Well-graded gravels
SW	Well-graded sands
SP	Poorly-graded sands
SM	Silty sands
SC	Clayey sands
ML	Silt, sandy silts, clayey silts
CL	Sandy clays, Silty clays

Approximate water level measured during drilling activities

Monitoring well screen interval

Geologic contact - Queried where uncertain

200 0 200

Horizontal Scale in Feet

Note: Vertical Scale Exaggeration is 20x

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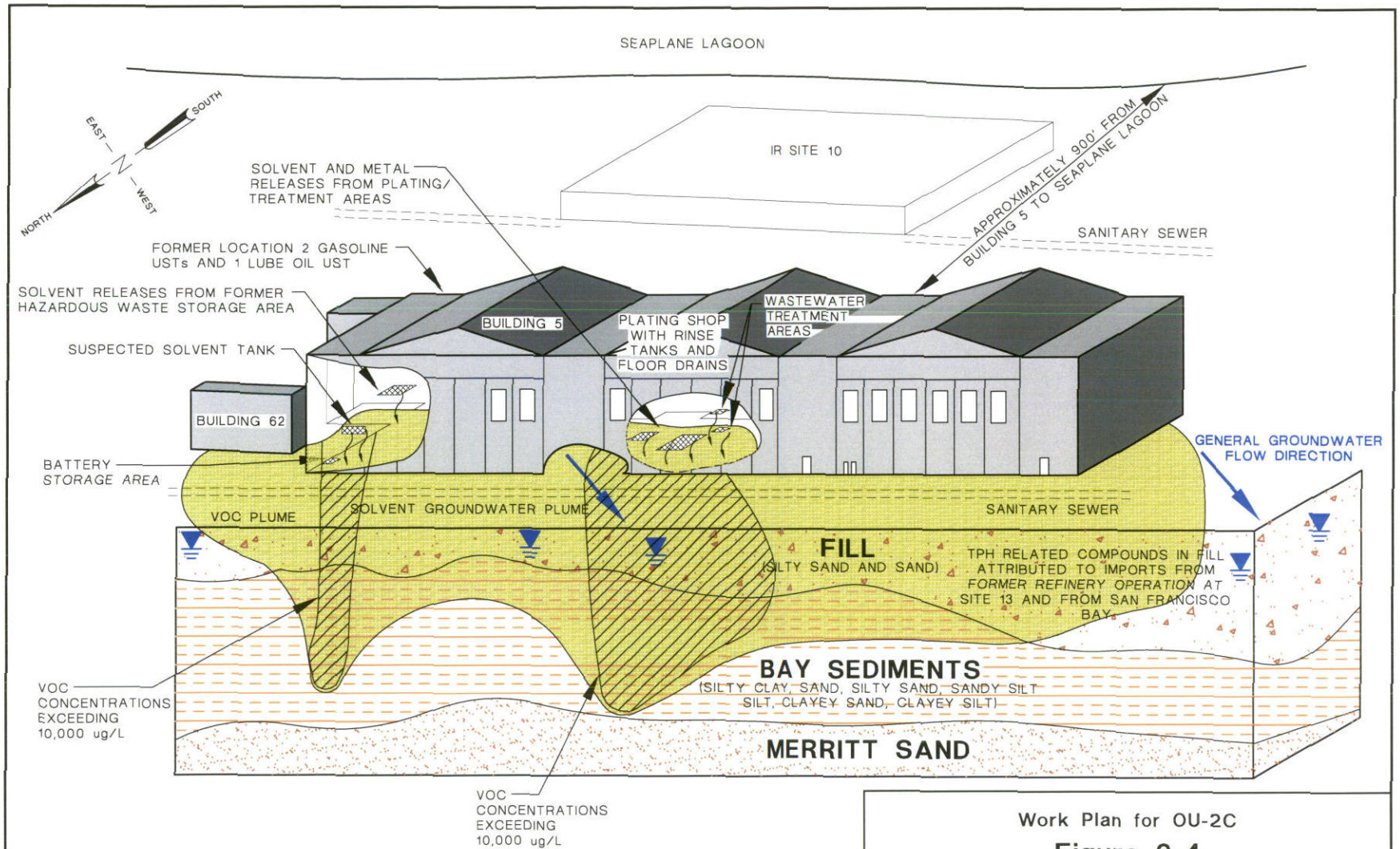
U.S. Navy, BRAC PMO West, San Diego, CA

Work Plan for OU-2C

Figure 2-3

Cross Section B-B'



LEGEND

WATER TABLE ELEVATION

NOTES:

IR – INSTALLATION RESTORATION (PROGRAM)
OU – OPERABLE UNIT
UST – UNDERGROUND STORAGE TANK
VOC – VOLATILE ORGANIC COMPOUND

NOT TO SCALE

Work Plan for OU-2C

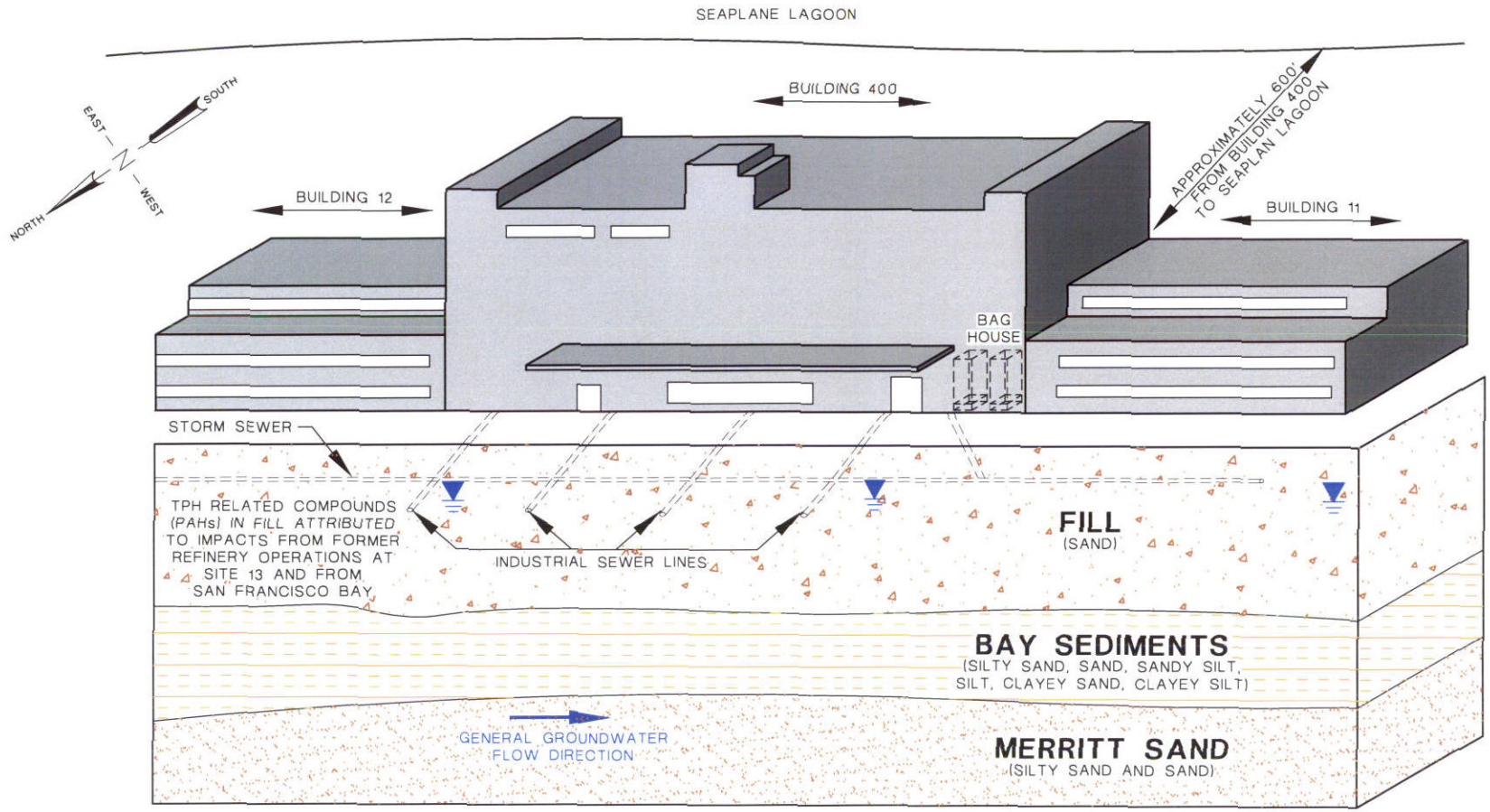
Figure 2-4

Conceptual Site Model for IR Site 5

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 12/29/06
File No: 093X15360
Job No: 23818-093
Rev No: B



NO DOCUMENTED OR SIGNIFICANT ON-SITE RELEASES ASSOCIATED WITH IR SITE 10

LEGEND

WATER TABLE ELEVATION

NOTES:

IR – INSTALLATION RESTORATION (PROGRAM)
OU – OPERABLE UNIT
PAH – POLYNUCLEAR AROMATIC HYDROCARBON
TPH – TOTAL PETROLEUM HYDROCARBONS

NOT TO SCALE

Work Plan for OU-2C

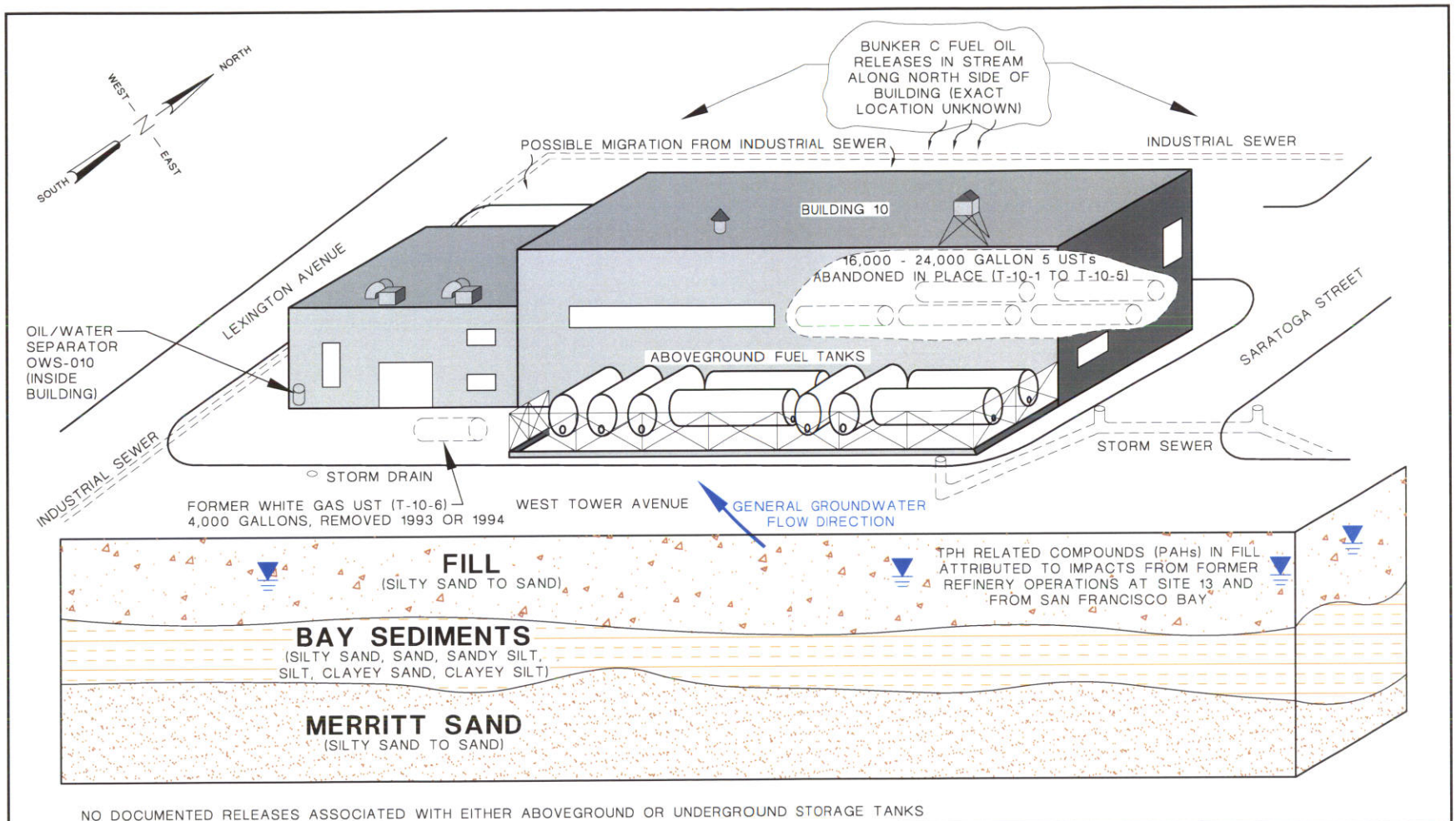
Figure 2-5

Conceptual Site Model for IR Site 10

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 12/18/06
File No: 093X15358
Job No: 23818-093
Rev No: A



NO DOCUMENTED RELEASES ASSOCIATED WITH EITHER ABOVEGROUND OR UNDERGROUND STORAGE TANKS

LEGEND

▼ WATER TABLE ELEVATION

NOTES:

OU – OPERABLE UNIT
PAH – POLYNUCLEAR AROMATIC HYDROCARBON
TPH – TOTAL PETROLEUM HYDROCARBONS
UST – UNDERGROUND STORAGE TANK

NOT TO SCALE

Work Plan for OU-2C

Figure 2-6

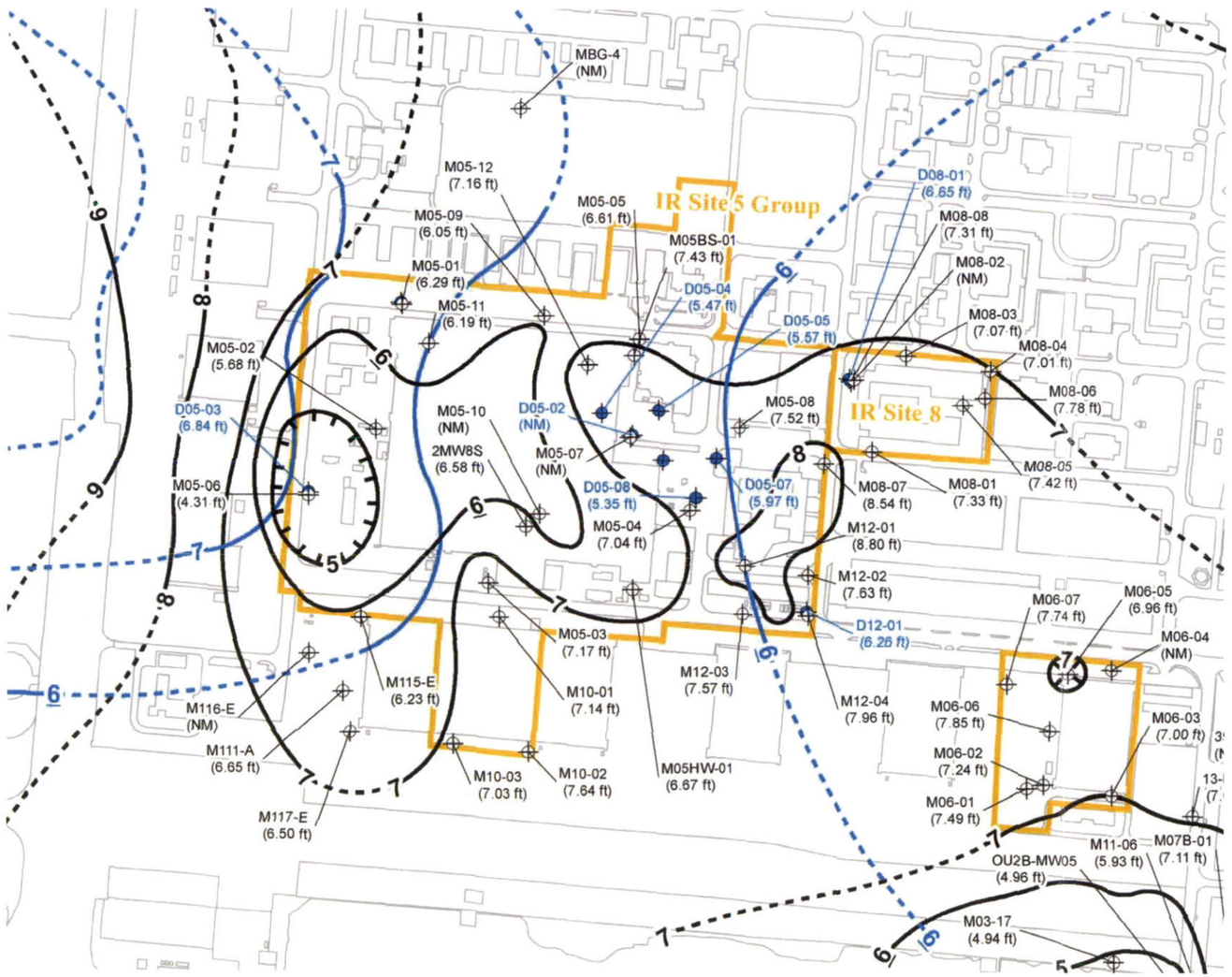
Conceptual Site Model for IR Site 12

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

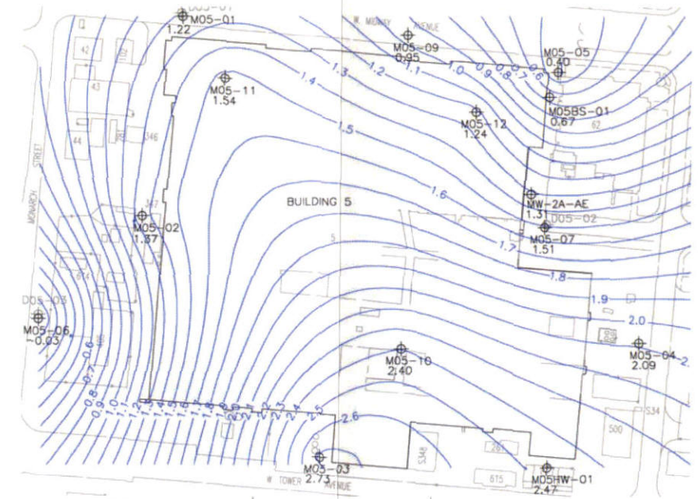
Date: 12/19/06
File No: 093X15359
Job No: 23818-093
Rev No: B

SPRING 2006



REFERENCE: INNOVATIVE TECHNICAL SOLUTIONS, INC. 2006. SPRING 2006 ALAMEDA BASEWIDE ANNUAL GROUNDWATER MONITORING REPORT, ALAMEDA POINT, ALAMEDA, CALIFORNIA. OCTOBER.

SUMMER 2001



LEGEND

- MONITORING WELL, SHALLOW
- *MONITORING WELL, DEEP*
- 2.73 GROUNDWATER ELEVATION (FEET MEAN LOW LOW WATER)
- GROUNDWATER POTENTIAL CONTOUR

NOTE:
FIRST WATER BEARING ZONE CONSISTS OF ARTIFICIAL FILL AND UPPER (SANDY) PORTION OF BSU

REFERENCE: INNOVATIVE CORPORATION. 2002. DATA TRANSMITTAL OF *DESIGN INVESTIGATION (PHASE III) FOR PLUME 5-1 AT IR SITE 5, ALAMEDA* POINT, ALAMEDA, CALIFORNIA. AUGUST.

Legend

- FWBZ Groundwater Elevation Contour (feet above msl)
- Dashed where Inferred
- Hachures indicate Closed Depression in Groundwater Contours
- SWBZ Groundwater Elevation Contour (feet above msl)
- *Dashed where Inferred*
- Hachures indicate Closed Depression in Groundwater Contours
- First Water Bearing Zone (FWBZ) Wells
- Second Water Bearing Zone (SWBZ) Wells
- IR Site Boundary
- Facility Infrastructure

Work Plan for OU-2C

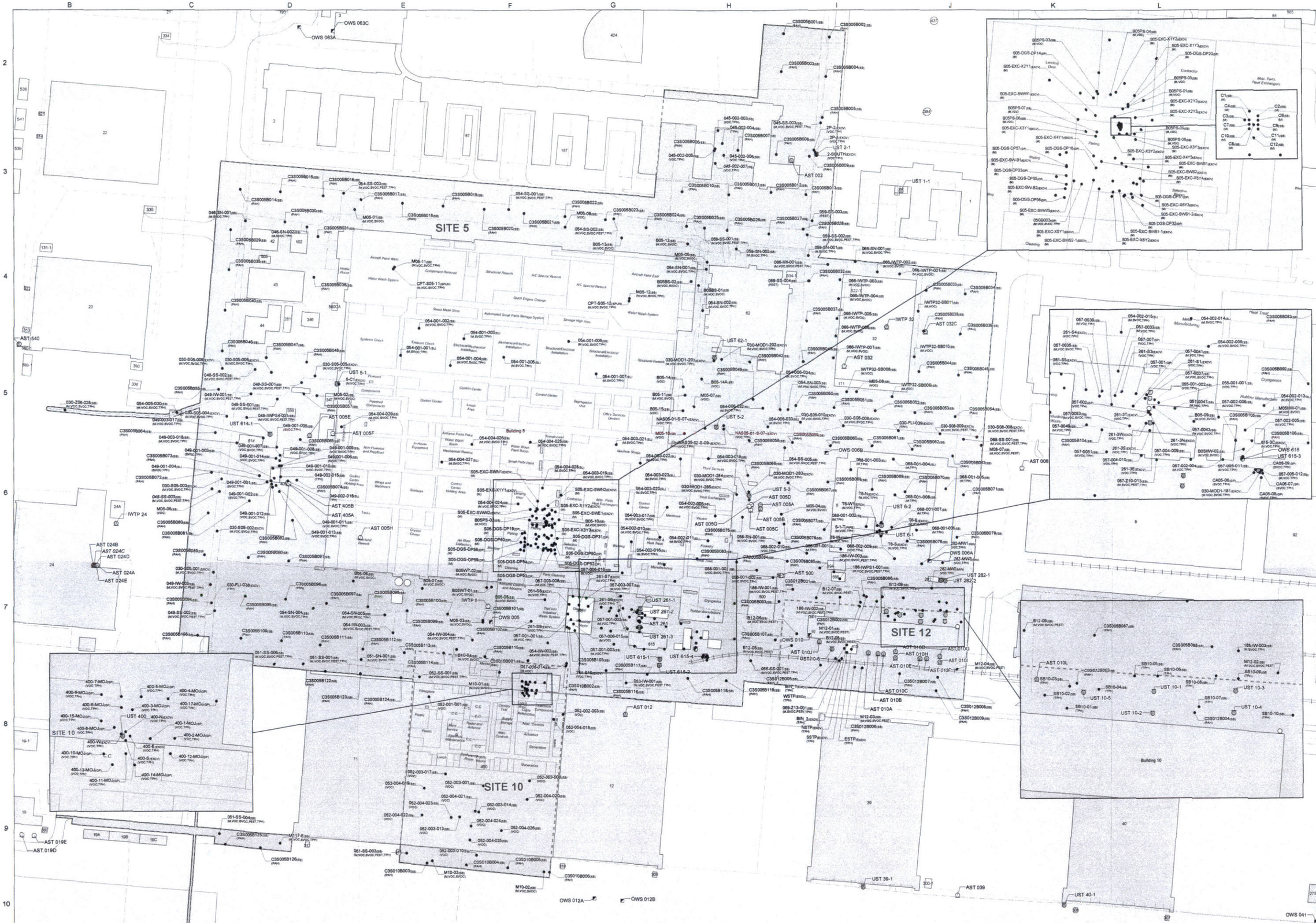
Figure 2-7

Groundwater Elevation Maps

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 12/19/06
File No.: fig2-7.doc
Job No.: 23818-093
Rev No.: C



Sampling Location

Oil Water Separator

Aboveground Storage Tanks

Present

Removed

Underground Storage Tanks

Closed in place

Exempt

Removed

Sanitary Sewer Line

Storm Sewer Line

Railroad

Operable Unit 2C

CERCLA Site

Industrial Wastewater Drain

Land Cover

Building

Present

Removed

Notes:
Grid represents 250 feet by 250 feet

CERCLA Comprehensive Environment Response, Compensation, and Liability Act
C.C Control Center

Point Name
Point Type
054-SS-002(SB)
(M,VOC,SVOC,PEST,TPH)
Analyte Group

Point Type:
DP Direct push technology
EX Excavation
GP Geoprobe
HP Hydropunch
MH Manhole storm drain, catch basin
MW Monitoring well
SB Soil boring
SL Surface Location
SP Soil Punch

Analyte Group:
M Metal
PAH Polynuclear aromatic hydrocarbon
PEST Pesticide
SVOC Semivolatile organic compound
TPH Total petroleum hydrocarbon
VOC Volatile organic compound

SYMBOLS FOR BORINGS B05PS-01 THROUGH B05PS-10 ARE INCORRECTLY SHOWN APPROXIMATELY 60 FEET NORTH OF ACTUAL SAMPLING LOCATION ON THIS FIGURE

100 0 100
Feet

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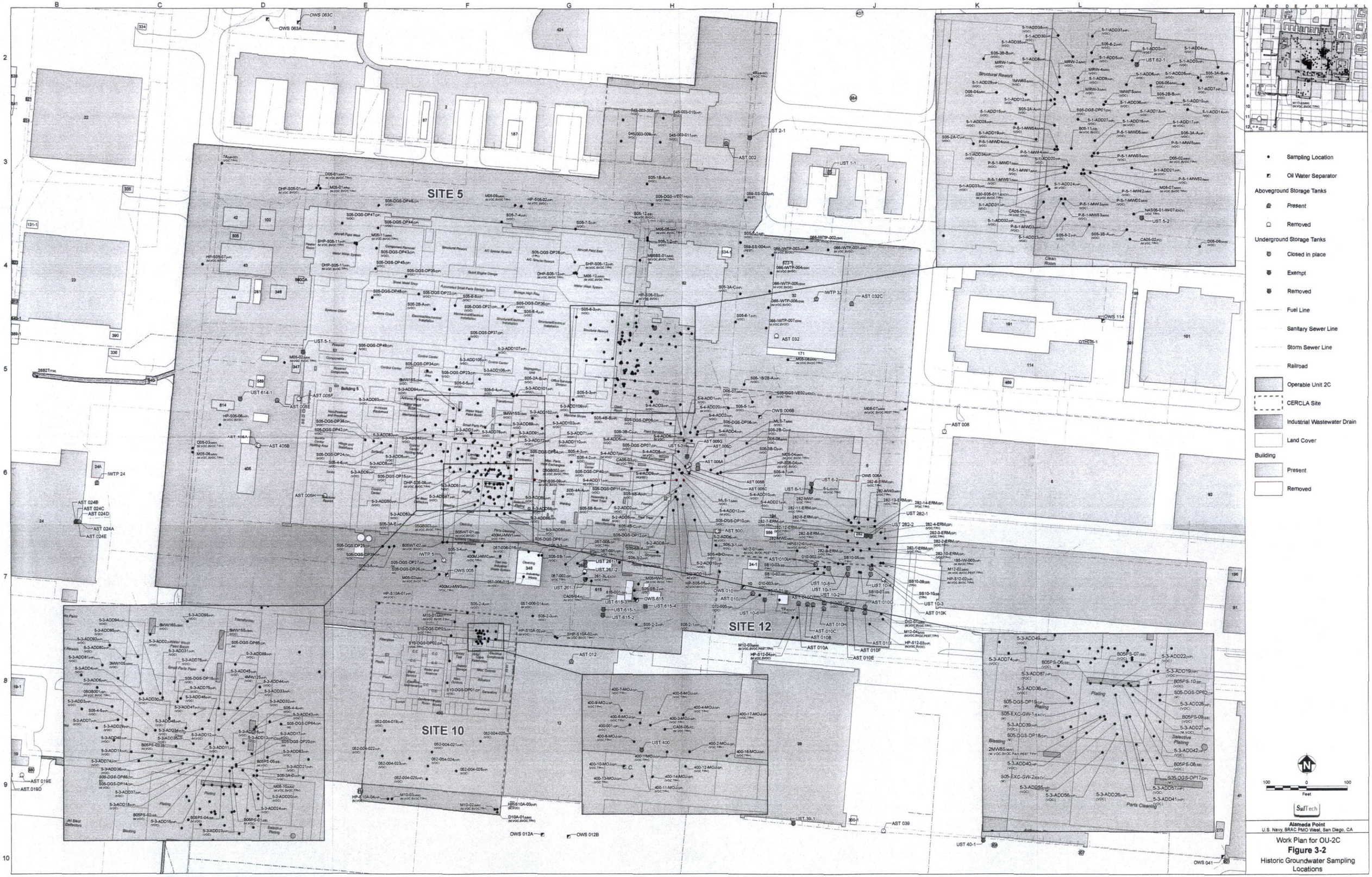
Work Plan for OU-2C
Figure 3-1
Historic Soil Sampling Locations

2005-06-30 U:\almda_sai\GIS\Projects\OU2C\Rl\Sampling Location\OU2C Soil_Sampling Locations_MA_combined.mxd SulTech Michelle Angeles


SITE 5
SITE 10
SITE 12
Sampling Location
Oil Water Separator
Aboveground Storage Tanks
Present
Removed
Underground Storage Tanks
Closed in place
Exempt
Removed
Fuel Line
Sanitary Sewer Line
Storm Sewer Line
Railroad
Operable Unit 2C
CERCLA Site
Industrial Wastewater Drain
Land Cover
Building
Present
Removed
100 0 100
Feet
SulTech
Alameda Point
U.S. Navy, BRAC PMO West, San Diego, CA
Work Plan for OU-2C
Figure 3-2
Historic Groundwater Sampling Locations
2005-06-30 U:\almda_sw\GIS\Projects\OU2C\RI\Sampling Location\OU2C Groundwater Sampling Locations_MA_combined.mxd SulTech Michelle Angeles

ATTACHMENT A

SAMPLING AND ANALYSIS PLAN (INCLUDES FIELD SAMPLING PLAN AND QUALITY ASSURANCE PROJECT PLAN)

Department of the Navy
Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

Contract No. N68711-95-D-7526

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY

CLEAN 3

FINAL
SAMPLING AND ANALYSIS PLAN (INCLUDES FIELD SAMPLING PLAN AND QUALITY ASSURANCE PROJECT PLAN) FOR SUPPLEMENTAL REMEDIAL INVESTIGATION SAMPLING AT OPERABLE UNIT 2C ALAMEDA POINT ALAMEDA, CALIFORNIA

CTO-0093/0203
April 2007

Prepared by:

BECHTEL ENVIRONMENTAL, INC.
1230 Columbia Street, Suite 400
San Diego, California 92101-8502

Signature: _____ Date: 4/18/07
Eric Johansen, CTO Leader

Signature: _____ Date: 4/18/2007
Cathie L. Stumpenhaus, PGA451

Signature: _____ Date: 4/18/07
Anil P. Dharmapal, Quality Manager

Signature: _____ Date: 4/27/2007
Nars Ancog, NAVFAC Southwest QA Officer

Elements of the UFP-QAPP and EPA QA/R-5 in Relation to This SAP

UFP-QAPP Worksheet	EPA QA/R-5	This SAP	Variance from UFP-QAPP
1 Title and Approval Page	A1	Report Cover	
2 QAPP Identifying Information	—	NAVFAC SW crosswalk table	
3 Distribution List	A3	QAPP Worksheet 3	
4 Project Personnel Sign-Off Sheet	—	QAPP Worksheet 4	
5 Project Organization Chart	A4	Section 1.1	
6 Communication Pathways	—	QAPP Worksheet 6	
7 Personnel Responsibilities and Qualifications Table	—	Table 1-1	
8 Special Personnel Training Requirements Table	A8	Section 1.5	
9 Project Scoping Sessions Participants Sheet	—	—	Sign-in sheets and meeting minutes of scoping sessions are maintained in the project file.
10 Problem Definition	A5	Section 1.2	
11 Project Quality Objectives/Systematic Planning Process Statements	A8	Section 1.4	
12 Measurement Performance Criteria Table	—	QAPP Worksheet 12	
13 Secondary Data Criteria and Limitations Table	—	Appendix A1	
14 Summary of Project Tasks	—	Section 1.3	
15 Reference Limits and Evaluation Table	—	QAPP Worksheet 15	
16 Project Schedule/Timeline Table	—	Section 1.3.2	
17 Sampling Design and Rationale	B1	Section 2.1	
18 Sampling Locations and Methods/SOP Requirement Table	B2	QAPP Worksheet 18	
19 Analytical SOP Requirement Table	B4	QAPP Worksheet 19	
20 Field Quality Control Sample Summary Table	B5	QAPP Worksheet 20	
21 Project Sampling SOP Reference Table	—	QAPP Worksheet 18	
22 Field Equipment Calibration, Maintenance, Testing, and Inspection Table	B7	QAPP Worksheet 22	
23 Analytical SOP Reference Table	B4	—	Analytical laboratory has not been identified. Information will be provided with lab data package.

(table continues)

Elements of the UFP-QAPP and EPA QA/R-5 in Relation to This SAP (continued)

UFP-QAPP Worksheet	EPA QA/R-5	This SAP	Variance from UFP-QAPP
24 Analytical Instrument Calibration Table	B7	Section 2.7	
25 Analytical Instrument and Equipment, Maintenance, Testing, and Inspection Table	B6	Section 2.6	
26 Sampling Handling System	B3	Section 2.3	
27 Sample Custody Requirements	B3	Section 2.3	
28 QC Samples Table	B5	Section 2.5	
29 Project Documents and Records Table	A9	QAPP Worksheet 29	
30 Analytical Services Table	—	Table 2-2	
31 Planned Project Assessment Table	C1	Section 3.1	
32 Assessment Findings and Response Actions	C1	Section 3.1	
33 QA Management Reports Table	C2	Section 3.2	
34 Sampling and Analysis Verification (Step 1) Process Table	D2	QAPP Worksheet 34	
35 Sampling and Analysis Validation (Steps 2a and 2b) Process Table	D2	Section 4	
36 Sampling and Analysis Validation (Steps 2a and 2b) Summary Table	D2	Section 4	
37 Data Usability Assessment	D3	Section 4	

I certify that this SAP is in compliance with the latest version of the UFP-QAPP and the EPA QA/R-5.

ANIL DHARMADAL	[signature]	4/17/07
PRINT NAME (Contractor QA Representative)	SIGNATURE	DATE

QAPP Worksheet 3
Distribution List

QAPP[1] Recipient	Title	Organization	Telephone Number	E-Mail Address
N. Ancog	Quality Assurance Officer	Navy	(619) 532-3046	narciso.ancog@navy.mil
C. Bonura	Remedial Technical Manager	Navy	(619) 532-0947	carl.bonura@navy.mil
D. DeLong	Environmental Compliance Manager	Navy	(415) 743-4713	douglas.delong@navy.mil
G. Grace	Resident Officer in Charge of Construction Project Engineer	Navy	(510) 749-5940	gregory.grace@navy.mil
M. Orpilla	Contracting Specialist	Navy	(619) 532-0944	melita.orpilla@navy.mil
M. Parker	Remedial Project Manager	Navy	(619) 532-0945	mary.parker@navy.mil
D. Silva	Administrative Records Manager	Navy	(619) 532-3676	diane.silva@navy.mil
D. Coons	Navy Environmental Health Center POC	Navy	(757)953-0936	coonsd@nehc.med.navy.mil
M. Slack	NAVSEADET RASO	Navy	(757) 887-4692	matthew.slack@navy.mil
M. Dalrymple	Engineering Geologist	DTSC	(510) 540-3767	mdalrymp@dtsc.ca.gov
D. Lofstrom	Remedial Project Manager	DTSC	(916) 255-3625	dlofstro@dtsc.ca.gov
J. Polisini	HERD Toxicologist	DTSC	(818) 551-2853	jpolisin@dtsc.ca.gov
A. Cook	Remedial Project Manager	U.S. EPA	(415) 972-3029	cook.anna-marie@epa.gov
S. Serda	Toxicologist	U.S. EPA	(415) 972-3057	serda.sophia@epa.gov
K. Brasaemle	Senior Geologist	Tech Law-U.S. EPA	(415) 282-8734	kbrasaemle@techlawinc.com
E. Simon	Project Manager	RWQCB	(510) 622-2355	ersimon@waterboards.ca.gov
P. Russell	Project Manager	Russell Resources, Inc.	(415) 492-0540	peter.russell@ngem.com
C. Hunter	Alameda Point Installation Coordinator	TtEMI	(916) 852-8300	craig.hunter@ttemi.com
D. Potter	Base Reuse Manager	ARRA	(510) 749-5800	dpotter@ci.alameda.ca.us
G. Humphreys	Community Co-Chair	RAB	(510) 865-3723	not available
J. Argyres	Project Manager	Bechtel	(415) 768-9917	jlargyre@bechtel.com
A. Dharmapal	Quality Manager	Bechtel	(619) 744-3099	apdharma@bechtel.com
E. Johansen	Contract Task Order Leader	Bechtel	(619) 744-3091	eajohans@bechtel.com
C. Stumpenhaus	Technical Specialist	Bechtel	(415) 768-4248	clstumpe@bechtel.com

QAPP Worksheet 3 (continued)

Note:
[1] the SAP includes the Field Sampling Plan and Quality Assurance Project Plan

Acronym/Abbreviation:
ARRA – Alameda Reuse and Redevelopment Authority
DTSC – (California Environmental Protection Agency) Department of Toxic Substances Control
HERD – Human and Ecological Risk Division
NAVSEADET – Naval Sea Systems Command Detachment
POC – point of contact
RAB – Restoration Advisory Board
RASO – Radiological Affairs Support Office
RWQCB – (California) Regional Water Quality Control Board
SAP – Sampling and Analysis Plan
TtEMI – Tetra Tech EM Inc.
U.S. EPA – United States Environmental Protection Agency

QAPP Worksheet 4
Project Personnel Sign-Off Sheet

Project Personnel	Organization	Title	Signature	Date QAPP* Read
Janet Argyres	BEI	Project Manager	Janet L. Argyres	4/30/07
Eric Johansen	BEI	CTO Leader	Eric Johansen	4/19/07
Anil Dharmapal	BEI	S&H/QA Manager	Anil Dharmapal	4/19/07
T. Heironimus	BEI	Technical Integration Manager	[illegible]	4/27/07
Jim Howe	BEI	Program Services Manager	[illegible]	4-27-2007
Jack Vellis	BEI	Contracts and Compliance Manager	[illegible]	4/26/07
Toni Kuzmack	BEI	Database/Laboratory Services Supervisor	Toni Kuzmack	4/27/07
Cathie Stumpenhaus	BEI	Lead Geologist	Cathie Stumpenhaus	4/30/07
Bob Schilling	BEI	Site Manager	[illegible]	4/27/07
Stephen Quayle	Kleinfelder	SSHR	Steph B. Quayle	4/27/07

Note:
* the SAP includes the Field Sampling Plan and Quality Assurance Project Plan

Acronyms/Abbreviations:
BEI – Bechtel Environmental, Inc.
CTO – contract task order
QAPP – Quality Assurance Project Plan
S&H/QA – Safety and Health/Quality Assurance
SAP – Sampling and Analysis Plan
SSHR – Site Safety and Health Representative

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Appendix

A1 STUDY AREAS AT OU-2C

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ACRONYMS/ABBREVIATIONS

AOC	area of concern
AST	aboveground storage tank
BEI	Bechtel Environmental, Inc.
bgs	below ground surface
°C	degrees Celsius
CHHSL	California human-health screening levels
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
COPC	chemical of potential concern
CTO	contract task order
DMP	data management plan
DOT	(United States) Department of Transportation
DQO	data quality objective
DWR	(California) Department of Water Resources
DTSC	(California Environmental Protection Agency) Department of Toxic Substances Control
ESL	environmental screening level
FWBZ	first water-bearing zone
GAP	generator accumulation point
HAZWOPER	Hazardous Waste Operations and Emergency Response Standard
IDW	investigation-derived waste
IR	Installation Restoration
LDC	Laboratory Data Consultants
LSS	Laboratory Services Supervisor
MCL	maximum contaminant level
MDL	method detection limit
NAS	Naval Air Station
NADEP	Naval Aviation Depot
OU	operable unit
OWS	oil/water separator

PARCC	precision, accuracy, representativeness, completeness, and comparability
PG	Professional Geologist
PPE	personal protective equipment
PQL	project quantitation limit
PVC	polyvinyl chloride
QA	quality assurance
QAO	Quality Assurance Officer
QAPP	quality assurance project plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RPM	Remedial Project Manager
SAP	sampling and analysis plan
SOP	standard operating procedure
SQL	sample quantitation limit
SWMU	solid waste management unit
TMRL	target method reporting limit
TPH	total petroleum hydrocarbons
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
UN	United Nations
U.S. EPA	United States Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound

Section 1
PROJECT DESCRIPTION AND MANAGEMENT

This document serves as the Sampling and Analysis Plan (SAP) for the supplemental remedial investigation (RI) sampling to be conducted at Operable Unit (OU)-2C at Alameda Point, Alameda, California (Figures 1-1 and 1-2). Bechtel Environmental, Inc. (BEI), prepared this SAP for Base Realignment and Closure Program Management Office West under Contract Task Order (CTO)-0081 of the Comprehensive Long-Term Environmental Action Navy (CLEAN) 3 Program, Contract No. N68711-95-D-7526. Figures, tables, and quality assurance project plan (QAPP) worksheets are presented at the end of this SAP. Appendix A1 to this SAP provides an area-specific description and proposed sampling plan for each area requiring further evaluation.

1.1 PROJECT/TASK ORGANIZATION

The project team for the supplemental RI at Alameda Point consists of representatives from the Navy and regulatory agencies along with the BEI CLEAN Program team. The names, roles, and contact information for the Navy and CLEAN Program team are presented in Table 1-1, and the overall organization and relationships of the Navy and team members are illustrated on Figure 1-3. The principal decision makers for the RI include the Navy and regulatory agency partners.

1.2 PROBLEM DEFINITION/BACKGROUND

Previous investigations indicated the presence of chemicals of potential concern (COPCs) in OU-2C soil and groundwater. However, further investigation is required to address identified data gaps described in Section 2.5 of the Work Plan, which includes the following:

- Evaluation Area 1 – groundwater impacted by VOCs, metals, and cyanide; and potentially impacted by , and by radium-226 and radium-228 beneath Building 5 and by 1,4-dioxane
  - direction of groundwater flow at the western, downgradient margin of OU-2C and tidal influence between Seaplane Lagoon and OU-2C
  - direction of plume migration off-site, if any
  - limits of volatile organic compounds (VOCs) in groundwater at concentrations exceeding maximum contaminant levels (MCLs) at the western margin of OU-2C
  - concentrations of VOCs in groundwater immediately downgradient of the source area for Plume 5-1 beneath the interior of Building 5
  - concentrations of VOCs in groundwater in the deeper first water-bearing zone (FWBZ) at the northeastern corner of Building 5
  - concentrations of VOCs in groundwater in the shallower FWBZ in the vicinity of former Building 348, located south of Building 5
  - concentrations of VOCs in groundwater in the shallower FWBZ at the upgradient margin of the VOC plume (southeast of Building 5)

- any presence of 1,4-dioxane in groundwater throughout Evaluation Area 1, and radium-226 and radium-228 beneath Building 5
- extent of hexavalent chromium, other metals, and cyanide in groundwater at concentrations exceeding MCLs throughout Evaluation Area 1
- concentrations of mercury in groundwater at the downgradient margin of the site

- Evaluation Area 2 – former dry cleaning operation
  - nature and extent of VOCs in soil and groundwater at location of former dry cleaning operation
  - direction of groundwater flow if VOCs are present in groundwater at concentrations exceeding MCLs
- Evaluation Area 3 – southern portion of Building 5
  - any presence of VOCs in soil the above VOC plume
  - concentrations of VOCs in soil gas from below building floor that may migrate to indoor air (subslab soil gas sampling)
  - extent of metals in soil beneath eastern portion of Evaluation Area 3
  - any presence of 1,4-dioxane, hexavalent chromium, and cyanide in soil and groundwater beneath southwestern portion
  - any presence of metals (including hexavalent chromium) and cyanide in soil along former industrial wastewater sewer lines originating from plating operations
  - any presence of total petroleum hydrocarbons (TPH), semivolatile organic compounds, and metals related to the former aboveground storage tank (AST) in soil and groundwater
  - any presence of chemicals in soil at locations in the former foundry area and rubber shop
- Evaluation Area 4 – Aircraft Maintenance Line and adjoining shop area (northeastern and north central portions of Building 5)
  - extent of metals in soil
  - concentrations of VOCs in soil gas from below building floor that may migrate to indoor air (subslab soil gas sampling)
  - any presence of chemicals in soil at utility vault and aircraft tie-down features
  - any presence of chemicals in soil and groundwater at the former battery acid shop
- Evaluation Area 5 – south of Building 5
  - any presence of VOCs in soil

  - extent of metals in soil near former Building 398
  - any presence of metals (including hexavalent chromium) and cyanide in soil along former industrial wastewater sewer lines originating from plating operations
  - extent of VOCs, hexavalent chromium, and cyanide in soil and groundwater and any presence of 1,4-dioxane in groundwater at the former location of Building 398
- Evaluation Area 6 – east of Building 5
  - extent of VOCs, TPH, and polychlorinated biphenyls in soil
- data gap areas
  - any presence of chemicals in soil
  - any presence of chemicals in groundwater at Building 34, 43, 44, 102, 282, or 505
  - extent of PAHs in soil near previous sampling locations 030-S05-009 and C3S005B048, which had PAH concentrations exceeding 1,000 µg/kg, and any presence in soil of other chemicals that may have resulted from historical storage of materials in the area near C3S005B048
- solid waste management units (SWMUs), including oil/water separators (OWSs)
  - any presence of chemicals in soil and groundwater

Therefore, sampling of soil and groundwater is required to complete the characterization of the nature and extent of contamination at OU-2C and the results of sampling of soil, groundwater, and subslab soil gas are required to assess the potential risk to human health and the environment. Further data are also required to assess groundwater flow direction at the western margin of OU-2C and the degree of tidal influence, if any. Potential receptors include current and future users of the site and ecological receptors.

1.2.1 Purpose and Objectives

The purpose of this SAP is to document systematic planning efforts, field activities, laboratory analysis, and review procedures necessary to develop sufficient high quality data to successfully address the following objectives.

- Complete delineation of the nature and extent of contamination at OU-2C.
- Determine whether the concentrations of COPCs present in soil or groundwater present an unacceptable risk to human health or the environment.
- Assess the direction of groundwater flow at the western margin of OU-2C.
- Evaluate tidal influence on groundwater between Seaplane Lagoon (located south of OU-2C) and OU-2C.

This effort includes collecting soil and groundwater samples for analysis and evaluation, conducting aquifer testing to assess groundwater flow direction, and collecting subslab soil gas samples to provide input for risk assessment of volatiles in groundwater beneath Building 5 that may migrate to indoor air. These activities will be used to support a recommendation for no further action, a removal action, or a feasibility study. In support of the supplemental RI objectives, this SAP:

- describes sampling locations, rationale, logistics, and frequency;
- specifies COPCs and analytical laboratory methods;
- specifies physical parameters and analytical laboratory methods;
- describes types (media) of samples to be taken;
- specifies monitoring well construction details;
- describes the sampling strategy that will be used to satisfy data quality objectives (DQOs), including the rationale for sampling locations, sample quantities, and analytical laboratory methods;
- describes the field sampling procedures and sample-handling protocol that will be used to collect representative samples; and
- describes the quality assurance (QA)/quality control (QC) protocols necessary to provide a control on potential field or laboratory biases in the data.

1.2.2 Facility Location

Alameda Point is located at the west end of Alameda Island, which lies at the base of a gently westward-sloping plain that extends from the Oakland-Berkeley hills on the east to the shore of the San Francisco Bay on the west (Figure 1-1).

1.2.3 OU-2C Description

OU-2C, located in the central portion of Alameda Point, is an approximately 53-acre area consisting of Installation Restoration (IR) Sites 5, 10, and 12. While the majority of OU-2C is covered by buildings, the remaining portions are paved areas and limited areas of unpaved open space.

IR Site 5 is located in the central portion of Alameda Point approximately 1,200 feet north of Seaplane Lagoon. The site is about 47 acres in size and roughly rectangular in shape (Figure 1-2). The most prominent site feature is Building 5, the Aircraft Rework Facility, which covers approximately 40 percent of the site and is currently vacant. Several smaller buildings and paved and unpaved open space are also present at the site (Figure 1-3 in the Work Plan). These smaller buildings were used for various purposes including engineering laboratories, electrical substations, storage, and barracks.

IR Site 10, approximately 4 acres in size, is south of West Tower Avenue (previously named Avenue F) between Buildings 11 and 12, is approximately 600 feet north of Seaplane Lagoon, and is bordered on the north by IR Site 5 (Figure 1-2). Site features include Building 400, which covers about 85 percent of the site with approximately

126,000 square feet of floor space. The remaining 15 percent is paved open space, roads, and parking lots. Building 400 was used as a missile rework facility, and surrounding areas provided support to the activities that occurred in the building.

IR Site 12 is north of West Tower Avenue between Saratoga and Lexington Streets (formerly named Second and Third Streets) (see Figure 1-2). The site is approximately 2 acres in size and roughly rectangular in shape. Site features include Building 10, which covers approximately 25 percent of the site and was used as a steam and air power plant. Surrounding areas supported activities within the building. IR Site 12 is 25 percent paved open space consisting of roads and parking lots.

1.2.4 Site History

As a management tool to accelerate site investigation, cleanup, and reuse at Alameda Point, the Navy developed a comprehensive OU strategy, which separates 35 Comprehensive Environmental Response, Compensation, and Liability Act sites into a total of ten OUs (-1, -2A, -2B, -2C, -3, -4A, -4B, -4C, -5, and -6). The United States Environmental Protection Agency (U. S. EPA) Region 9, California Environmental Protection Agency Department of Toxic Substances Control (DTSC), and the San Francisco Bay Water Board provide regulatory oversight.

OU-2C comprises IR Sites 5, 10, and 12, which are discussed below.

1.2.4.1 IR SITE 5

IR Site 5 consists of several buildings, including Building 5, which is the largest. Building 5 was erected in two stages: the southern portion (Building 5) was erected in the 1940s, followed some years later by the northern portion (Building 5A). For the purpose of this report, the combined portions are identified as Building 5. Operations in the building ceased in 1993 and it is currently vacant; however, its past uses included cleaning, reworking, and manufacturing of metal parts; plating, painting, and tool maintenance operations; and specialty operations, such as the application of radioluminescent paint to aircraft dial faces (Canonie Environmental 1990). The building contained a main paint shop that consisted of two paint bays and several smaller paint spray booths. In addition, there was a plating shop with operations involving degreasing; caustic and acid etching; metal stripping and cleaning; and chrome, nickel, silver, cadmium, and copper plating.

Between 1940 and 1972, wastewaters from all Navy operations at Alameda Point were discharged directly into the nearest surface waters through the storm sewer system. From the beginning of that time period through the early 1960s, radioluminescent painting operations on the second floor of Building 5 discharged paint containing radium-226 into the storm sewer system leading from Building 5 into the Seaplane Lagoon at Outfall F. After 1972 and until 1991, wastewater from the plating shops was split into two waste streams: one for alkaline tanks and one for cyanide tanks. The wastewater streams were kept separate until the cyanide stream was treated in a cyanide destruction unit. The two waste streams were then rerouted together to a pretreatment plant located near the southwestern corner of the building. Building 5 also housed a hazardous waste storage

area, which was closed in 1988; drummed wastes formerly stored in the hazardous waste storage area included spent solvents, waste paints, and waste oils. The area also stored drummed hydraulic fluid and lubricating oils. This area was located outside Building 5 in the southeastern corner of the site. Building 5 also contained numerous generator accumulation points (GAPs) and other types of Resource Conservation and Recovery Act (RCRA) SWMUs.

Lead-acid and nickel-cadmium batteries were serviced in the battery storage area located in the northeastern portion of Building 5. The battery fluids were discharged into a sink in the storage area, and the sink discharged into the base industrial sewer system. Base personnel have indicated that the corrosive fluids deteriorated the piping in the sink and drain that led to the sewer system at Outfalls F and FF.

Building 5 was investigated in 1991 under the Phase 2B and 3 investigation, and since that time, several additional investigations have been conducted (see Section 3 of the Work Plan). Past radiological surveys have also been conducted, during which radioactive contamination was detected in the Building 5 drain piping that discharged into the storm sewer. Leaks from the storm drain piping inside the building contaminated several indoor areas, including the first floor spray booths and rooms on the second floor. In 2000, removal of the contaminated piping and associated storm sewer pipelines was completed, and rooms on the first and second floors were decontaminated. Results of the radiological closeout survey indicated that no significant radioactive contamination remained in Building 5. All final measurements taken during this survey were at or below applicable surface activity limits. As a result, Building 5 was considered for radiological release by the Navy for unrestricted public use, as specified by applicable federal and state guidance and policies (SulTech 2005).

Other buildings at IR Site 5 were used for various purposes including engineering laboratories, storage, woodworking, and electrical substations.

1.2.4.2 IR SITE 10

IR Site 10 contains Building 400 (the missile rework facility) along with the area that supports, surrounds, or is part of the activities that occur in the building. According to Navy personnel (DeLong, pers. com. 2006), although the facility is referred to as the missile rework facility, only guidance systems were actually repaired in this building. Around 1930, filling began in the area now covered by IR Site 10. Before 1930, that area was completely inundated by San Francisco Bay. Before construction of Building 400 in 1957, IR Site 10 was open space used for aircraft parking and maneuvering. After 1957, the site was used for missile and aircraft component repair and maintenance operations. In addition to Building 400, other physical features at the site include one former underground storage tanks (UST) (400-1), sanitary sewer lines, industrial waste lines, and open space (Figure 1-2). The site also includes six RCRA sites: M-08 and five SWMUs (Naval Aviation Depot [NADEP] GAPs 36, 37, 38, 39, and 42). Because of possible petroleum product contamination from floating product, a portion of IR Site 10 is designated as CAA-5C.

Building 400 operated as a missile rework facility from 1957 to 1972 and as an avionic component rework facility from 1966 to the closure of the base in 1996. Currently, the building is used by a movie production company as office space and a production lot. Past operations at Building 400 included paint stripping, construction of fiberglass airplane components, airplane parts cleaning and degreasing, silk screening, photographic development, and radioluminescent painting of aircraft dial faces. Industrial wastewater produced at Building 400 was discharged into Seaplane Lagoon before 1972. After 1972, wastewater was discharged to an off-site wastewater treatment facility, and used chemicals were collected at five collection points throughout the building. Wastes generated at Building 400 included paint sludges, metal shavings, paint strippers, cleaning solvents (such as trichloroethene and carbon tetrachloride), testing fluids, and miscellaneous oil and grease (SulTech 2005).

During Navy operations at Alameda Point from the 1950s to base closing, radioluminescent aircraft instrument dials were refurbished with radium-226 in Building 400. Site history indicates that radium-226 was used and stored on the second floor of the building, where radium paint was washed down sink drains that led into the storm sewer system from Building 400 into the main line and out to Seaplane Lagoon (SulTech 2005).

In 1996, the second floor of Building 400 was extensively surveyed for radiological materials. Equipment found to be contaminated was removed, and hot spots found on the floors were identified and also removed (SulTech 2005). Additionally, because radiological contamination was identified in the storm drains that service Building 400, the piping was removed in 1999 and 2000. A radiological closeout survey was performed in 2001 to determine whether any radiological contamination existed at Building 400. The survey demonstrated that no significant contamination remained in the building (SulTech 2005).

1.2.4.3 IR SITE 12

IR Site 12 contains Building 10 (the power plant) along with the area that supports, surrounded, or was part of the activities that occurred in the building. Around 1930, filling began in the area now covered by IR Site 12. Prior to 1930, that area was completely covered by the waters of San Francisco Bay. Building 10 is approximately 21,000 square feet in size and was constructed in the late 1930s as the power plant. No buildings or structures are known to have previously existed at IR Site 12. Activities at the site included the generation of steam and air compression. Although little documentation exists on past uses of Building 10, petroleum products, laboratory chemicals, plant treatment chemicals, microbiocide, morpholine, and corrosives are documented to have been stored there (SulTech 2005). Building 10 operated as a power plant from the late 1930s until base closure in 1997. Boilers at the power plant were designed to generate power by using fuel oil. In the early 1970s, the use of fuel oil was discontinued and replaced by natural gas with diesel fuel as a backup fuel supply. Currently, the building is vacant.

Other physical features present at IR Site 12 are 6 USTs, 12 ASTs, 16 transformers (6 of which have been removed), sanitary sewer lines, storm sewer lines, industrial waste sewer lines, one OWS, and open space (see Figure 1-2).

1.2.5 Study Areas at OU-2C

Sampling during this RI will be performed at study areas called evaluation areas, data gap areas, and SWMUs. These study areas and details of their sampling plans are presented in Appendix A1 to this SAP. The study areas in OU-2C are the following:

- 6 evaluation areas requiring further field activities
  - Evaluation Area 1: OU-2C groundwater impacted by VOCs, metals, and cyanide; and potentially impacted by radium-226 and radium-228 beneath Building 5 and by 1,4-dioxane
  - Evaluation Area 2: soil and groundwater in the vicinity of Building 2 (former dry cleaning operations, including Naval Air Station [NAS] GAP 05)
  - Evaluation Area 3: soil beneath the southern portion of Building 5 (plating shop, foundry, etc.)
  - Evaluation Area 4: soil beneath Aircraft Maintenance Line and adjoining shop area
  - Evaluation Area 5: soil south of Building 5
  - Evaluation Area 6: soil east of Building 5
- 13 data gap areas
  - IR Site 5: Buildings 6, 34, 43, 44, 102, 282, 347, 405, 415, 500, and 505
  - IR Site 5: PAH data gap area and former materials storage area south and east of Building 44
  - IR Site 10: Building 400 hangar floor
- 22 SWMUs
  - 4 OWSs (OWS 005, OWS 006A, OWS 006B, and OWS 010)
  - 1 AST (AST 005G, removed)
  - 4 solvent distillation units (M-01, M-02, M-05, and M-08)
  - 1 coolant recovery system (M-09)
  - 9 NADEP GAPs (02, 04, 17, 20, 25, 27, 31, 57, 70)
  - 1 NAS GAP (NAS GAP 01)
  - 1 RCRA area of concern (AOC) (AOC 005; also known as USTs 5-2 and 5-3, both removed)
  - 1 RCRA UST (UST[R]-02, also known as USTs 6-1 and 6-2; both removed)

1.3 PROJECT/TASK DESCRIPTION

To achieve the objectives identified in Section 1.2.1, the scope of the Supplemental RI sampling includes the activities listed below. Tables 1-2 through 1-5 summarize the sampling approach. Appendix A1 to this SAP provides a detailed discussion of the sampling approach and rationale for each study area in OU-2C.

- **Groundwater sampling**: Up to 15 new groundwater monitoring wells will be installed as described in Appendix A1 to this SAP. During the supplemental RI, both the new and existing monitoring wells (presented in Appendix A1 to this SAP) will be sampled. The rationale for the various analyses of these monitoring well samples is presented in Table 1-2 and in Appendix A1 to this SAP. Discrete groundwater samples will be collected from direct-push boreholes. The rationale for the various analyses of these discrete groundwater samples is presented in Tables 1-3 and 1-4 and in Appendix A1 to this SAP.
- **Soil sampling**: Up to 218 direct-push borings (presented in Appendix A1 to this SAP) will be advanced. Specific soil sampling locations, sampling depths, analyses to be performed, and rationales for the various analyses are described in Appendix A1 to this SAP and presented in Tables 1-3 and 1-4. In addition, soil samples to be analyzed for geotechnical parameters will be collected during the installation of the new groundwater monitoring wells mentioned above (Table 1-2) and from selected soil borings (Table 1-3).
- **Soil gas sampling**: One hundred direct-push borings will be used during collection of subslab soil gas samples within Building 5. Soil gas samples will be analyzed for VOCs to provide input for risk assessment of volatiles in groundwater beneath Building 5 that may migrate to indoor air. Table 1-5 provides sampling details and the rationale for this analysis.
- **Aquifer testing**: A 25-hour groundwater-elevation study will be performed using newly installed temporary piezometers and selected new and existing monitoring wells to assess the direction of groundwater flow and the extent of tidal influence on groundwater beneath OU-2C. Slug tests will be conducted on all newly installed monitoring wells to determine the hydrologic characteristics of the saturated zone at the site.
- **Data evaluation**: Data collected during the supplemental RI will be evaluated to characterize the nature and extent of soil and groundwater contamination, assess groundwater flow direction and tidal influence, determine hydrologic characteristics of the aquifer, and evaluate risk from COPCs to human health and the environment.
- **Report preparation**: A report will be prepared describing the activities performed during the supplemental RI and detailing its findings.

1.3.1 Project Planning

The following general tasks will be completed before fieldwork is begun.

- **Subcontracted services**. The CLEAN Program team will procure subcontractors for geophysical clearance, land surveying, hollow-stem-auger

and direct-push drilling (for soil and discrete groundwater sampling), radiological support, subslab soil gas sampling and analysis, laboratory analysis of soil and groundwater, independent data validation, and investigation-derived waste (IDW) characterization and disposal activities.

- **Field equipment and logbooks.** Where possible, field equipment will be rented or leased rather than purchased. Containers and coolers for sample shipment will be obtained from the subcontract laboratory providing analytical services. Field logbooks and labels (sample, shipping, and IDW) will be prepared in advance by CLEAN Program personnel.
- **Notifications to program participants.** At least 1 week before fieldwork begins, requests for facility access and fieldwork initiation will be transmitted to the Navy Remedial Project Manager (RPM) and Resident Officer in Charge of Construction, and to the Department of Defense Base Realignment and Closure Program Management Office Environmental Compliance Manager. The requests will identify the planned field activities and their estimated duration and the areas where the activities will be conducted. Any access requirements will be facilitated by the Navy.

1.3.2 Project Schedule

The supplemental RI activities schedule is being prepared and will be completed before fieldwork begins.

1.4 QUALITY OBJECTIVES AND CRITERIA

DQOs for the supplemental RI for OU-2C were prepared in accordance with the U.S. EPA seven-step DQO process (U.S. EPA 2000). The DQOs for the supplemental RI are summarized in Tables 1-6 through 1-9.

1.5 SPECIAL TRAINING/CERTIFICATION

All CLEAN Program personnel who work at a known or potentially hazardous waste site are required to meet the safety and health training requirements of Title 29, *Code of Federal Regulations* Section 1910.120(e). Depending on individual responsibilities in the field and the complexity of a particular project, on-site personnel will be required to meet special training requirements.

CLEAN Program personnel typically have undergraduate degrees in environmental science, geology, or engineering. All CLEAN field personnel are required to undergo 24 hours of in-field supervised training in the areas of soil, sediment, surface water, and groundwater sampling. For this CTO, lead project team members have prior CLEAN-specific field experience involving soil and groundwater sampling and are capable of overseeing the direct-push drilling and well installation activities. Additionally, as part of the site mobilization activities, all project team members will have read the applicable CLEAN program procedures specific to this CTO. A minimum of one member of the field team will have at least 30 days of actual field experience on Navy CLEAN field projects. Copies of training records will be maintained by the field quality representative.

Additionally, all field personnel will have completed the initial 40-hour Hazardous Waste Operations and Emergency Response Standard (HAZWOPER) training course and will have maintained their training by successfully completing the 8-hour refresher training course within the previous 12-month period. All CLEAN field personnel will be trained in cardiopulmonary resuscitation, blood-borne pathogens, and first aid applications. At least one site safety and health representative with current 24-hour Occupational Safety and Health Administration safety training will be part of the field team. Copies of field clearance and training records for CLEAN Program personnel will be maintained in the project files. These records include certificates for initial safety and health training, first aid, cardiopulmonary resuscitation, 8-hour HAZWOPER refresher training, annual medical clearance, and CLEAN Program 24-hour supervised training experience.

Subcontractors who work on-site will certify that their employees have been trained for work on hazardous waste project sites. This training will meet the same requirements as those for CLEAN Program personnel. Before beginning work at the project site, subcontractors will submit certifications of training for each employee involved in fieldwork to the CLEAN Safety and Health Manager. These certifications will be included in the project files. Subcontractors will also assure that these employees attend a safety briefing prior to site entry.

1.6 DOCUMENTS AND RECORDS

Generators of data will follow this SAP and program procedures to assure that collected data adhere to CLEAN Program environmental data standards including standard operating procedures (SOPs) (BNI 2004b).

1.6.1 Field Documentation

In accordance with SOP 17, Logbook Protocols (BNI 2004b), field activities and original data generated in the field will be recorded using permanently bound, uniquely labeled field logbooks with sequentially numbered pages. At a minimum, the following information will be recorded:

- CTO number
- dates and times of field activities
- names and affiliations of all on-site personnel or visitors
- weather conditions during field activities
- summaries of daily activities and significant events
- records of all samples collected
- references to other field books or electronic data files that contain specific, relevant information
- discussions of problems encountered and their resolutions
- discussions of deviations from this SAP or other governing documents
- descriptions of all photographs taken

1.6.2 Data Packages

Project data will consist of various types, including field measurements and laboratory analyses. Figure 2-1 in the Data Management Plan (DMP) (Attachment B to the Work Plan) shows the typical data life cycle, including stages of sampling plan development, data collection, data analysis, data review, and data use.

1.6.3 Data Package Format

Data will be tracked and documented through the Program Document Control Center to comply with analytical data reporting requirements as specified in CLEAN Technical Specification 002 (BNI 2004a).

Managing sampling information will include the use of data collection forms, chain-of-custody forms, sample labels, and custody seals, as necessary to follow the procedures outlined in Section 2.3 and in the DMP (Attachment B to the Work Plan).

Detailed procedures for transmittal of data are provided in Navy Environmental Work Instruction No. 6 (NAVFAC Southwest 2005) and in the DMP (Attachment B to the Work Plan).

Section 2
DATA GENERATION AND ACQUISITION

This section outlines data acquisition and management intended to fulfill the DQOs for the supplemental RI. Data acquisition and management includes the sampling process design, field sampling methods and procedures, sample handling and custody, laboratory analytical methods, quality control procedures, instrument quality maintenance, and data management.

2.1 SAMPLING PROCESS DESIGN

Supplemental RI activities to be performed under the provisions of this SAP include soil investigations (hollow-stem-auger drilling and direct-push drilling), subslab soil gas sampling (to provide input for risk assessment of volatiles in groundwater beneath Building 5 that may migrate to indoor air), piezometer and monitoring well installations, aquifer testing, and a groundwater investigation (water-level measurements, groundwater sampling of new and existing monitoring wells, and the collection of discrete groundwater samples from direct-push boreholes).

2.1.1 Hollow-Stem-Auger Drilling

After pavement is sawed or cored (if applicable), a hand auger will be manually advanced to 4 to 5 feet bgs at each proposed monitoring well location to check for subsurface obstructions. The hollow-stem auger boring will then be advanced adjacent to the hand-auger-cleared hole.

A hollow-stem auger rig will be used to drill borings for well installation. Monitoring wells will be installed in the shallower FWBZ (approximately 10 to 15 feet bgs), deeper FWBZ (approximately 25 to 30 feet bgs), and the SWBZ (approximately 60 to 70 feet bgs). The hollow-stem auger method uses a truck-mounted drilling rig equipped with hollow-stem, continuous-flight augers. Soil samples for lithologic logging and geotechnical analysis will be collected using continuous direct-push soil sampling through the hollow-stem auger flights in advance of the auger cutter head to avoid soil sampling disruption. Soil samples for geotechnical analysis will be collected from borings using a split-barrel sampler lined with stainless steel or acetate sleeves.

The hollow-stem auger drilling method refers to the use of a continuous-flight and lead auger with a cutter head at the bottom. As the cutter head rotates and advances the hole, the soil cuttings are lifted to the surface on the flights. Where incremental rather than continuous soil sampling is performed, cuttings lifted to the surface on the auger flights will be examined by the field geologist for lithologic logging purposes to supplement data obtained from the incremental soil samples. Soil will be logged by the field geologist in accordance with the methods provided in Section 2.1.2 and SOP 3, Borehole Logging (BNI 2004b). Soil samples will be analyzed using the methods presented in QAPP Worksheet 19.

When the borehole has been advanced to a designated sampling depth, the center plug will be removed from the cutter head to allow collection of soil samples with the split-spoon sampler. The sampler, attached to the appropriate drive-weight assembly, is positioned through the augers at the bottom of the borehole and driven into undisturbed material by repeated blows of a 140-pound hammer free-falling 30 inches in general

accordance with American Society for Testing and Materials Standard D1586. The split-spoon sampler collects a sample up to 18 inches in length. The number of hammer blows required to advance the sampler through each 6-inch increment will be recorded on the borehole log in the field logbook. The split-spoon sampler will be fitted with stainless steel or acetate sleeves to facilitate sample collection and shipment to the laboratory. Soil collected in the sample sleeves will be used for lithologic logging purposes and for geotechnical analyses.

Soil sampling will be conducted at approximate depths of 10 to 15, 25 to 30, and 60 to 70 feet bgs. The number of samples and the planned sample collection depths are described in the site-specific DQOs for OU-2C (Tables 1-6 through 1-9) and in Appendix A1. The field geologist will determine the actual depth interval and the number of sleeves collected for each sample based on site-specific conditions and analytical volume requirements.

2.1.2 Direct-Push Drilling

The direct-push drilling method was selected for field sampling for the following reasons.

- A low volume of waste soil is generated during drilling and sampling.
- The method will have minimal impact at Alameda Point, as compared with other methods.
- Wells will not be constructed within the direct-push boreholes, and therefore larger-diameter boreholes are not required.
- The method is fast and reliable to the expected sampling depth (generally 12 to 30 feet bgs).

The direct-push soil boring method involves the use of a truck-mounted hydraulic/ percussion drive point. The hydraulic/percussion drive point will be pushed downward through the soil column. The sampler will then be pushed to the desired sampling depth, where a soil sample will be collected using a split-barrel sampler lined with stainless steel or acetate sleeves. A retractable piston inside the split-barrel sampler prevents soil from filling the sleeves until the desired sampling depth is reached. The drill cuttings retained by the sampler will be described by the geologist in accordance with SOP 3, Borehole Logging (BNI 2004b), as follows.

1. The drill cuttings will be classified using the Unified Soil Classification System which will include the classification symbol, name, color, relative density or consistency, moisture, structure, and other observations.
2. Organic vapor readings of the drill cuttings will be collected using a flame ionization detector or an equivalent organic vapor analyzer.
3. For selected direct-push soil borings, radiological monitoring will be performed in accordance with the Radiological Work Instruction (Attachment H).
4. Additional information concerning observations made during drilling operations will be recorded in the remarks column of the borehole record.

Soil samples to be analyzed for VOCs and gasoline-range TPH will be collected from the sleeve using the En Core sampling method, U.S. EPA preparation Method 5035A, or a similar airtight sampling device. This method involves manually driving a smaller diameter sampling tube into the soil within the stainless steel or acetate sampling sleeve. This tube is retracted when full of soil and capped with a locking cap to prevent the loss of volatile analytes during shipping. A minimum of two cores will be collected for each volatile sample. After capping, the samples will be sealed in a bag and kept chilled during shipping.

Direct-push soil samples will be collected at one location for PAH analysis only; these samples will be homogenized before transferring to glass jars.

The direct-push boreholes will be filled completely using an approved sealing material and method as defined in DWR Bulletin 74-90, Alameda County Public Works Agency borehole abandonment requirements, and SOP 13, Destruction of Boreholes and Wells (BNI 2004b). DWR-approved sealing materials include neat cement, bentonite, or bentonite-cement mixture (DWR 1990).

2.1.3 Piezometer Installation

Piezometer pairs will be installed at up to eight locations in the shallower FWBZ (approximately 10 to 15 feet bgs) and in the deeper FWBZ (approximately 25 to 30 feet bgs). These 16 piezometers will be used for aquifer-testing activities described in Section 2.1.4. Permit applications will be submitted to the Alameda County Public Works Agency at least 2 weeks before drilling activities begin. Soil cuttings will be handled as described in the IDW Management Plan (Attachment C to the Work Plan).

The piezometer installation and development procedures are summarized below.

1. Boreholes with a nominal diameter ranging from 6 to 8 inches will be advanced using a hollow-stem-auger drilling rig.
2. Piezometers will be constructed with new 2-inch-diameter schedule 40 polyvinyl chloride (PVC) blank casings and 2-inch-diameter, 0.010-inch slot, continuous well screens. Well screens will be 5 feet long. The depths of the screened intervals will be determined at the time of construction based on lithologic data obtained from the soil boreholes and water-level measurements taken in nearby monitoring wells. An approximately 0.5-foot section of blank casing fitted with an end cap will be installed below the well screen as a sump.
3. A commercial sand filter pack appropriate for the 0.010-inch slot size (e.g., Lonestar #2/12 sand or equivalent) will be placed in the annular space around the screened interval. Assuming that the water table is at a depth of 6 feet bgs, the filter pack will extend approximately 1 foot above the top of the screened interval for the shallower FWBZ piezometers. For the deeper FWBZ piezometers, the filter pack will extend at least 2 feet above the top of the screened interval. For all piezometers, the well casing will be surged during construction using a vented surge block to facilitate maximum settling of the filter pack. Upon placement and settling of the filter pack, a 2-foot-thick annular seal consisting of bentonite pellets hydrated in place with potable water will be

placed above the sand filter pack. The remaining borehole annulus will be filled with a cement/bentonite grout to a depth of approximately 0.5 to 1 foot bgs.

4. All piezometer construction materials will be inspected for integrity and cleanliness when delivered to the site and, if necessary, cleaned before use. Observations during piezometer construction will include the length of blank casing and screen installed (to the nearest 0.1 foot), the amount of materials used, and the volume and source of any water used during construction. This information will be recorded the well construction logbook.

5. Each piezometer surface completion will consist of a flush-mount, traffic-rated vault set in concrete. The top of the vault will be completed at an elevation approximately 1 to 2 inches above the existing surrounding surface elevation to provide for surface water runoff. The top of the piezometer casing will be secured with a watertight, locking well cap and locked to deter unauthorized entry. The piezometer designation will be marked on the vault or box.

6. Piezometers will be developed as soon as practical after completion, but no sooner than 24 hours after the annular seal has been installed. Piezometers will be developed by surging, bailing, and/or pumping using a surge block, bailer, and submersible pump, respectively. A pumping rate will be chosen to lower the water in the piezometer sufficiently but not to pump the piezometer dry. Since the piezometers will only be used to collect water level measurements during the 25-hour groundwater-elevation study, changes in turbidity will be noted at regular intervals during development. Unlike monitoring well development methods (Section 2.1.6), measurements of field parameters such as temperature, conductivity, and pH are not necessary. Field measurements of turbidity and observations will be recorded on well development logs. Development will be continued until groundwater appears relatively clear. Piezometers will be developed using a development rig capable of bailing, surging, and pumping groundwater. Development water will be placed in 55-gallon drums at each well location, then transported to the designated IDW storage area in accordance with the IDW Management Plan (Attachment C to the Work Plan).

2.1.4 Aquifer Testing

The direction of groundwater flow at the western margin of OU-2C (and, consequently, the area of discharge to surface water) is not known. Therefore, aquifer testing will be performed on existing monitoring wells and on new groundwater monitoring wells and temporary piezometers to be installed in the FWBZ. Aquifer testing will include a 25-hour groundwater-elevation study based on potentiometric-surface measurements and slug testing. The 25-hour groundwater-elevation study will be performed using newly installed temporary piezometers and selected new and existing monitoring wells to assess the direction of groundwater flow and the extent of tidal influence on groundwater beneath OU-2C. Slug tests will be conducted on all newly installed monitoring wells to determine aquifer parameters, including transmissivity/horizontal hydraulic conductivity and storage coefficient. Water chemistry parameters measured during groundwater monitoring will be used to define the freshwater/saline water interface and to adjust potentiometric surfaces for water density. The aquifer testing procedures are presented in Section 2.2.4.

As part of BGMP activities in spring 2006, an informal tidal study was conducted to evaluate whether nearshore FWBZ wells at Alameda Point are tidally affected. Pressure transducers were placed in 23 wells located throughout Alameda Point including two wells within OU-2C (M10-02 and M117-E), to investigate areas where groundwater was considered to be potentially tidally affected. Each transducer logged hourly groundwater-level measurements over the course of a 25-hour period. The transducers were then removed from their respective wells and the information collected was downloaded for evaluation (ITSI 2006). The transducer data for wells M10-02 and M117-E will be incorporated into the OU-2C RI report.

2.1.5 Subslab Soil Gas Sampling

Soil gas samples will be collected from 100 locations beneath the concrete slab inside the currently vacant Building 5 for analysis, and the resulting data will be used to evaluate the potential risk from vapor intrusion to hypothetical future occupants of the building. Analytical results for soil gas samples will be compared to both soil gas environmental screening levels (ESLs) and California human-health screening levels (CHHSLs). Target soil gas concentrations from U.S. EPA's subsurface vapor intrusion guidance (U.S. EPA 2002) will be used as a secondary resource if ESLs or CHHSLs are not available. In certain cases where screening values are not available for comparison, ESLs, CHHSLs, or U.S. EPA target concentrations for soil gas for chemically similar compounds will be used as surrogate values. Any chemical concentration that exceeds selected comparison criteria will be evaluated further using 1) vapor intrusion modeling to model soil gas concentrations into indoor air and 2) risk assessment equations to estimate cancer risks and noncancer hazards from inhalation of vapors in indoor air. Detailed information on the subslab soil gas sampling procedures is presented in Section 2.2.3. The Risk Assessment Work Plan is included as Appendix E.

2.1.6 Monitoring Well Construction

Up to 15 new groundwater monitoring wells will be installed in the shallower FWBZ (approximately 10 to 15 feet bgs), in the deeper FWBZ (approximately 25 to 30 feet bgs), and in the SWBZ (approximately 60 to 70 feet bgs). These wells will be located in accordance with the descriptions provided in Appendix A1 to this SAP. Available monitoring well construction information for the existing wells is included in Table 2-1. During the installation of the new monitoring wells, soil samples will be collected to be analyzed for geotechnical parameters (Table 1-2 and QAPP Worksheet 19). Table 1-3 provides the rationale for the collection of the soil samples.

Well installation and development will generally be performed in accordance with SOP 5, Monitoring Well Design, Installation, and Development, as well as local and state guidelines. Well installation permit applications will be submitted to the Alameda County Public Works Agency at least 2 weeks before drilling activities begin. Soil cuttings will be handled as described in the IDW Management Plan (Attachment C to the Work Plan). The well installation and development procedures are summarized below.

1. Boreholes with a nominal diameter ranging from 10 to 12 inches for the FWBZ monitoring wells will be advanced using a hollow-stem-auger drilling rig. The borehole for the SWBZ monitoring well will be advanced using a mud rotary drilling rig and a hollow-stem-auger drilling rig. The mud rotary drilling rig will be used first to advance the borehole (with a nominal diameter ranging from 16 to 20 inches) and install a conductor casing at an approximate depth of 30 to 40 feet bgs to seal the FWBZ and prevent the migration of contaminants from the FWBZ to the SWBZ. Once the conductor casing is grouted in place, a hollow-stem-auger drilling rig will then be used to advance the borehole to the required total depth (up to 70 feet bgs). If the hollow-stem-auger drilling rig encounters problems advancing the borehole (e.g., due to heaving sands), the mud rotary drilling rig will be used to advance the borehole. If the borehole is completed using a mud rotary drilling rig, the borehole will be cleaned by circulating potable water prior to well installation.

2. The monitoring wells will be constructed with new 4-inch-diameter schedule 40 polyvinyl chloride (PVC) blank casings and 4-inch-diameter, 0.010-inch slot, continuous well screens. Well screens will be 10 feet long. For the shallower FWBZ monitoring wells, the screened intervals will extend from approximately 2 feet above the water table (to detect any possible light non-aqueous phase liquid) to 8 feet below the water table. For the deeper FWBZ and SWBZ wells, the depths of the screened intervals will be determined at the time of construction based on lithologic data obtained from the soil boreholes and water-level measurements taken in nearby monitoring wells. Screens will be placed at appropriate depths to evaluate the hydrogeologic properties and to allow the collection of representative groundwater samples from the lower FWBZ and SWBZ. An approximately 0.5-foot section of blank casing fitted with an end cap will be installed below the well screen as a sump. Figure 2-1 shows a typical monitoring well design.

3. A commercial sand filter pack appropriate for the 0.010-inch slot size (e.g., Lonestar #2/12 sand or equivalent) will be placed in the annular space around the screened interval. Assuming that the water table is at a depth of 6 feet bgs, the filter pack will extend approximately 1 foot above the top of the screened interval for the shallower FWBZ monitoring wells. For the deeper FWBZ and SWBZ wells, the filter pack will extend at least 2 feet above the top of the screened interval. For all monitoring wells, the well casing will be surged during construction using a vented surge block to facilitate maximum settling of the filter pack. Upon placement and settling of the filter pack, a 2-foot-thick annular seal consisting of bentonite pellets hydrated in place with potable water will be placed above the sand filter pack. The remaining borehole annulus will be filled with a cement/bentonite grout to a depth of approximately 0.5 to 1 foot bgs.

4. All well construction materials will be inspected for integrity and cleanliness when delivered to the site and, if necessary, cleaned before use. Observations during well construction will include the length of blank casing and screen installed (to the nearest 0.1 foot), the amount of materials used, and the volume and source of any water used during construction. This information will be recorded in the well construction logbook.

5. Each well surface completion will consist of a flush-mount, traffic-rated vault that is set in concrete. The top of the vault will be completed at an elevation approximately 1 to 2 inches above the existing surrounding surface elevation to provide for surface water runoff (Figure 2-1). The top of the well casing will be secured with a watertight, locking well cap and locked to deter unauthorized entry. The well designation will be marked on the well vault or box.

6. Wells will be developed as soon as practical after completion, but no sooner than 24 hours after the well seal has been installed. The new wells will be developed to remove loose sediment in the filter pack and borehole. Development will improve hydraulic conductivity between the well and the surrounding formation. Development typically consists of surging using a surge block during construction and then surging, bailing, and pumping using a surge block, bailer, and submersible pump, respectively, after completion. Well development will be performed in accordance with SOP 5, Monitoring Well Design, Installation, and Development (BNI 2004b). A pumping rate will be chosen to lower the water in the well sufficiently but not to pump the well dry. During development, changes in temperature, conductivity, pH, and turbidity will be noted at regular intervals. Field measurements and observations will be recorded on well development logs. Well development will be continued until at least five well volumes of water plus any volume of water added during well installation are removed; at least three consecutive measurements of temperature, conductivity, and pH are within 10 percent of each other; and/or groundwater appears relatively clear. Wells will be developed using a well development rig capable of bailing, surging, and pumping groundwater. Development water will be placed in 55-gallon drums at each well location, then transported to the designated IDW storage area in accordance with the IDW Management Plan (Attachment C to the Work Plan).

2.1.7 Water-Level Measurements

Water levels will be measured (in accordance with SOP 7, Water and Free Product Level Measurement in Wells (BNI 2004b), as summarized in Section 2.2.2) sitewide prior to groundwater sampling. Each well location will be visually inspected for evidence of damage or tampering, and any recommendations for corrective action will be recorded.

Observations will be recorded using forms bound in water-level or groundwater sampling logbooks as appropriate. Recorded data will include, but will not be limited to, the following:

- well identifier
- date and time of the measurement
- measured depth to water (in feet, to the nearest hundredth of a foot)
- measured depth to free product (in feet, to the nearest hundredth of a foot), where applicable
- any unusual conditions observed
- type and serial number of the instrument used

Water-level meters and/or interface probes will be decontaminated before their initial use and after each measurement in accordance with SOP 11, Decontamination of Equipment (BNI 2004b), as summarized in Section 2.2.5.

2.1.8 Discrete Groundwater Sampling

Discrete groundwater sampling will be performed using a truck-mounted hydraulic/ percussion drive-point rig. Discrete groundwater samples will be collected within the FWBZ from approximately 5 to 10 feet below the groundwater table to allow for sufficient sample volume. The number of samples and the planned sample collection depths are described in the site-specific DQOs for OU-2C (Tables 1-6 through 1-9) and specific details are provided in Appendix A1. Most of the discrete groundwater samples will be collected from the same borings as the soil samples.

The hydraulic/percussion drive point will be pushed downward to the desired sampling depth, and then the HydroPunch (or equivalent sampling device) will be retracted to allow groundwater to flow through the screen and into the sampling tip. The HydroPunch has a sacrificial drive point that will be left in place as the screen assembly is pulled to the surface. If an adequate amount of groundwater cannot be collected by the HydroPunch (or equivalent) method, the sampling rods will be removed from the ground, and a 1-inch-diameter PVC temporary well casing with 0.010-inch slotted well screen will be inserted into the boring.

Discrete groundwater samples for VOC analysis will be collected using a microbladder pump and new disposable, flexible tubing that runs from the desired sampling depth to the ground surface. The microbladder pump will be used inside either the HydroPunch sampling tool or the 1-inch-diameter PVC temporary well casing for sample collection. Samples will be collected directly into precleaned laboratory-supplied sample containers at a low flow rate to minimize volatilization of potential analytes (i.e., at a pumping rate to achieve laminar water flow). If turbidity in the temporary well results in the microbladder pump's filter screen becoming clogged repeatedly with silt or other particles, a peristaltic pump will be used to collect the sample. If a peristaltic pump is used, every effort will be made to minimize agitation of the sample and volatilization of potential analytes by collecting samples directly into precleaned laboratory-supplied sample containers at a low flow rate (i.e., at a pumping rate to achieve laminar water flow), similar to the collection method that will be followed when a microbladder pump is used. If sample collection times longer than 15 minutes are encountered when using a microbladder pump to collect discrete groundwater samples and fill sample containers for non-VOC analysis, a peristaltic pump may be used.

Groundwater samples for metals and radium analyses will be filtered in the field prior to shipment to the laboratory.

2.1.9 Groundwater Monitoring Well Sampling

One round of groundwater sampling will be performed for all wells at OU-2C, including existing and newly installed wells (presented in Appendix A1 to this SAP), in accordance with low-flow sampling procedures outlined in SOP 8, Groundwater Sampling

(BNI 2004b), and summarized in Section 2.2.2. Monitoring wells will be sampled using portable low-flow bladder pumps. Monitoring well construction details of existing wells are presented in Table 2-1.

Field water-quality parameters will be measured during purging at approximately 5-minute intervals and recorded using the sampling logbook. Purging will continue until three consecutive measurements have stabilized within the indicated range for the following parameters:

- pH plus or minus 0.1
- conductivity within 3 percent
- oxidation-reduction within plus or minus 10 millivolts
- turbidity and dissolved oxygen within plus or minus 10 percent
- temperature within 1 degree Celsius (°C)

2.1.10 Utility Survey

Underground utility clearance will be completed for all subsurface investigation activities and areas. The entire area within a 5-foot radius of each proposed subsurface sampling location will be cleared at OU-2C using the following protocol.

1. Find/confirm the latest version of as-built drawings.
2. Perform a site reconnaissance to locate utilities on as-built drawings and to find evidence of any undocumented utilities.
3. Mark the proposed sampling locations and the utility lines in the immediate vicinity using color-coded surveyor paint.
4. Coordinate utility-locating activities with Navy Public Works Center.
5. Coordinate utility-locating activities with Underground Service Alert.
6. Use ground-penetrating radar/electromagnetic geophysical equipment and procedures wherever underground obstruction clearance is not guaranteed.
7. After pavement is sawed or cored (if applicable), advance a hand auger manually to a depth of 4 to 5 feet bgs at each proposed sampling location to check for subsurface obstructions. Because some of the soil samples will be collected between the ground surface and 5 feet bgs, advance another boring for the collection of samples adjacent to the hand-auger-cleared borehole.

If a utility is identified within 3 feet of the proposed sampling/drilling location, the sampling/drilling point will be moved and the clearance procedures will be repeated. The clearance of each boring location will be documented in the field logbook.

2.1.11 Land Survey

Once the field activities have been completed, a licensed land surveyor will conduct a survey to establish the horizontal position and elevations of all groundwater monitoring wells, piezometers, and soil boreholes at OU-2C. Land surveying will be coordinated

with Alameda Point personnel and operations as necessary before this activity begins. The elevations and positions of the boreholes and wells will be determined using the same benchmarks as used for previous site surveys (if applicable) to allow for correlation and maintain consistency.

All elevations will be determined and reported to the nearest 0.01 foot relative to the North American Vertical Datum 1988. The horizontal positions of monitoring wells, piezometers, and soil boreholes will be reported to the nearest 0.1 foot defined relative to the State Plane Coordinate System, North American Datum 1983.

2.2 SAMPLING METHODS

This section specifies SOPs to be used and describes the methods and procedures to be followed during field activities. The use of these procedures is intended to assure that field measurements are consistent and reproducible. The CLEAN Program technical staff will follow all appropriate CLEAN Program SOPs as documented in the Program Procedures Manual (BNI 2004b).

The CLEAN Program Quality Manager has provided controlled copies of all CLEAN Program SOPs to the Navy, DTSC, San Francisco Bay Water Board, and U.S. EPA Region 9. Copies of the SOPs can be made available to other document reviewers upon request through the Navy RPM. Field personnel are required to acknowledge receipt of SOPs, and copies of all applicable SOPs will be available on-site. Senior technical staff members are required to review procedures prior to fieldwork.

The following sections provide the sampling methods and procedures to be followed during field activities.

2.2.1 Soil Sampling Procedures

Soil samples will be collected using the following procedures.

1. Don a new pair of disposable latex/nitrile gloves immediately before collecting samples.
2. Collect soil samples using the direct-push sampling methods and split-barrel sampler lined with stainless steel or acetate sleeves as described in Section 2.1.2. Sample numbering, labeling, packaging, and documentation procedures will be followed as described in Section 2.3.
3. For VOC analysis, collect three En Core samplers as follows.
   a. Holding the coring body, push the plunger rod down until the small O-ring rests against the tabs. This will assure that the plunger will move easily.
   b. Depress the locking lever on the En Core T-handle. Place the coring body, with the plunger end first, into the open end of the T-handle, aligning the slots of the coring body with the locking pins in the T-handle. Twist the coring body clockwise to lock the pins in the slots. Check the sampler to assure that it is locked in place. The sampler will then be ready for use.

c. Holding the T-handle, push the coring body into the soil until the coring body is full. Remove the sampler from the soil and wipe any excess soil from the exterior of the coring body.

d. Cap the coring body while it is still on the T-handle. Push the cap over the flat area of the ridge. To lock the cap in place, push and twist the cap so that it seals the sampler.

e. Remove the capped sampler by depressing the locking lever on the T-handle while twisting and pulling the sampler from the T-handle.

f. Place the En Core sampler in its aluminum sealed bag.

g. Complete the sample label on the outside of the aluminum bag, place the aluminum bag in a resealable bag, place a custody seal over the resealable bag, and immediately place the bag on ice.

4. Soil samples for PAH analysis only will be collected from three soil borings. These samples will be collected as follows.

   a. Each sample will be homogenized in the field prior to shipment to the laboratory. Homogenization will consist of a quartering process that will occur within a dedicated disposable aluminum tray. Following the transfer of the soil material from the stainless steel or acetate sleeve to an aluminum tray, material will be divided into quarters that will be mixed individually using a dedicated disposable plastic scoop. Two quarters will be mixed to form halves, and these halves will then be mixed. The procedure will be repeated several times until the sample is adequately mixed.

   b. Samples will then be placed into new sampling jars provided by the laboratory. One 8-ounce glass jar will be submitted per soil sample.

5. For two of the soil borings with samples for PAH analysis only (see Item 4 above), additional analyses will be conducted for selected samples. The samples to receive additional analyses will be collected as follows.

   a. Collect VOC and TPH-gasoline subsamples from the 0-to-0.5-foot and 2-to-4-feet depth intervals, and at the soil/water interface from the 4-to-8-feet depth interval using En Core devices prior to homogenization.

   b. For remaining parameters (TPH-ff, SVOCs, PAHs, PCBs, and metals) for soil samples from the 0-to-0.5-foot, 2-to-4-feet, and 4-to-8-feet depth intervals, follow PAH homogenization protocol (see Item 4 above) and place soil sample in an 8-ounce jar.

   c. For the soil sample collected at the 0.5-foot-to-2-feet depth interval, only PAH analysis will be conducted

2.2.2 Groundwater Sampling Procedures

Groundwater samples will be collected in accordance with SOP 8, Groundwater Sampling (BNI 2004b). The following steps summarize the procedures for measuring water levels, purging wells, determining when water-quality parameters have stabilized, and collecting samples using the low-flow groundwater sampling technique.

1. Monitor the well head for organic vapors and explosive gases with a calibrated flame ionization detector (or an equivalent organic vapor analyzer) and explosimeter. Record all readings on an air monitoring or groundwater sampling data sheet. Calibrate the flame ionization detector (or an equivalent organic vapor analyzer) and explosimeter used daily using the manufacturer's suggested specifications. Document calibration results on a field calibration record.
2. Check and record the condition of the well box, well/piezometer, and well cap for any damage. Record all information on the groundwater sampling data sheet.
3. Don a new pair of disposable latex/nitrile gloves immediately before collecting depth-to-water measurements.
4. Measure depth to water (to nearest 0.01 foot) relative to a known surveyed reference point using an electronic water-level meter in accordance with SOP 7, Water and Free Product Level Measurement in Wells (BNI 2004b). To avoid disturbing sediment at the bottom of the well prior to using low-flow sampling procedures, do not sound the well (measure total well depth) immediately before sampling.
5. Purge and sample the monitoring well using a low-flow submersible pump (e.g., bladder pump, variable-speed electric pump). In preparation for purging, thoroughly decontaminate the pump and any associated electrical wiring. The discharge tubing used to convey water from the pump outlet to the discharge point at ground surface shall be new, clean, polyethylene tubing. Slowly lower the pump in the well to prevent the disturbance of the water column and adverse impacts on turbidity levels. In order to maximize the possibility of obtaining representative samples (i.e., to avoid mixing with any stagnant water above the screened interval) and minimize agitating accumulated sediments at the bottom of the well, position the pump intake in the middle or slightly above the middle of the screened interval. When purging and sampling wells screened across the water table, position the pump intake approximately in the middle of the water column or at the particular level of interest within the screened interval.
6. After setting the pump in the well, measure the depth to water (to nearest 0.01 foot) again relative to a known surveyed reference point using an electronic water-level meter.
7. Connect the pump to a compressed air source (for bladder pumps) or to a portable generator (for electric pumps).
8. Connect one end of the discharge tubing to the inlet of the micropurge flow-through cell. Place a 5-gallon bucket under the outlet of the flow-through cell to hold purged water.
9. Turn on the pump controller to start purging the well. Adjust and maintain the flow rate between 100 to 500 milliliters per minute or at the recharge capability of the formation to minimize water level drawdown (less than approximately 0.1 meter or 0.33 foot). Observe drawdown by monitoring depth to water measurements during purging.

10. In accordance with SOP 8, use the calibrated micropurge flow-through cell to monitor field parameters such as pH, electrical conductivity, turbidity, and temperature of the initial groundwater purged from the well (e.g., after one discharge tubing and flow-through cell volume). Testing of these field parameters shall continue until measurements have stabilized within the indicated range according to the following parameters:

    - pH plus or minus 0.1
    - conductivity within 3 percent
    - oxidation-reduction within plus or minus 10 millivolts
    - turbidity and dissolved oxygen within plus or minus 10 percent
    - temperature within 1 degree Celsius (°C)

    Perform measurements of field parameters at regular intervals (e.g., at the end of each purged volume, every 3 to 5 minutes). Purging will be considered adequate after the readings have stabilized or when a minimum of three to five well volumes have been removed form the well.

11. After the completion of the purging activities, disconnect the pump discharge tubing from the micropurge flow-through cell. Groundwater samples should not pass through the flow-through cell during sample collection. Measure the depth to water and allow the water level in the well to stabilize before collecting groundwater samples.

12. Discard the latex/nitrile gloves worn during purging activities and don a new pair of latex/nitrile gloves. Fill the appropriate sample containers according to QAPP Worksheet 19, using the pump discharge tubing. Collect samples directly into precleaned laboratory-supplied sample containers at a low flow rate to minimize agitation of the sample and volatilization of potential analytes (i.e., at a pumping rate to achieve laminar water flow). Monitoring well sampling is planned for unfiltered metals analysis. If filtered metals analysis is preferred, or for discrete groundwater samples, use a new 0.45-micron in-line cartridge filter attached to the end of the sample tubing.

13. Follow sample numbering, labeling, packaging, and documentation procedures as described in Section 2.3.

14. Decontaminate reusable sampling equipment (e.g., the low-flow pump) between sampling locations in accordance with SOP 11 as described in Section 2.2.5.

2.2.3 Subslab Soil Gas Sampling Procedures

Prior to the installation of the subslab soil gas probes, a concrete corer will be used to drill through the foundation. The soil gas probes will be installed using a direct-push rig. The soil gas probes will be semipermanent installations consisting of a 0.25-inch diameter brass or stainless steel pipe with a permeable probe tip (see Figure 2-2). Soil gas probes will be installed at the proposed locations shown on Figure 2-3. A sand pack will be placed in the annular space around the tip of the vapor probe, and a Teflon sealing disk will be placed between the probe tip and blank pipe. Bentonite chips will be used to

fill the borehole annular space around the probe pipe to the base of the concrete foundation. Deionized water will be used to hydrate the bentonite chips and care will be taken to ensure that the minimum amount of water necessary to hydrate the bentonite chips will be used. The probe pipe will be tightly secured to the foundation slab with quick-setting, contaminant-free Portland cement. Each probe will be constructed with a recessed threaded cap with a brass or stainless steel threaded fitting or compression fitting so the probe completion is flush with the foundation slab. After sample probes are placed, a minimum of 48 hours is required before soil gas is sampled to allow subsurface conditions to equilibrate.

A sampling pump fitted with a particulate prefilter, flow controller, and combination vacuum and pressure gauge will be used to purge soil gas from the probe. Soil gas samples will be collected in 1-liter Summa canisters for low-level analysis by U.S. EPA Method TO-15 (U.S. EPA 1999). The sampling pump and Summa canister will be connected to the soil gas probe using a Y-shaped tubing with a three-way central valve. One line will be connected to the soil gas probe's brass or stainless steel threaded fitting or compression fitting. The second line will be connected to the vacuum pump, and the last sampling line will be connected to a flow regulator and Summa canister.

The procedures for sample collection are summarized below.

1. **Purge volume**. Before sampling, three purge volumes will be extracted using a vacuum pump to ensure that stagnant or ambient air is removed from the sampling system and that samples collected are representative of subsurface conditions. Each branch of the Y-shaped tubing (with a three-way central valve) will be purged of ambient air; purging of the sampling line will be conducted before connecting the Summa canister. The purge volume will be estimated based on a summation of the volume of tubing used and the annular space around the probe tip.

2. **Purging and sampling flow rates**. The flow rates for both purging and sampling will be between 100 and 200 milliliters per minute.

3. **Leak tests**. Leak tests will be conducted at each soil gas probe location to determine whether leaks have occurred. A tracer compound (pentane, isopropanol, isobutene, propane, butane, or isopropyl alcohol) will be used as leak check compounds if a detection limit of 10 micrograms per liter or less can be achieved. Immediately before sampling, a leak check compound will be placed at any location where ambient air can enter the sampling system or where cross contamination may occur (such as the sample system connection and top of the soil gas probe).

4. **Soil gas sampling**. After the subslab soil gas probe is adequately purged to remove stagnant or ambient air, a soil gas sample will be collected using a 1-liter Summa canister that has been certified clean. At the start of the sample collection, the sampling valve on the canister is opened, which allows the evacuated canister to draw in soil gas until the canister reaches ambient pressure. When approximately 5 millimeters of mercury is remaining on the vacuum gauge, the sampling valve will be closed and the canister will be removed from the sampling line. The final vacuum will be recorded on the field form and the

chain-of-custody form. Closing the valve with 5 millimeters of mercury remaining allows the laboratory to monitor for leaks. Additional samples will be collected from an adjacent location if air flow is found to be insufficient during sampling. After the soil gas sample is collected, the Summa canister will be labeled with a sample tag attached to its handle. The label information will then be recorded in the field logbook and chain-of-custody form.

5. **Field data sheet.** The following information will be recorded on the field data sheet during sampling:
   - date and start time
   - meteorological conditions, including temperature, humidity, wind speed, and direction
   - purge flow rate
   - purge volume
   - sampling flow rate
   - sample identification number
   - final vacuum reading
6. **Field log book.** Soil gas probe installation data will be recorded in a field logbook. This data will include but not be limited to the following:
   - date and start and finish time of probe installation
   - thickness of building foundation encountered
   - size of borehole annulus
   - probe installation depth
   - material used to construct probes
   - amount of water added
   - methods and results of leak testing

2.2.4 Aquifer Testing Procedures

Aquifer testing will be performed to determine hydraulic characteristics of the aquifers and to understand the movement of groundwater underlying OU-2C.

2.2.4.1 25-HOUR GROUNDWATER-ELEVATION STUDY

Tidal fluctuations create a cyclical change in pore pressure in adjacent and underlying aquifers. These changes in pore pressure result in fluctuations in water levels and groundwater gradient. The groundwater gradient in an aquifer influenced by tidal fluctuations should be determined from mean water levels rather than from a single measurement of water level. The most accurate determination of mean water levels in the aquifer requires the sinusoidal tidal influence effects on the water-level measurements to be removed through a mathematical filtering methodology (Serfes 1991). In this

method, a set of 25 consecutive hourly water level measurements will be collected and used in a mathematical approach that filters out the cyclic pressure response at the observation point (e.g., monitoring well, temporary piezometer) that results from tidal fluctuations.

The 25-hour groundwater-elevation study will be performed by using monitoring wells and temporary piezometers to assess the direction of groundwater flow and the extent of tidal influence on groundwater beneath OU-2C. The study will use selected new monitoring wells (well pair M05-13 and L05-01, well pair M05-14 and L05-03, and L05-02 next to M05-02) and existing monitoring wells (M05-01, M05-02, M05-06, 26SW03, M117-E, and, if accessible, MBG-04). Pressure transducers with data loggers will be placed at each location to monitor changes in groundwater elevation. In areas with well clusters in the FWBZ and second water-bearing zone, transducers will be placed in both wells to monitor changes in groundwater elevation in both aquifers.

Pressure transducers and data loggers will be used to record water-level data at an accuracy of 0.01 foot. The data loggers will collect readings every 10 minutes for a minimum of 25 hours. The top-of-casing elevations of the monitoring wells and the piezometers will be surveyed to an accuracy of 0.01 foot. These measurements will be used to produce groundwater contour maps and evaluate potential reversals in horizontal and vertical flow directions.

As part of BGMP activities in spring 2006, an informal tidal study was conducted to evaluate whether nearshore FWBZ wells at Alameda Point are tidally affected. Pressure transducers were placed two wells within OU-2C (M10-02 and M117-E) where groundwater was considered to be potentially tidally affected. Each transducer logged hourly groundwater-level measurements over the course of a 25-hour period. The transducers were then removed from their respective wells and the information collected was downloaded for evaluation (ITSI 2006). The transducer data for wells M10-02 and M117-E will be incorporated in the OU-2C RI report.

2.2.4.2 SLUG TESTS

A slug test is a relatively quick and cost-effective way to estimate a site's aquifer parameters such as hydraulic conductivity, transmissivity, and storage coefficient for the localized zone surrounding a well. A slug test involves the instantaneous addition or removal of a known volume of water, and measurement of the rate at which the water level returns to its static elevation. The test is performed by rapidly dropping a solid cylinder (slug) into a well to displace an equivalent volume of water. Once the water level has returned to static conditions, the slug is rapidly removed to simulate the instantaneous removal of the same volume of water. No water is removed from the well during the slug test, which eliminates groundwater disposal costs.

During the slug tests at OU-2C, a pressure transducer and data logger will be used to record water-level responses. Slug tests will be performed in accordance with SOP 14, Aquifer Testing (BNI 2004b). Slug test data will be evaluated using the Bouwer-Rice method (Bouwer and Rice 1976).

2.2.5 Equipment Decontamination

Sampling equipment will be decontaminated between sampling locations in accordance with SOP 11 (BNI 2004b), as follows.

- Large equipment will be decontaminated using a steam- or pressure-washer capable of delivering water at a minimum temperature of 180 degrees Fahrenheit.
- Smaller equipment will be decontaminated as follows.
  - Equipment will be washed in low- or nonphosphate detergent (e.g., Alconox or Liqui-Nox solutions made as directed by the manufacturer).
  - Equipment will be rinsed with potable water.
  - Equipment will be rinsed twice with deionized or distilled water.

Small equipment that will not be used immediately following decontamination will be wrapped in new plastic bags. Disposable sampling equipment (e.g., unused portions of acetate sleeves, used bladders or tubing) will be placed with used personal protective equipment (PPE) for disposal.

2.2.6 Investigation-Derived Waste Management

IDW will be managed in accordance with guidelines in SOP 22, Investigation-Derived Waste Management (BNI 2004b), summarized below. All IDW materials will be disposed by CLEAN Program personnel as described in the IDW Management Plan (Attachment C to the Work Plan).

The following types of IDW are expected from field activities:

- purgewater from monitoring wells
- decontamination washwater
- soil cuttings
- used PPE and disposable sampling equipment
- nonhazardous solid waste (refuse)

The IDW management protocols include the following requirements.

1. Liquid IDW (decontamination water) and soil cuttings will be stored separately in United Nations (UN)-approved 55-gallon drums. Contaminated PPE and sampling equipment will be placed in covered UN-approved 55-gallon drums. Uncontaminated PPE will be placed in industrial waste bins. Regular trash and nonhazardous construction debris will not be mixed with potentially contaminated IDW.
2. Each container will be clearly marked to indicate the waste source. IDW containers used at OU-2C will be transported to, and stored in, a secured area designated by the base environmental manager. Before disposal or shipment off-site, containers will be labeled with appropriate United States Department of

Transportation (DOT) identification and classification information by the waste disposal subcontractor.

3. All IDW will be characterized, treated, and/or disposed within 90 days of collection. The Navy will be responsible for selecting the methods/location of IDW disposal and for signing all manifests.

2.3 SAMPLE HANDLING AND CUSTODY

Sample custody and documentation are important elements of acceptable and defensible data. Each sample or field measurement must be properly documented to facilitate timely, correct, and complete analysis and to support use of field and laboratory data. The documentation system provides the means to identify, track, and monitor each sample from the point of collection through final data reporting.

2.3.1 Sample Containers

Sample containers will be selected in accordance with the U.S. EPA Region 9 Quality Assurance Management Section (U.S. EPA 1992a).

Sample containers will be cleaned and QC-tested following procedures appropriate to the specific analyses to be performed. Sample containment will follow the procedures prescribed by the U.S. EPA Contract Laboratory Program (CLP) Sample Bottle Repository Program (U.S. EPA 1992a) to assure that containers are free of contaminants. This QC testing will be verified or performed by the laboratory before the containers are shipped to the field sampling team.

Sample containers with caps (e.g., volatile organic analysis vials, amber bottles, or polyethylene bottles) will be shipped to the user in protective cardboard cartons or other wrapping and will be inspected for condition prior to use.

2.3.2 Sample Preservation

Samples will be preserved in accordance with CLP protocols (U.S. EPA 1992b), DOT regulations (49 *Code of Federal Regulations*), and methods presented in SOP 10, Sample Custody, Transfer, and Shipment (BNI 2004b). The laboratory will add sample preservatives, as required, to the containers before they are shipped to the field. Field and associated QC samples requiring cooling will be maintained at approximately 4 °C until shipment to the laboratory.

2.3.3 Sample Packaging and Shipment

Samples will be packaged and shipped according to procedures listed in SOP 10, which are based on U.S. EPA specifications as well as DOT regulations (49 *Code of Federal Regulations*), as follows.

1. Attach sample labels to sample containers and cover the labels with clear packing tape.
2. Place custody seals on the sample containers.

3. Wrap all glass containers in foam sheet or bubble wrap and place them in zip-lock bags.
4. Pack the cooler with double-bagged ice to prevent leakage during shipment.
5. Place completed chain-of-custody forms in a plastic zip-lock bag, and tape it to the inside of the cooler lid.
6. Secure the cooler with strapping tape and custody seals.

At the end of each day or when a cooler is filled, the field crew will ship the samples to the laboratory by project vehicle and/or by common carrier, or by delivery courier.

2.3.4 Sample Documentation

This section describes the use of paperwork, including field logbooks, photographs, chain-of-custody records, sample labels, and custody seals, following procedures presented in SOPs 10 and 17 (BNI 2004b). Examples of chain-of-custody records, sample labels, and custody seals are included in SOP 10, Sample Custody, Transfer, and Shipment (BNI 2004b).

2.3.4.1 FIELD LOGBOOKS

Controlled, permanently bound field logbooks will be maintained by the senior field representative and will become part of the permanent project record (SOP 17, Logbook Protocols). Field logbooks will be used to record details such as weather conditions, chain of custody, instrument calibration records, and safety and health information. All entries will be made using waterproof ink and will be signed and dated.

2.3.4.2 PHOTOGRAPHS

Photographs may be taken to document field activities, including the surrounding area and events, objects, or unusual conditions. Photographs will be described in the field logbook and will include the date, initials of the photographer, photograph number, compass direction, and a brief description of the photographed object.

2.3.4.3 CHAIN-OF-CUSTODY RECORDS

Chain-of-custody records will be prepared so that sample identification and chain of custody are maintained, and sample disposition is controlled from sample collection through validation of analytical results (SOP 10). Chain-of-custody forms will be completed by the sampler and will accompany the samples from the field to the analytical laboratory.

Waterproof ink will be used to fill out chain-of-custody records with all applicable information, including signatures, completely and legibly. Unused space (rows) for sample/analysis information will be crossed out, initialed, and dated. If samples are to be delivered to the laboratory by an overnight carrier, the airbill number will be recorded, and the chain-of-custody record(s) will be placed in a waterproof plastic bag that is taped to the lid inside the sample cooler prior to sealing.

Laboratory personnel will be responsible for acknowledging receipt of samples, recording the interior temperatures of shipping containers, and verifying that these containers have not been opened or damaged. They will also be responsible for maintaining custody and sample tracking records throughout sample preparation and analysis. A copy of the chain-of-custody record will be sent to the CLEAN Program office at the completion of analytical work.

2.3.4.4 SAMPLE LABELS

Labels will be affixed to all sample containers and will include the following information:

- CTO number
- well identifier
- 10-digit sample identifier
- collector's initials (not preprinted)
- collection date and time
- type of preservation
- analyses to be performed
- special instructions

2.3.4.5 TEN-CHARACTER SAMPLE IDENTIFIER

A unique ten-character sample identification number, consisting of the letter C to indicate a CLEAN 3 sample, a three-digit CTO number, a four-character sample number, and a two-digit sequential container number, will be used to distinguish between multiple samples collected for the CTO. This ten-character identifier will allow input directly into a database in compliance with CLEAN Technical Procedure T 2.2, Sample Information Management System, and Navy Environmental Work Instruction No. 6 (NAVFAC Southwest 2005).

The CTO number for this field activity (currently 081) will follow the letter C and precede the sample and container numbers. The first character of the four-character sample number identifies the sample medium (e.g., "S" for soil sample or "G" for groundwater sample or V for soil gas samples) or the type of QC sample ("T" for trip blanks, "W" for source water blanks, or "R" for equipment rinsates). The last three characters in the sample number are sequential digits (e.g., 001 for the first sample collected, 002 for the second sample collected, and 003 for the third sample collected).

The two-digit container number following the four-character sample number identifies multiple containers collected for an individual sample (e.g., 01 for first sample container, 02 for second sample container, and 03 for the third sample container).

The following provides an example of a soil sample identifier:

C081S00101

where

C = denotes a CLEAN 3 sample
093 = the CTO project number
S = soil sample
001 = sample number (sequential)
01 = container number (sequential)

2.3.4.6 CUSTODY SEALS

Signed and dated custody seals will be used to detect tampering between the time samples are packed and the time they are received at the laboratory. Two or more custody seals will be used on the outside of each shipping container or cooler and will be placed where they must be broken to open the containers. Clear packing tape will be placed over custody seals on shipping containers to prevent accidental breaks.

2.3.4.7 CORRECTIONS TO DOCUMENTATION

Errors in field logbooks will be corrected by drawing a single line through the error and writing the correct information using waterproof ink. The correction will be initialed and dated.

2.4 ANALYTICAL METHODS

Analytical methods, sample volumes, container types, and holding times for this project are listed in QAPP Worksheets 15-soil, 15-groundwater, and 19. Table 2-2 lists method reporting limits and regulatory criteria for this project.

The analytical methods for this project were selected, to the extent practicable, to have method detection limits (MDLs) at or below the level of concern. A target method reporting limit (TMRL) or project quantitation limit (PQL) for each analyte was provided in Table 2-2 and QAPP Worksheet 15 (soil and water) based on the MDL. The TMRLs or PQLs are generally set above the MDLs to simplify comparisons between results from individual samples by minimizing influences from matrix effects (e.g., water content, high-level analytes). The laboratory will meet these TMRLs and PQLs to provide analytical results at or below the regulatory comparison criteria.

Quantitation limits are a compromise between analytical sensitivity and precision. Setting low TMRLs and PQLs can lead to poorly defensible data due to false positive (Type I) errors, whereas elevated TMRLs and PQLs can hamper site characterization. Laboratory determinations of MDL are performed on nontypical samples (e.g., distilled water) leading to idealized (and low) limits. Confidence in detection limits increases with instrument signal level above the MDL, and higher limits mean better precision in the analytical results.

For this project, analytical results will be reported by the laboratory according to rules that provide established certainty of detection and quantitation limits. The result for an analyte will be flagged with a "U" if that analyte is not detected (i.e., is not present at a concentration above the limit of measurement). The associated numerical value will be

the sample quantitation limit (SQL) based on the MDL as adjusted for sample characteristics such as dilutions or percent moisture, and laboratory judgment. If an analyte is present at a concentration between the MDL and the TMRL or PQL, the analytical result will be flagged with a "J" indicating an estimated quantity. If an analyte is not present at a concentration between the MDL and the TMRL or PQL, the analytical result will be flagged with a "UJ" indicating that the SQL is an estimated quantity. Qualifying the result as an estimated concentration reflects increased certainty in the reported value.

As shown in Table 2-2 and QAPP Worksheet 15 (soil and water), the TMRLs or PQLs for several analytes are above the regulatory comparison criteria. Regardless of the specified limits, the actual limits reported by the laboratory may be different. The actual limits will be sample-specific, especially in the case of soil samples, samples having complex matrices, or samples containing numerous analytes with widely differing concentration ranges. The OU-2 C RI report will provide a summary of analytes with one or more detection or reporting limits exceeding the regulatory comparison criteria. An evaluation of these analytes will also be presented in the RI report as part of the discussion of the nature and extent of contamination.

2.5 QUALITY CONTROL

QA/QC checks will be employed to evaluate the performance of field and laboratory analytical procedures. QA/QC samples introduced into sample collection, transport, and analytical streams will be used to evaluate sampling precision and accuracy and to verify that sampling, decontamination, packaging, and shipping procedures are not introducing variables that could compromise the validity of sampling data. The number and types of QC samples to be collected are discussed below and are listed in QAPP Worksheet 20.

Laboratory analytical QA/QC procedures will satisfy requirements established by the Navy Installation Restoration Chemical Data Quality Manual (NFESC 1999), the CLEAN Program Technical Specification for Analytical Laboratory Services (BNI 2004a), and U.S. EPA method-specific criteria. The laboratory QA program will provide procedures for QC samples, instrument calibration, preventive maintenance, internal QC checks and corrective action, and data review and reporting.

2.5.1 Field Quality Control Samples

Field QC samples for this project will include field duplicates, trip blanks, equipment rinsate blanks, and source water blanks as appropriate.

2.5.1.1 FIELD DUPLICATES

Field duplicates are two samples of the same matrix, collected at the same location and time (to the extent possible), with an assumed level of overall homogeneity within the sample matrix. The same sampling techniques and analytical methods are performed on both samples. Analysis of field duplicates provides a quantitative measure of the precision of the overall sampling and analysis process as the sum of contributions from sample heterogeneity, the precision of the sampling process, and the analytical method(s).

Duplicate groundwater samples will be collected at a frequency of one duplicate for every ten discrete groundwater samples, and one duplicate for every ten monitoring well samples. Due to the heterogeneity of the soil sample matrices, true field duplicates cannot be collected. No field duplicates will be collected for soil samples.

2.5.1.2 TRIP BLANKS

Trip blanks are used to detect contamination introduced during sample handling and shipment. They are prepared by the laboratory using contaminant-free, reagent-grade water and are shipped to the field with the sample containers. They are not opened in the field and are returned to the laboratory in every sample cooler containing VOC samples.

2.5.1.3 EQUIPMENT RINSATE BLANKS

Equipment rinsate blanks are samples of contaminant-free water that is passed through or over decontaminated field sampling equipment. They are used to assess the adequacy of the decontamination process as well as possible cross-contamination from handling, storage, shipment, and/or analysis. Equipment rinsate blanks will be collected at a minimum of one set (for all parameters of concern) per day for nondedicated equipment.

2.5.1.4 SOURCE WATER BLANKS

Source water blanks are used to assess the potential for contamination to be introduced during the final decontamination process. One blank from each source water location will be collected and analyzed for the same parameters as the related samples. Source water blank samples are from the same contaminant-free water used in rinsate blanks, but are not passed over sampling equipment.

2.5.2 Laboratory Quality Control Analyses

A laboratory control sample or method blank spike sample and a method blank will be analyzed with each analytical/QC batch containing a total of 20 project samples or less. A matrix spike and a matrix spike duplicate will be submitted for organic analyses at a frequency of one set per 20 environmental samples or one per analytical/QC batch of analyzed samples, whichever is more frequent. A matrix spike and an unspiked matrix duplicate will be submitted for metals analyses and all applicable inorganic analyses at a frequency of one set per 20 environmental samples. Surrogates will be added to all samples for organic analyses, as applicable.

2.5.3 Laboratory Quality Control Acceptance Criteria

At a minimum, the laboratory will maintain control charts for laboratory control sample analyses and will generate acceptance limits on the basis of historical recoveries in accordance with the Laboratory Technical Specification (BNI 2004a). The acceptance limits for the method blank will be the detection limit. The laboratory will comply with limits for matrix spike recoveries, duplicate and matrix spike duplicate precision, and surrogate recoveries in accordance with the Laboratory Technical Specification

programmatic analytical DQOs or U.S. EPA methods. Table 2-3 presents the accuracy and precision criteria for the methods to be used in this project.

The laboratory will take corrective action as required in the Laboratory Technical Specification (BNI 2004a) to correct or address out-of-control events. Such actions may include sample reextraction and/or reanalysis. Noncompliant QC results attributed to sample matrix effects will be documented and noted in the laboratory reports.

2.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

Laboratory instrument/equipment testing, inspection, and maintenance will be performed in accordance with SOP 6, Instrument Calibration and Use (BNI 2004b), and the Laboratory Technical Specification (BNI 2004a).

2.7 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

Laboratories are required to document instrument calibration procedures according to Section 4.6 of the Laboratory Technical Specification (BNI 2004a). Calibration of field equipment and instrumentation, and frequency of calibration, will be in accordance with relevant CLEAN Program SOPs. Rented field equipment will be calibrated by rental companies in accordance with the manufacturer's instructions, prior to being shipped to field personnel.

2.8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

The CTO Leader will be responsible for identifying and procuring supplies necessary for the project and for determining acceptance criteria for these items. The CTO Leader and the Laboratory Services Supervisor (LSS) will be responsible for coordination with the analytical laboratory and ensuring that appropriate sample containers are received. The field crew will visually inspect the bottles, jars, and any other sampling containers received from the laboratory. If the containers or packaging appears to be damaged or tampered with, the containers will be rejected. The CTO Leader will also be responsible for receipt and inspection of all equipment used on the project. Containers of distilled or deionized water to be used on-site for field blanks and/or decontamination will be inspected by field personnel prior to use to ensure that caps and seals have not been broken or tampered with. Drums and bins for containment of IDW will be visually inspected by the field crew for integrity and will be refused if found to be damaged or otherwise unacceptable.

PVC well construction material will be inspected by the field crew to confirm its receipt in factory-sealed plastic bags. If a bag is compromised, the material will be refused.

2.9 NONDIRECT MEASUREMENTS

All nondirect measurement data will be reviewed completely for usability. The nondirect measurement data expected to be used include:

- historical soil and contaminant-specific data from previous site assessments and monitoring reports, and
- background soil concentration ranges for metals.

Before these data are used, the LSS will review associated SOPs to determine compliance with CLEAN Program standards and inspect accompanying verification data. The Project Manager is responsible for obtaining approval from the LSS.

2.10 DATA MANAGEMENT

Data management procedures are established by the CLEAN Program DMP (BNI 1993). Requirements for hard copy and electronic data deliverables are detailed in the Laboratory Technical Specification (BNI 2004a). Electronic deliverables to be loaded into the Bechtel Environmental Integrated Data Management System will also be submitted. Required project field and analytical data will be submitted to the Navy in accordance with Navy Environmental Work Instruction No. 6 (NAVFAC Southwest 2005). Project-specific modifications are incorporated into the project DMP presented as Attachment B to the Work Plan.

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Section 3
ASSESSMENT AND OVERSIGHT

QA oversight, performance and system audits, and corrective actions will be conducted in accordance with the CLEAN Program Quality Control Management Plan (BNI 1998b), which describes the responsibilities to be fulfilled by CLEAN Program personnel and subcontractors to attain the designed level of quality. CLEAN Program or Navy personnel will evaluate compliance of the laboratory QA program and procedures with Navy Installation Restoration Chemical Data Quality Manual requirements (NFESC 1999). Oversight will include internal and external audits, documentation of findings, and reports of corrective action.

3.1 ASSESSMENTS AND RESPONSE ACTIONS

Audits and surveillances will be conducted to assure that work is accomplished by trained personnel using approved procedures. Corrective actions will be identified, tracked, and closed out in a timely manner.

3.1.1 Performance and System Audits

Performance and system audits will be conducted by the Quality Manager, who will be assisted by various technical experts not directly responsible for accomplishing the work being reviewed. Field sampling and administrative activities will be audited. Analytical laboratories will be audited annually (approximately) by BEI or the Navy in accordance with the Navy Installation Restoration Chemical Data Quality Manual process (NFESC 1999), and reports will be provided to BEI and Navy management. Audits may be scheduled or unscheduled and will be conducted commensurate and in coordination with work activities.

3.1.2 Corrective Actions

Project activities that are found to be in noncompliance with quality requirements and cannot be resolved in the normal course of verification activities will be appropriately documented in accordance with approved procedures. Corrective action requests will be used to document noncompliance, corrective action commitments, and resolutions.

Corrective action will not be complete until the problem has been solved effectively and permanently. Follow-up action to assure that the problem remains corrected will be an important step in the corrective action process.

3.2 REPORTS TO MANAGEMENT

Monthly QA reports will be provided to CLEAN Program management. These reports will discuss the project's current status (including results of performance and system audits), results of data quality assessments, and problems and methods to resolve these problems. In addition, data quality assessment results for the project will be summarized and reported in the QA section of the semiannual and annual monitoring reports.

3.2.1 Quality Assurance Implementation

The CLEAN Program Quality Manager will assist the Navy Quality Assurance Officer (QAO) in documenting QA implementation. Documentation will provide evidence of compliance with specific QA activities required by this SAP, such as conduct of field audits.

3.2.2 SAP Revision or Amendment

When circumstances arise that impact the original project DQOs (such as a significant change in work scope), this SAP will be revised or amended. The modification process will be based on U.S. EPA guidelines and direction from the Navy RPM and QAO.

3.2.3 Data Quality Assessment

The data quality assessment process includes analytical data review by the project chemist, data verification of hard copy and electronic results, independent data validation, and evaluation of overall data in terms of precision, accuracy, representativeness, completeness, and comparability (PARCC) criteria. Data evaluation will include an assessment of the results from field QC samples such as trip, equipment rinsate, and source water blanks.

Section 4
DATA VALIDATION AND USABILITY

Data quality management includes data review, verification, validation, and assessment; preventive maintenance; and corrective actions as described in this section.

4.1 DATA REVIEW, VERIFICATION, AND VALIDATION

Data validation and usability will be controlled through the review, verification, and validation processes described below.

4.1.1 Data Review

Project staff will review data for internal and external consistency in accordance with the CLEAN Program Technical Specification for Data Validation Services (BNI 1998c). CLEAN Program Procedures (BNI 2004b) for performance, system audits, and corrective action oversight will be used.

Requirements for performing laboratory analyses will be specified in technical services subcontracts under which the work will be performed. The subcontracts will specify deliverable requirements, turnaround time, and performance standards. Receipt of the deliverables will be verified during the contract compliance screening. Data packages will be reviewed against a checklist prepared on the basis of the subcontract and the project-specific needs. Outstanding items will be resolved before the project is closed.

4.1.2 Data Verification

Field and laboratory data will be managed using manual and electronic systems. Data stored, evaluated, and reported electronically will be subject to 100 percent manual verification against hard copy data reports. Discrepancies will be corrected and documented following the CLEAN Program DMP (BNI 1993).

4.1.3 Data Validation

Laboratory results will be subjected to third-party validation in accordance with the CLEAN Technical Specification for Data Validation Services (BNI 1998c). Laboratory data validation requirements are described in Southwest Division Naval Facilities Engineering Command (SWDIV 2001) and U.S. EPA (1999, 2004a) guidance documents. Laboratory Data Consultants (LDC) in Carlsbad, California, will perform the validation.

Level IV data validation follows the U.S. EPA protocols and CLP criteria set forth in the functional guidelines for evaluating organic and inorganic analyses (U.S. EPA 1999, 2004). Calculations will be checked for QC samples (e.g., matrix spike/matrix spike duplicate and laboratory control sample data) and routine field samples (including field duplicates, field and equipment rinsate blanks, and VOC trip blanks). To assure that detection limits and data values are appropriate, the instrument performance, method of calibration, and original data for calibration standards will be evaluated.

For a Level III data validation effort, data values for routine and QC samples will be assumed to be correctly reported by the laboratory. Data quality will be assessed by comparing the QC parameters listed above with the appropriate criteria (or limits) as specified in this SAP, by CLP requirements, or by method-specific requirements (e.g., CLP or SW-846).

Fixed-base laboratory data will be subjected to a data validation strategy appropriate for the intended use of the data.

LDC will perform a Level III data validation on 90 percent of the laboratory data and a Level IV data validation on the remaining 10 percent. The sampling data that receive Level IV validation will be selected randomly to obtain a representative data set, unless review of the first round of sampling data suggests focused data validation of specific sampling locations.

4.2 VERIFICATION AND VALIDATION METHODS

The data quality assessment process will encompass data validation and internal technical data review to evaluate the entire data set for the project. The assessment will consider each type of data, the relationship to the entire data set, and the adequacy of the data to fulfill the DQOs of the sampling event or project. Data sets will be assessed for completeness and compliance to method-specific or project-specific QA/QC requirements, which include independent data validation results. Data validation will compare the DQOs to the actual level of data quality obtained through evaluation of the PARCC criteria and other method performance requirements, and determine data usability for the intended purpose(s) as described below.

4.2.1 Precision and Accuracy

The assessment procedures in this section are designed to review data for the two types of QC samples to be performed: spikes and blanks.

4.2.1.1 SPIKES

The procedure for assessing spikes will be as follows.

1. Calculate the percent recovery as shown below for each sample:

   $$\textit{Percent Recovery} = [(t-x)/a] \times 100\%$$

   where

   t = total concentration found in the spiked sample
   x = original concentration in sample prior to spiking
   a = actual spike concentration added to the sample

2. Qualitatively evaluate the significance of data that fall outside the recovery limits along with associated sample data (per data validation process).

4.2.1.2 BLANKS

The evaluation procedure for blanks may involve a qualitative review of laboratory analytical data. If chemicals are detected in blank samples, the assessment procedure will be as follows.

1. The laboratory will determine the nature and source of the contamination problem.
2. The compound(s) and concentration(s) detected will be reported, and the data will be assessed for potential misinterpretation or high bias (per the data validation process).

Laboratory method blank data will be quantitatively evaluated during the data validation process. Field blank data will be evaluated using the Risk Assessment Guidance for Superfund (U.S. EPA 1989). This guidance provides specific rules on data evaluation and editing data sets with respect to the presence of laboratory and field-based contamination. Field blanks will be evaluated during the internal data evaluation process, and data qualifiers will be applied where appropriate.

4.2.2 Representativeness

Representativeness is the reliability with which a measurement or measurement system reflects the true conditions under investigation. Representativeness is influenced by the number and location of sampling points, sampling timing and frequency of monitoring efforts, and field and laboratory procedures.

4.2.3 Completeness

Data completeness is expressed as the ratio of the amount of usable, valid data versus the total amount of data planned to be collected. Valid data must constitute 95 percent of the total data collected. The data validation process and the data quality assessment determine whether data are valid and usable or rejected. Data completeness is defined as follows:

$$\textit{Percent Complete} = (v/t) \times 100\%$$

where

v = number of valid measurements
t = total number of planned measurements

4.2.4 Comparability

Comparability expresses the confidence with which one data set can be compared to another based on U.S. EPA-defined procedures, where available.

4.3 RECONCILIATION WITH USER REQUIREMENTS

Field and laboratory data will be managed using manual and electronic systems. Data stored, evaluated, and reported electronically will be subject to 100 percent manual

verification against hard copy data reports. Discrepancies will be corrected and documented following the CLEAN Program DMP (BNI 1993).

If QA/QC audits or reviews of data indicate unacceptable data, samples will be reanalyzed if holding-time criteria permit. If the requirements are not met following reanalysis, the LSS will be responsible for developing and initiating corrective action. The Quality Manager will be responsible for assessing whether the selected corrective action is adequate.

Corrective action may include reanalyzing samples (if holding-time criteria permit), resampling and analyzing, evaluating and amending established sampling and analytical procedures, or reevaluating DQOs.

Section 5
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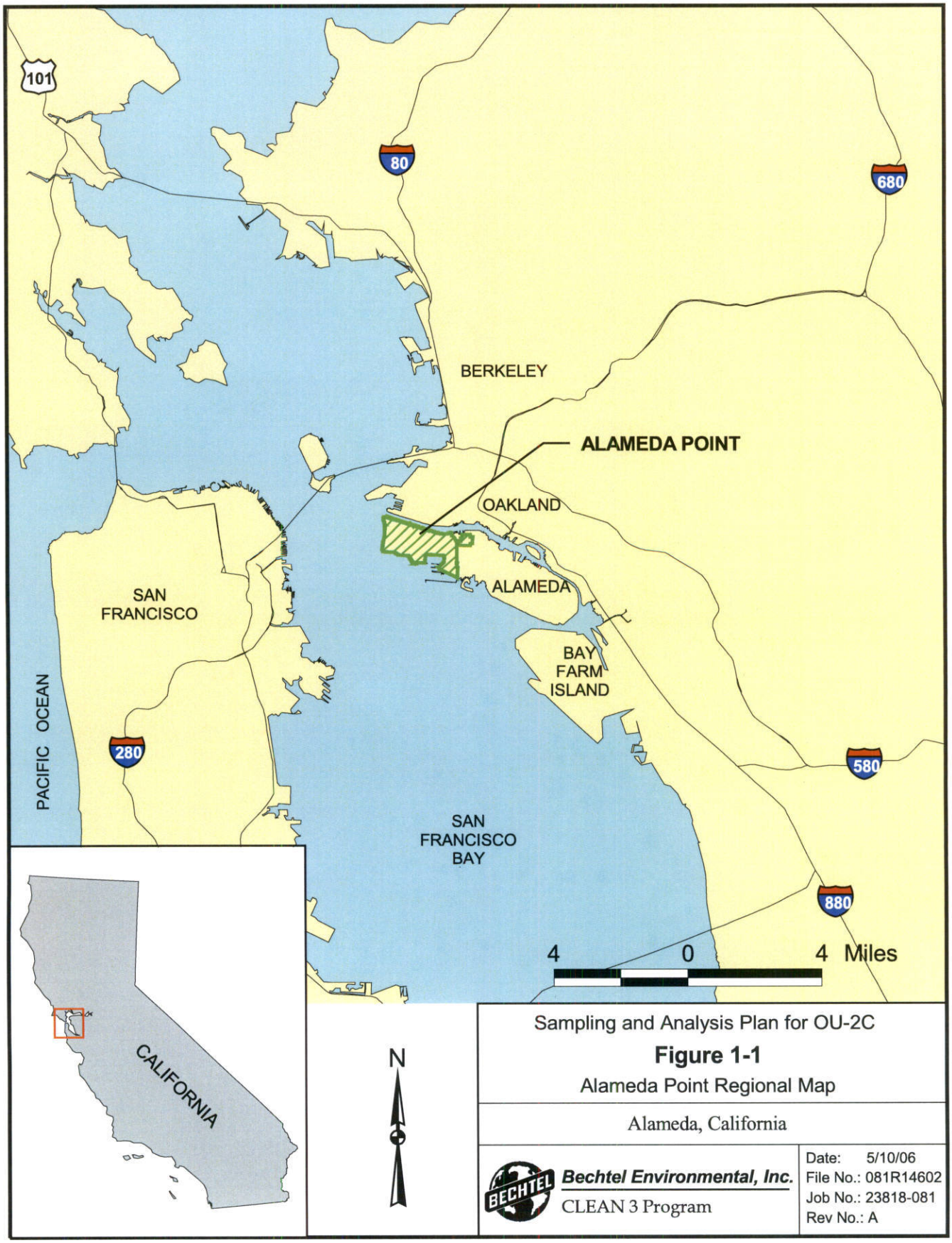


Sampling and Analysis Plan for OU-2C

Figure 1-1

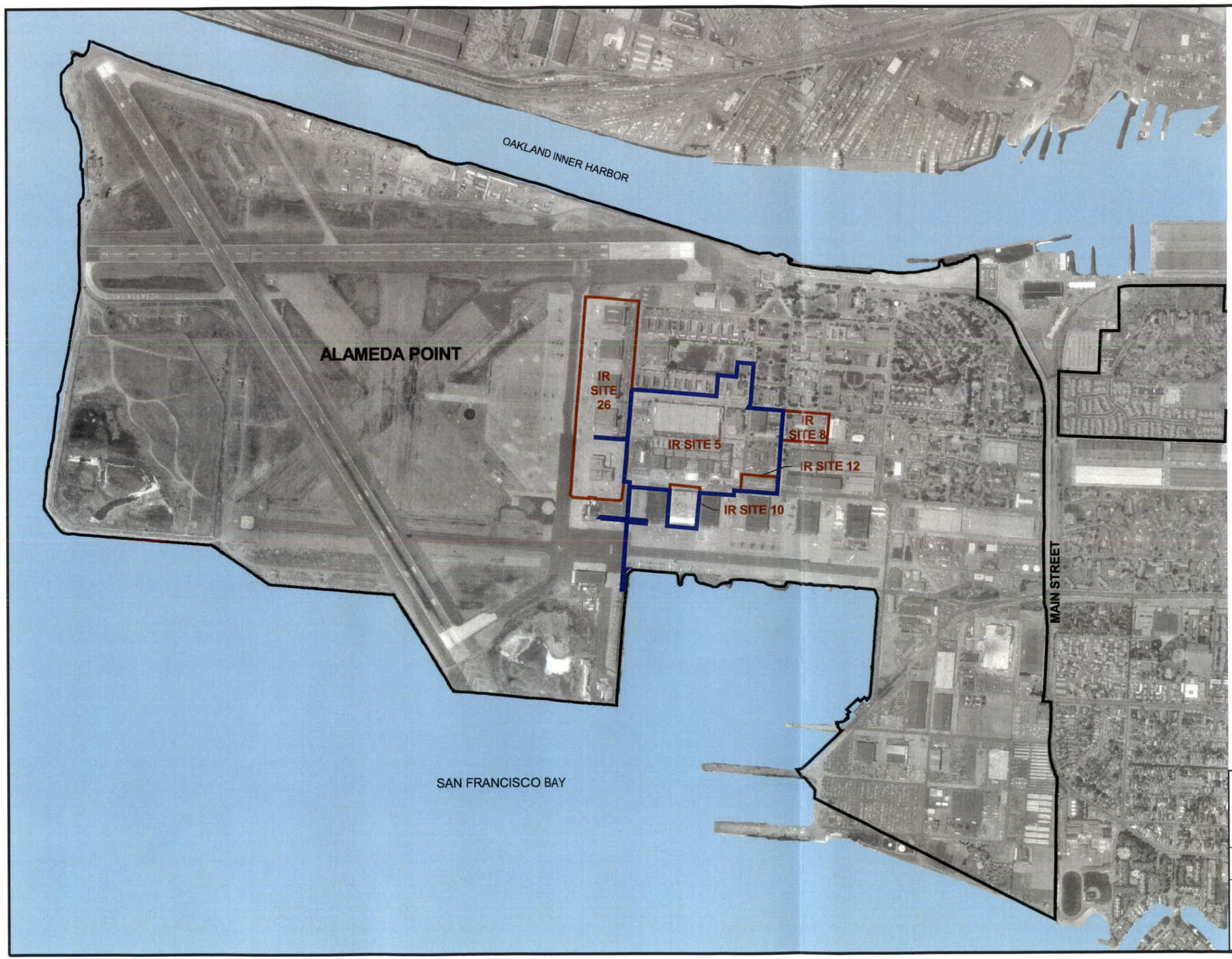
Alameda Point Regional Map

Alameda, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 5/10/06
File No.: 081R14602
Job No.: 23818-081
Rev No.: A



LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- NAVY ONSHORE PROPERTY BOUNDARIES
- WATER

NOTES:

IR – INSTALLATION RESTORATION (PROGRAM)

OU – OPERABLE UNIT

N

1200 0 1200 Feet

Sampling and Analysis Plan for OU-2C

Figure 1-2

Site Location Map

Alameda, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 5/10/06
File No.: 081L14605
Job No.: 23818-081
Rev No.: A

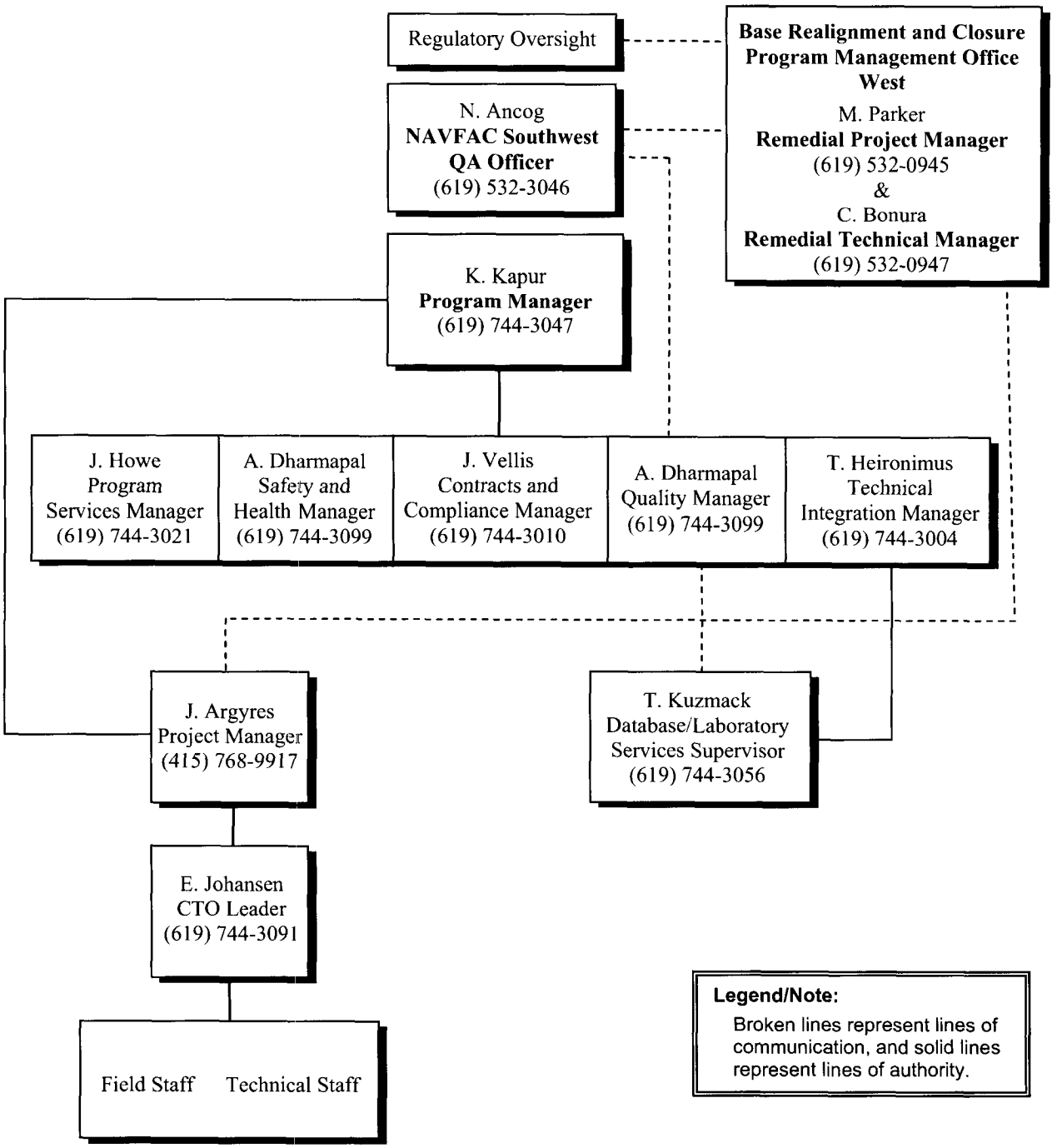
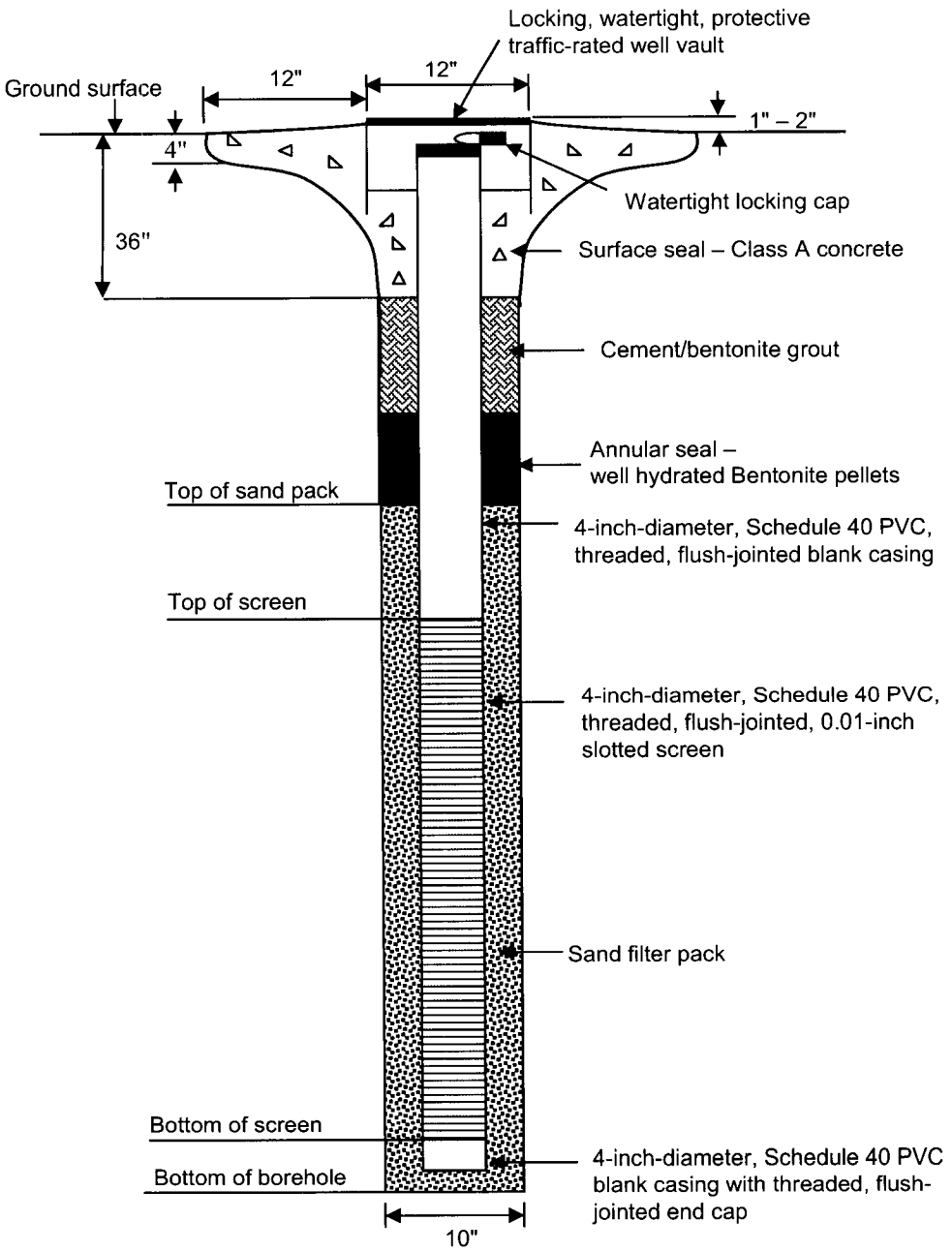


Figure 1-3
Project Organization Chart

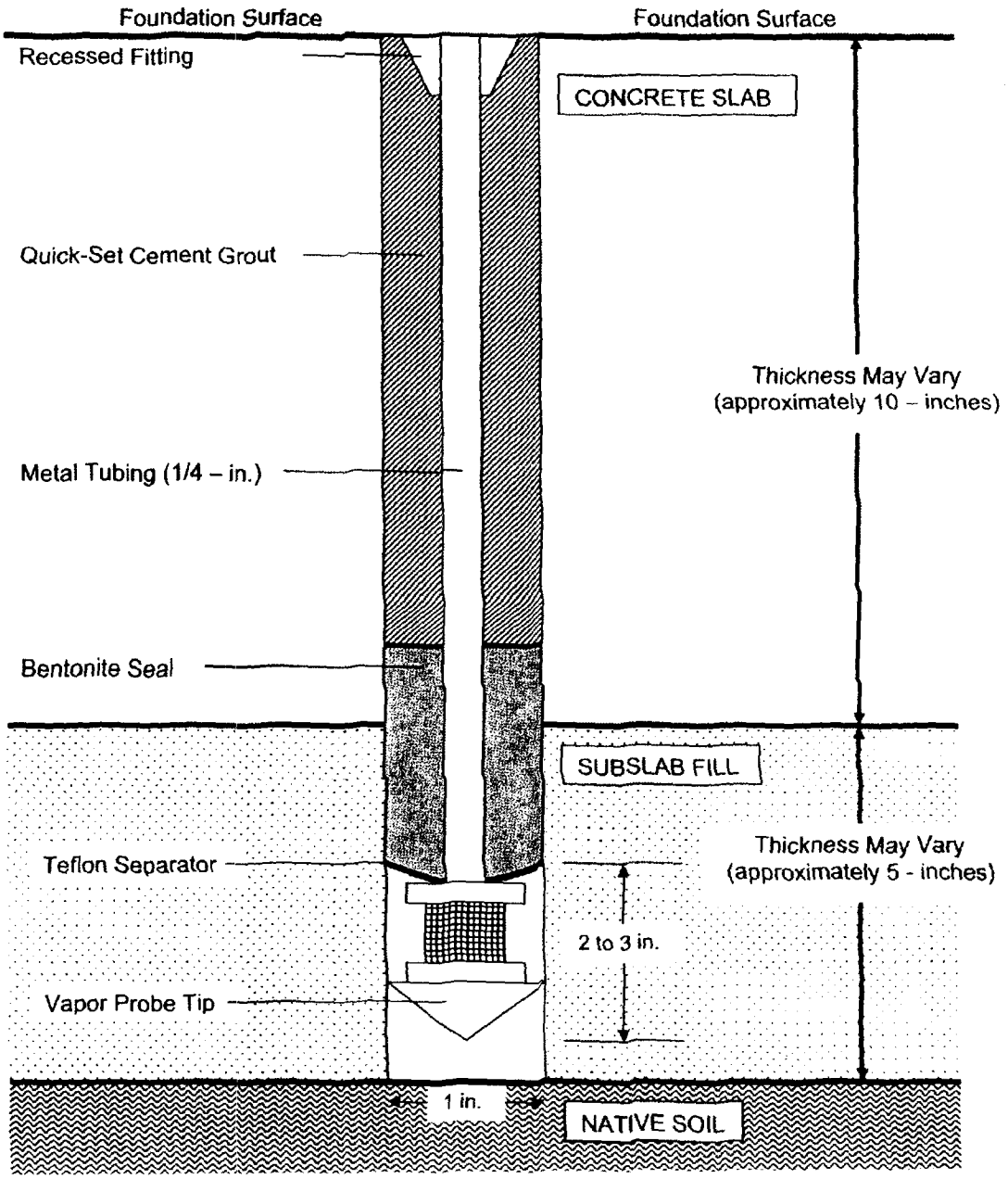
Revised 04/06/07



Not to Scale

Note:
PVC – polyvinyl chloride

Figure 2-1
Conceptual Groundwater Monitoring Well Construction Diagram



Not to Scale

Figure 2-2
Subslab Soil Gas Probe Diagram

LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- 140 EBS PARCEL AND EBS PARCEL NUMBER
- CORRECTIVE ACTION AREA
- ROAD OR PAVED AREA
- 68 BUILDING OR STRUCTURE (PRESENT)
- BUILDING OR STRUCTURE (REMOVED)
- TANK FOOTPRINT
- CATCH BASIN
- MANHOLE
- STORM DRAIN
- ABANDONED STORM DRAIN
- INDUSTRIAL WASTEWATER LINE
- CHROMIUM WASTEWATER LINE
- CYANIDE WASTEWATER LINE
- APPROXIMATE LOCATION OF RAILROAD
- APPROXIMATE LOCATION OF FENCE
- 10,000 µg/L VOC CONCENTRATION CONTOUR
- EXISTING MONITORING WELL
- ABANDONED (OR SCHEDULED TO BE ABANDONED) MONITORING WELL WITH WELL ID
- SUB SLAB SOIL GAS SAMPLING LOCATION AND STATION ID
- EXISTING FENCELINE AND LABELS FOR 6-PHASE HEATING REMOVAL ACTION

N

NOTES :

AST – ABOVEGROUND STORAGE TANK
EBS – ENVIRONMENTAL BASELINE SURVEY
IR – INSTALLATION RESTORATION (PROGRAM)
IWTP – INDUSTRIAL WASTE TREATMENT PLANT
µg/L – MICROGRAMS PER LITER
OU – OPERABLE UNIT
VOC – VOLATILE ORGANIC COMPOUND

100 0 100 Feet

Sampling and Analysis Plan for OU-2C

Figure 2-3

Subslab Soil Gas Sampling Grid

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 4/9/07
File No.: 093L15362
Job No.: 23818-093
Rev No.: E

Table 1-1
Key Personnel

Name	Organization	Role	Responsibilities	Contact Information
Mary Parker	BRAC Program Management Office West	Remedial Project Manager	Directly responsible for project execution and coordination with regulatory agencies and the BRAC management team	BRAC Program Management Office West, San Diego, California mary.parker@navy.mil (619) 532-0945
Carl Bonura	BRAC Program Management Office West	Remedial Technical Manager	Directly responsible for project technical issues, including review of all relevant documents prepared as part of this CTO	BRAC Program Management Office West, San Diego, California carl.bonura@navy.mil (619) 532-0947
Narciso Ancog	NAVFAC Southwest	QA Officer	Provides government oversight of the QA program, including review and sign-off of SAPs; provides quality-related direction to the CLEAN Program Quality Manager; has authority to suspend affected projects or site activities if NAVFAC Southwest-approved quality requirements are not maintained	Naval Facilities Engineering Command Southwest, San Diego, California narciso.ancog@navy.mil (619) 532-3046
Gregory Grace	Navy ROICC San Francisco Bay Area	ROICC Project Engineer	Supervises construction projects; ensures the health and safety of workers, residents, and visitors on the base; coordinates the fieldwork of all contractors who perform daily activities at Alameda Point	Navy ROICC Alameda, California gregory.grace@navy.mil (510) 749-5940
Doug DeLong	DoD BRAC Program Management Office	Environmental Compliance Manager	Coordinates fieldwork at Alameda Point with the City of Alameda and local community (residents, business owners, tenants, and operators); notifies off-site authorities in the event of a spill	DoD BRAC Program Management Office San Francisco, California douglas.delong@navy.mil (415) 743-4713
Krish Kapur	BEI	Program Manager	Responsible for all aspects of the CLEAN Program, including assigning adequate resources to complete the work, to conduct technical reviews of deliverables, and to perform field operations	Bechtel Environmental, Inc. San Diego, California kkapur@bechtel.com (619) 744-3047
Janet Argyres	BEI	Project Manager	Supervises all work performed at Alameda Point under the CLEAN Program contract, including project planning, scheduling, staffing, executing tasks and subcontracts, and managing deliverables	Bechtel Environmental, Inc. San Francisco, California jlargyre@bechtel.com (415) 768-9917

Table 1-1 (continued)

Name	Organization	Role	Responsibilities	Contact Information
Eric Johansen	BEI	CTO Leader	Responsible for day-to-day supervision of staff and coordination of tasks for CTO project completion; responsible for production of deliverables, oversight of data review and management, and QA	Bechtel Environmental, Inc. San Diego, California eajohans@bechtel.com (619) 744-3091
Anil Dharmapal	BEI	Quality Manager	Responsible for developing the QA process and supervising audits of projects for compliance with program procedures and specifications; has the authority to suspend site or project activities if quality standards are not maintained	Bechtel Environmental, Inc. San Diego, California apdharma@bechtel.com (619) 744-3099
Tim Heironimus	BEI	Technical Integration Manager	Oversees the technical quality of project deliverables; provides quality control; responsible for technical staffing and innovative technologies	Bechtel Environmental, Inc. San Diego, California tlheiron@bechtel.com (619) 744-3004
Anil Dharmapal	BEI	Safety and Health Manager	Responsible for developing and implementing the Program Safety and Health Plan and project- or CTO-specific modifications and amendments	Bechtel Environmental, Inc. San Diego, California apdharma@bechtel.com (619) 744-3099
Jim Howe	BEI	Program Services Manager	Assists the CTO Leader and the Project Manager by reporting on project budgets, schedules, and costs	Bechtel Environmental, Inc. San Diego, California jghowe@bechtel.com (619) 744-3021
Jack Vellis	BEI	Contracts and Compliance Manager	Responsible for solicitation, selection, and award and management of purchase orders and subcontracts for services and materials required for the project	Bechtel Environmental, Inc. San Diego, California jdvellis@bechtel.com (619) 744-3010
Toni Kuzmack	BEI	Database/Laboratory Services Supervisor	Responsible for management of the database, which is the repository of data gathered in the course of the project; responsible for selection, coordination, technical oversight, and management of analytical laboratory and data validation subcontracts and services	Bechtel Environmental, Inc. San Diego, California amkuzmac@bechtel.com (619) 744-3056

Table 1-1 (continued)

Acronyms/Abbreviations:

BEI – Bechtel Environmental, Inc.
BRAC – Base Realignment and Closure
CLEAN – Comprehensive Long-Term Environmental Action Navy
CTO – contract task order
DoD – Department of Defense
NAVFAC – Naval Facilities Engineering Command
QA – quality assurance
ROICC – Resident Officer in Charge of Construction
SAP – sampling and analysis plan

Table 1-2
Supplemental Remedial Investigation Activities and Rationales for OU-2C: Piezometers and Monitoring Wells

Study Area/ EBS Parcel	Description of Well Locations [Well ID]	Total No. of Sampling Locations	NO. OF SAMPLES PER MEDIUM		ANALYSES FOR SOIL SAMPLES	ANALYSES FOR GW SAMPLES U.S. EPA Method												GW Sampling Depth Intervals (feet bgs)	Rationale
			Soil	GW	Geotech[a]	VOCs	TPH	SVOCs including 1,4-Dioxane (no PAHs)	1,4-Dioxane only	PAHs	PCBs	Metals	Hexavalent Chromium	Mercury	Cyanide	TDS	General Water Quality Parameters[a]		
						5035A/ 8260B	8015-M, 8015B-M	8270C	8270C	8270C SIM	8082	6010B/ 7000	7196A	1631	9010B	160.1			
Evaluation Area 1 – GW																			
	Piezometers/ piezometer pairs near Seaplane Lagoon and west of OU-2C	8	0	0														10–15, 25–30	Data gap for groundwater flow direction and tidal influence; water level measurements only
45A	See Evaluation Area 2																		
47	New wells west of Building 5 [M05-13, L05-01]	2	2	2	2	2	2	2		2	2	2[b]	2	2	2	2	2	10–15, 25–30	Data gap for western extent of VOCs in FWBZ; data gap for mercury at down gradient margin of site; full suite of analytes for new wells; soil from hollow-stem auger boring at well screen depth for each well
48	New wells west of Building 5, adjacent to existing well M05-02 [L05-02, D05-09]	2	0	2		2	2	2		2	2	2[b]	2	2	2	2	2	25–30, 60–70	Data gap for western extent of VOCs in lower FWBZ and SWBZ; data gap for mercury at downgradient margin of site; full suite of analytes for new wells
48	Existing well west of Building 5 [M05-02[c]]	1	0	1		1			1			1[b]	1	1	1			10–15	Data gap for 1,4-dioxane, hexavalent chromium, and cyanide in FWBZ; data gap for mercury at down gradient margin of site; VOC analysis included for temporally consistent data
49	New wells west of Building 5 [M05-14, L05-03]	2	0	2		2	2	2		2	2	2[b]	2	2	2	2	2	10–15, 25–30	Data gap for western extent of VOCs in FWBZ; data gap for mercury at down gradient margin of site; full suite of analytes for new wells
49	Existing wells west of Building 5 [M05-06[c], D05-03[c]]	2	0	2		2	2[c]		2			2[b]	2	2	2			10–15, 60–70	Data gap for 1,4-dioxane, hexavalent chromium, and cyanide in FWBZ and SWBZ; data gap for mercury at down gradient margin of site; VOC analysis included for temporally consistent data
54	New wells inside Building 5 [M05-15, L05-04]	2	2	2	2	2	2	2		2	2	2	2		2	2	2	10–15, 25–30	Data gap for extent of VOCs in FWBZ downgradient of source area; full suite of analytes for new wells; soil from hollow-stem auger boring at well screen depth for each well

Table 1-2 (continued)

Study Area/ EBS Parcel	Description of Well Locations [Well ID]	Total No. of Sampling Locations	NO. OF SAMPLES PER MEDIUM		ANALYSES FOR SOIL SAMPLES	ANALYSES FOR GW SAMPLES U.S. EPA Method												GW Sampling Depth Intervals (feet bgs)	Rationale
			Soil	GW	Geotech[a]	VOCs	TPH	SVOCs including 1,4-Dioxane (no PAHs)	1,4-Dioxane only	PAHs	PCBs	Metals	Hexavalent Chromium	Mercury	Cyanide	TDS	General Water Quality Parameters[a]		
						5035A/ 8260B	8015-M, 8015B-M	8270C	8270C	8270C SIM	8082	6010B/ 7000	7196A	1631	9010B	160.1			
54	Existing well inside of Building 5 [D05-04[c]]	1	0	1		1			1			1	1		1	1[c]	1[c,d]	60–70	Data gap for 1,4-dioxane, hexavalent chromium, and cyanide in SWBZ; VOC analysis included for temporally consistent data
54	New wells east of Building 5 [M05-16, L05-05]	2	2	2	2	2	2	2		2	2	2	2		2	2	2	10–15, 25–30	Data gap for extent of VOCs in FWBZ in potential source area; full suite of analytes for new wells; soil from hollow-stem auger boring at well screen depth for each well
54	Existing wells north of Building 5 [M05-01, M05-09[c], D05-01[c]]	3	0	3		3	2[c]		3			3	3		3	2[c]	2[c,d]	10–15, 60–70	Data gap for 1,4-dioxane, hexavalent chromium, and cyanide in FWBZ and SWBZ; VOC analysis included for temporally consistent data; VOC analysis included for temporally consistent data
54	Existing well south of Building 5 [M05-03]	1	0	1		1	1		1			1	1		1			10–15	Data gap for 1,4-dioxane, hexavalent chromium, and cyanide in FWBZ; data gap related to previous detection of TPH-gasoline and VOCs
59	New well northeast of Building 5 adjacent to existing well M05-05 [L05-06]	1	0	1		1	1	1		1	1	1	1		1	1	1	25–30	Data gap for extent of VOCs in FWBZ; full suite of analytes for new wells
59	Existing wells northeast of Building 5 [M05-05[c], D05-05[c]]	2	0	2		2	1[c]		2			2	2		2	2[c]	2[c,d]	10–15, 60–70	Data gap for 1,4-dioxane, hexavalent chromium, and cyanide in FWBZ and SWBZ; VOC analysis included for temporally consistent data
54	Existing wells east of Building 5 (if present) [P-5-1-MW4S, P-5-1-MW4I, P-5-1-MW4D]	3	0	3		3			3			3	3		3			10–15, 18–22, 25–30	Data gap for extent of VOCs in FWBZ in former Plume 5-1 area (if wells still existing)

Table 1-2 (continued)

Study Area/ EBS Parcel	Description of Well Locations [Well ID]	Total No. of Sampling Locations	NO. OF SAMPLES PER MEDIUM		ANALYSES FOR SOIL SAMPLES	ANALYSES FOR GW SAMPLES U.S. EPA Method												GW Sampling Depth Intervals (feet bgs)	Rationale
			Soil	GW	Geotech[a]	VOCs	TPH	SVOCs including 1,4-Dioxane (no PAHs)	1,4-Dioxane only	PAHs	PCBs	Metals	Hexavalent Chromium	Mercury	Cyanide	TDS	General Water Quality Parameters[a]		
						5035A/ 8260B	8015-M, 8015B-M	8270C	8270C	8270C SIM	8082	6010B/ 7000	7196A	1631	9010B	160.1			
57 and 53A/70	New wells south of Building 5: [M05-19, M05-20]	2	0	2		2	2	2		2	2	2	2		2	2	2	10–15, 25–30	Data gap for extent of VOCs in FWBZ south of Building 5 in the vicinity of former Building 348 and at the upgradient margin of the OU-2C VOC plume; full suite of analytes for new wells
52 or 54	Existing well north of Building 400 [400MJ-MW2 or 400MJ-MW3]	1	0	1		1			1			1	1		1				Data gap for extent of VOCs in FWBZ south of Building 5 in the vicinity of historical discrete groundwater sampling points; and data gap for 1,4-dioxane, hexavalent chromium, and cyanide in FWBZ
	Total New Wells	**13**	**6**	**13**	**6**	**13**	**13**	**13**	**0**	**13**	**13**	**13**	**13**	**6**	**13**	**13**	**13**		
	Total Existing Wells	**14**	**0**	**14**	**0**	**14**	**6**	**0**	**14**	**0**	**0**	**14**	**14**	**3**	**14**	**5**	**5**		
	Total Evaluation Area 1	**27**	**6**	**27**	**6**	**27**	**19**	**13**	**14**	**13**	**13**	**27**	**27**	**9**	**27**	**18**	**18**		
Evaluation Area 2																			
	TBD[e]: Wells north and south of Building 2 [M05-17, M05-18]	2	0	2		2	2	2		2	2	2	2		2	2	2	10–15	Data gap for extent of VOCs in FWBZ; full suite of analytes for new wells
	Total New Wells	**2**	**0**	**2**	**0**	**2**	**2**	**2**	**0**	**2**	**2**	**2**	**2**	**0**	**2**	**2**	**2**		
	Total Evaluation Area 2	**2**	**0**	**2**		**2**	**2**	**2**	**0**	**2**	**2**	**2**	**2**	**0**	**2**	**2**	**2**		
TOTALS		**29**	**6**	**29**	**6**	**29**	**21**	**15**	**14**	**15**	**15**	**29**	**29**	**9**	**29**	**20**	**20**		

Notes:
[a] see QAPP Worksheet 19 for geotechnical and general water quality parameter analytical methods
[b] does not include mercury for those samples also being analyzed for low-detection-limit mercury under separate analysis
[c] wells included in BGMP for which spring 2007 sampling is to be conducted under the Work Plan for Supplemental RI Sampling at OU-2C; BGMP analyses added to RI analytical list for these wells
[d] BGMP analysis for general chemistry parameters to include sulfide by U.S. EPA Method 376.2
[e] wells will be installed only if VOCs reported at concentrations exceeding MCLs in discrete groundwater samples; if not needed for Evaluation Area 2, wells may be installed at other locations (see Figure A1-17)

Table 1-2 (continued)

Acronyms/Abbreviations:
- BGMP – basewide groundwater monitoring program
- bgs – below ground surface
- EBS – environmental baseline survey
- FWBZ - first water-bearing zone
- GW – groundwater
- IR – Installation Restoration (Program)
- MCL – maximum contaminant level
- OU-2C – Operable Unit 2C
- PAH – polynuclear aromatic hydrocarbon
- PCB – polychlorinated biphenyl
- QAPP – quality assurance project plan
- SAP – sampling and analysis plan
- SVOC – semivolatile organic compound
- SWBZ – second water-bearing zone
- TBD – to be determined
- TDS – total dissolved solids
- TPH – total petroleum hydrocarbons (purgeable- and extractable-range, unless otherwise noted)
- U.S. EPA – United States Environmental Protection Agency
- VOC – volatile organic compound

Table 1-3

Supplemental Remedial Investigation Activities and Rationales for OU-2C[a]: Soil and Discrete Groundwater Samples

Study Area/ EBS Parcel	Well and Boring Locations [Boring No.]	Total No. of Sampling Locations	NO. OF SAMPLES		ANALYSES FOR SOIL SAMPLES U.S. EPA Method								ANALYSES FOR DISCRETE GROUNDWATER SAMPLES U.S. EPA Method											Soil Sampling Depth Intervals[c] (feet bgs)	GW Sampling Depth Intervals[c] (feet bgs)	Rationale
			Soil	GW	VOCs	TPH	SVOCs including 1,4-Dioxane (no PAHs)	PAHs	PCBs	Metals	Hex Chrom	Cyanide	VOCs	TPH	SVOCs including 1,4-Dioxane (no PAHs)	1,4-Dioxane only	PAHs	PCBs	Metals	Hex Chrom	Mercury	Cyanide	TDS[b]			
					5035A/ 8260B	8015-M, 8015B-M	8270C	8270C SIM	8082	6010B/ 7000	7196A	9010B	5035A/ 8260B	8015-M, 8015B-M	8270C	8270C	8270C SIM	8082	6010B/ 7000	7196A	1631	9010B	160.1			
Evaluation Area 2																										
45A	Around Building 2 [EA2SB01–B02, EA2SB05-B07]	5	10	10	10								10			10								0–0.5, 2–4	10–15, 25–30	Assess any presence of VOCs in soil and FWBZ
	Around Building 2 [EA2SB03–B04]	2	0	4									4			4									10–15, 25–30	Assess any presence of VOCs in FWBZ
Total Evaluation Area 2		**7**	**10**	**14**	**10**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**14**	**0**	**0**	**14**	**0**	**0**	**0**	**0**	**0**	**0**	**0**			
Evaluation Area 3																										
54	Western portion of EA 5 inside Building 5 [EA3SB01–B11]	11	22	0	22																			0–0.5, 2–4		Assess any presence of VOCs in soil
	Near former AST 005H[d] [EA3SB12]	1	3	2	3	3	3	3	3	3	3	3	2	2	2				2	2		2	2	0–0.5, 2–4, 4–6	10–15, 25–30	Assess any presence of VOCs in soil and any presence of TPH, SVOCs, and metals related to former AST; data gap for 1,4-dioxane, hexavalent chromium, and cyanide in soil and FWBZ; one soil sample collected at soil/water interface of FWBZ
	TBD: Within VOC removal action area [EA3SB13–B16]	4	8	0	8																			0–0.5, 2–4		Assess any presence of VOCs in soil
	Eastern Building 5 [EA3SB17–SB27]	11	22	0	22					22														0–0.5, 2–4		Assess any presence of VOCs in soil; characterize extent of metals previously detected in soil
	Along industrial wastewater lines [EA3SB28, EA3SB30–B35][e]	7	14	0	14		14			14	14	14												0–0.5, 2–4		Assess any presence of VOCs, metals, hexavalent chromium, and cyanide in soil along former industrial wastewater sewer lines
	Along industrial wastewater lines [EA3SB29, EA3SB40-41]	3	6	6	6		6			6	6	6	6			6			6	6		6		0–0.5, 2–4	10–15, 25–30	Assess any presence of VOCs, metals, hexavalent chromium, and cyanide in soil and FWBZ along former industrial wastewater sewer lines including area near former cyanide and chromium surge tanks; assess presence of cadmium, chromium, and lead in soil at southern margin of excavated area
	Along industrial wastewater line, former location of cyanide eductor sump [EA3SB42]	1	2	1	2		2			2	2	2	1			1			1	1		1		0–0.5, 2–4	4–8	Assess any presence of VOCs, metals, hexavalent chromium, and cyanide in soil and in groundwater at the soil/water interface of the FWBZ at the former location of the cyanide eductor sump along the former industrial watewater sewer line; assess presence of cadmium, chromium, and lead in soil at southern margin of excavated area
	Along industrial wastewater line, former location of chromium eductor sump within excavated area [EA3SB43]	1	0	1									1			1			1	1		1			4–8	Assess any presence of VOCs, metals, hexavalent chromium, and cyanide in groundwater at the soil/water interface of the FWBZ at the former location of the chromium eductor sump along the former industrial watewater sewer line within the excavated area
	Foundry floor drains and reddish dirt pile [EA3SB36–B37]	2	4	0	4		2	2	2	2	2	2												0–0.5, 2–4		Assess any presence of chemicals in soil at locations in foundry and heat treatment area identified during April 18, 2006 site walk
	Rubber shop former chemical tanks and chemical mixing operations [EA3SB38–B39]	2	4	0	4		2	2	2	2	2	2												0–0.5, 2–4		Assess any presence of chemicals in soil at two locations in rubber shop identified during April 18, 2006 site walk
Total Evaluation Area 3		**43**	**85**	**10**	**85**	**3**	**29**	**7**	**7**	**51**	**29**	**29**	**10**	**2**	**2**	**8**	**0**	**0**	**10**	**10**	**0**	**10**	**2**			

Table 1-3

Supplemental Remedial Investigation Activities and Rationales for OU-2C[a]: Soil and Discrete Groundwater Samples

Study Area/ EBS Parcel	Well and Boring Locations [Boring No.]	Total No. of Sampling Locations	NO. OF SAMPLES		ANALYSES FOR SOIL SAMPLES U.S. EPA Method								ANALYSES FOR DISCRETE GROUNDWATER SAMPLES U.S. EPA Method											Soil Sampling Depth Intervals[c] (feet bgs)	GW Sampling Depth Intervals[c] (feet bgs)	Rationale
			Soil	GW	VOCs	TPH	SVOCs including 1,4-Dioxane (no PAHs)	PAHs	PCBs	Metals	Hex Chrom	Cyanide	VOCs	TPH	SVOCs including 1,4-Dioxane (no PAHs)	1,4-Dioxane only	PAHs	PCBs	Metals	Hex Chrom	Mercury	Cyanide	TDS[b]			
					5035A/ 8260B	8015-M, 8015B-M	8270C	8270C SIM	8082	6010B/ 7000	7196A	9010B	5035A/ 8260B	8015-M, 8015B-M	8270C	8270C	8270C SIM	8082	6010B/ 7000	7196A	1631	9010B	160.1			
Evaluation Area 4																										
54	Aircraft Maintenance Line [EA4SB02-SB06, EA4SB8-B20; EA4SB23-B29]	25	50	0	50					50														0–0.5, 2–4		Characterize extent of metals previously detected in soil and any presence of VOCs; 12 sampling points (EA4SB03, 23, and 24; EA4SB08, 25, and 26, EA4SB12, 13, and 27; and EA4SB15, 16 and 28) specifically located within 25 feet of four EBS boring locations with elevated metals concentrations
54	Aircraft Maintenance Line [EA4SB01 and EA4SB07] one location to be adjacent to utility vault and one location to be adjacent to aircraft tie-down structure	2	6	0	6	6	6	6	6	6														0–0.5, 2–4, 4–6		Characterize extent of metals previously detected in soil and any presence of VOCs, TPH, SVOCs, PAHs, or metals; adjust sampling location to target utility vault and aircraft tie down features identified during April 18, 2006 site walk; collect one soil sample at soil/water interface of FWBZ
54	Battery Acid Shop [EA4SB21]	1	2	2	2					2	2	2	2			2			2	2		2		0–0.5, 2–4	10–15, 25–30	Assess any presence of chemicals in soil and FWBZ at locations in battery acid shop identified during April 18, 2006 site walk
54	Battery Acid Shop [EA4SB22]	1	2	0	2					2	2	2												0–0.5, 2–4		
Total Evaluation Area 4		**29**	**60**	**2**	**60**	**6**	**6**	**6**	**6**	**60**	**4**	**4**	**2**	**0**	**0**	**2**	**0**	**0**	**2**	**2**	**0**	**2**	**0**			
Evaluation Area 5																										
54	EA5SB01–B07	7	14	0	14																			0–0.5, 2–4		Assess any presence of VOCs in soil
51A	EA5SB08	1	2	0	2																			0–0.5, 2–4		Assess any presence of VOCs in soil
52	EA5SB09–B10	2	4	0	4																			0–0.5, 2–4		Assess any presence of VOCs in soil
53A	EA5SB11–B12	2	4	0	4																			0–0.5, 2–4		Assess any presence of VOCs in soil
55	EA5SB13	1	2	0	2					2	2	2												0–0.5, 2–4		Assess any presence of VOCs, metals, hexavalent chromium, and cyanide in soil
57	EA5SB14–B16[d]	3	6	0	6					4	4	4												0–0.5, 2–4		Assess any presence of VOCs in soil; characterize the extent of metals previously detected in soil
	EA5SB17	1	2	2	2					2	2	2	2			2			2	2		2		0–0.5, 2–4	10–15, 25–30	Assess extent of VOCs in soil or FWBZ at former location of Building 348; data gap for 1,4-dioxane, hexavalent chromium, and cyanide
	EA5SB20-B21	2	4	0	4																			0–0.5, 2–4		Assess any presence of VOCs in soil
54	Along industrial wastewater lines [EA5SB18–B19]	2	4	4	4		4			4	4	4	4			4			4	4		4		0–0.5, 2–4	10–15, 25–30	Assess any presence of VOCs, metals, hexavalent chromium, and cyanide in soil or FWBZ along former industrial wastewater sewer lines
Total Evaluation Area 5		**21**	**42**	**6**	**42**	**0**	**4**	**0**	**0**	**12**	**12**	**12**	**6**	**0**	**0**	**6**	**0**	**0**	**6**	**6**	**0**	**6**	**0**			
Evaluation Area 6																										
54	EA6SB01–B08	8	24	0	24	24			24															0–0.5, 2–4, 4–6		Assess any presence of VOCs, TPH, and PCBs in soil; one soil sample collected at soil/water interface of FWBZ
58	EA6SB09	1	3	0	3	3			3															0–0.5, 2–4, 4–6		Assess any presence of VOCs, TPH, and PCBs in soil; one soil sample collected at soil/water interface of FWBZ
Total Evaluation Area 6		**9**	**27**	**0**	**27**	**27**	**0**	**0**	**27**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**			
DATA GAP AREA BUILDINGS																										
Data Gap Building 6																										
68	Within Building 6 [DG006SB01–B03]	3	6	0	6		6		6	6														0–0.5, 2–4		Assess any presence of VOCs, non-PAH SVOCs, PCBs, and metals in soil
Data Gap Building 34																										
58	DG034SB01	1	3	2	3	3	3		3	3			2	2	2			2	2				2	0–0.5, 2–4, 4–6	10–15, 25–30	Assess any presence of VOCs, non-PAH SVOCs, PCBs, and metals in soil and FWBZ; one soil sample collected at the soil/water interface of the FWBZ

Table 1-3

Supplemental Remedial Investigation Activities and Rationales for OU-2C[a]: Soil and Discrete Groundwater Samples

Study Area/ EBS Parcel	Well and Boring Locations [Boring No.]	Total No. of Sampling Locations	NO. OF SAMPLES		ANALYSES FOR SOIL SAMPLES U.S. EPA Method								ANALYSES FOR DISCRETE GROUNDWATER SAMPLES U.S. EPA Method											Soil Sampling Depth Intervals[c] (feet bgs)	GW Sampling Depth Intervals[c] (feet bgs)	Rationale
			Soil	GW	VOCs	TPH	SVOCs including 1,4-Dioxane (no PAHs)	PAHs	PCBs	Metals	Hex Chrom	Cyanide	VOCs	TPH	SVOCs including 1,4-Dioxane (no PAHs)	1,4-Dioxane only	PAHs	PCBs	Metals	Hex Chrom	Mercury	Cyanide	TDS[b]			
					5035A/ 8260B	8015-M, 8015B-M	8270C	8270C SIM	8082	6010B/ 7000	7196A	9010B	5035A/ 8260B	8015-M, 8015B-M	8270C	8270C	8270C SIM	8082	6010B/ 7000	7196A	1631	9010B	160.1			
Data Gap Building 43																										
47	Within Building 43 [DG043SB01]	1	2	2	2		2		2	2			2	2	2			2	2[f]		2			0–0.5, 2–4	10–15, 25–30	Assess any presence of VOCs, non-PAH SVOCs, PCBs, and metals in soil and FWBZ; mercury at downgradient margin of site
Data Gap Building 44																										
48	Within Building 44 [DG044SB01]	1	2	2	2		2		2	2			2	2	2			2	2[f]		2			0–0.5, 2–4	10–15, 25–30	Assess any presence of VOCs, non-PAH SVOCs, PCBs, and metals in soil and FWBZ, and radium in soil; mercury at downgradient margin of site
Data Gap Building 102																										
46	Within Building 102[d] [DG102SB01]	1	2	2	2		2		2	2			2	2	2			2	2[f]		2			0–0.5, 2–4	10–15, 25–30	Assess any presence of VOCs, non-PAH SVOCs, PCBs, and metals in soil and FWBZ; mercury at downgradient margin of site
Data Gap Building 282																										
186	At former location of Building 282 [DG282SB01]	1	3	1	3	3	3		3	3			1		1			1	1					0–0.5, 2–4, 4–6	10–15	Assess any presence of VOCs, non-PAH SVOCs, PCBs, and metals in soil and shallower portion of FWBZ; one soil sample collected at the soil/water interface of the FWBZ
Data Gap Building 347																										
54	One within and two adjacent to Building 347 [DG347SB01–B03]	3	9	0	9	9	9		9	9														0–0.5, 2–4, 4–6		Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil; one soil sample collected at the soil/water interface of the FWBZ
Data Gap Building 400																										
52	Within Hangar Area of Building 400 [DG400SB01–B08]	8	24	0	24	24	24		24	24														0–0.5, 2–4, 4–6		Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil; one soil sample collected at the soil/water interface of the FWBZ
Data Gap Building 405																										
49	Within Building 405 [DG405SB01–B02]	2	6	0	6	6	6		6	6														0–0.5, 2–4, 4–6		Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil; one soil sample collected at the soil/water interface of the FWBZ
Data Gap Building 415																										
57	At former location of Building 415 and former hazardous waste storage area [DG415SB01-B02]	2	6	0	6	6	6		6	6	6	6												0–0.5, 2–4, 4–6		Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, metals, hexavalent chromium, and cyanide in soil; one soil sample collected at the soil/water interface of the FWBZ
Data Gap Building 500																										
56	Within northern portion of Building 500 [DG500SB01]	1	3	0	3	3	3		3	3														0–0.5, 2–4, 4–6		Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil; one soil sample collected at the soil/water interface of the FWBZ
Data Gap Building 505																										
47	Through concrete pad at former location of Building 505 [DG505SB01]	1	3	2	3	3	3		3	3			2	2	2			2	2[f]		2			0–0.5, 2–4, 4–6	10–15, 25–30	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil and FWBZ; mercury at downgradient margin of site; one soil sample collected at the soil/water interface of the FWBZ

Table 1-3

Supplemental Remedial Investigation Activities and Rationales for OU-2C[a]: Soil and Discrete Groundwater Samples

Study Area/ EBS Parcel	Well and Boring Locations [Boring No.]	Total No. of Sampling Locations	NO. OF SAMPLES		ANALYSES FOR SOIL SAMPLES U.S. EPA Method								ANALYSES FOR DISCRETE GROUNDWATER SAMPLES U.S. EPA Method											Soil Sampling Depth Intervals[c] (feet bgs)	GW Sampling Depth Intervals[c] (feet bgs)	Rationale
			Soil	GW	VOCs	TPH	SVOCs including 1,4-Dioxane (no PAHs)	PAHs	PCBs	Metals	Hex Chrom	Cyanide	VOCs	TPH	SVOCs including 1,4-Dioxane (no PAHs)	1,4-Dioxane only	PAHs	PCBs	Metals	Hex Chrom	Mercury	Cyanide	TDS[b]			
					5035A/ 8260B	8015-M, 8015B-M	8270C	8270C SIM	8082	6010B/ 7000	7196A	9010B	5035A/ 8260B	8015-M, 8015B-M	8270C	8270C	8270C SIM	8082	6010B/ 7000	7196A	1631	9010B	160.1			
PAH DATA GAP AREA																										
48	West of previous sampling location 030-S05-009 [DGPAHSB01]	1	4	0				4																0–0.5, 0.5–2, 2–4, 4–8		Assess the extent of PAHs in soil at concentrations exceeding criterion
	Northeast of previous sampling location C3S005B048 [DGPAHSB02]	1	4	0	3	3	3	4	3	3														0–0.5, 0.5–2, 2–4, 4–8		Assess the extent of PAHs in soil at concentrations exceeding criterion; for depth intervals 0-0.5, 2-4, and 4-8, assess any presence of chemicals in soil related to former materials storage identified from air photographs
	Northwest of previous sampling location C3S005B048 [DGPAHSB03]	1	4	0	3	3	3	4	3	3														0–0.5, 0.5–2, 2–4, 4–8		Assess the extent of PAHs in soil at concentrations exceeding criterion
Total for Data Gap Areas		**28**	**81**	**11**	**75**	**63**	**75**	**12**	**75**	**75**	**6**	**6**	**11**	**10**	**11**	**0**	**0**	**11**	**11**	**0**	**8**	**0**	**2**			
OWS and UST(R)																										
54	**OWS 005** Adjacent to location of reportedly existing OWS [SOW5SB01] TBD[g]: [S0W5SB02–B03]	1	4	2	4	4	4		4	4	4	4	2	2	2			2	2	2		2	2	0–0.5, 2–4, 4–6, 10–12	10–15, 25–30	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, metals, hexavalent chromium, and cyanide in soil and FWBZ; one soil sample collected at soil/water interface of FWBZ
68	**OWS 006A** Adjacent to location of existing OWS [SOW6ASB01]	1	4	1	4	4	4		4	4			1	1	1			1	1					0–0.5, 2–4, 4–6, 10–12	10–15	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil and shallower portion of FWBZ; one soil sample collected at soil/water interface of FWBZ
68	**OWS 006B** Adjacent to location of existing OWS [SOW6BSB01] TBD[g]: [SOW6BSB02–B03]	1	4	1	4	4	4		4	4			1	1	1			1	1					0–0.5, 2–4, 4–6, 10–12	10–15	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil and shallower portion of FWBZ; one soil sample collected at soil/water interface of FWBZ
68	**OWS 010** Adjacent to location of existing OWS [SOW10SB01]	1	4	1	4	4	4		4	4			1	1	1			1	1					0–0.5, 2–4, 4–6, 10–12	10–15	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil and shallower portion of FWBZ; one soil sample collected at soil/water interface of FWBZ
68	**UST(R)-02** Adjacent to former location of USTs [SUSTSB01]	1	4	1	4	4	4		4	4			1	1	1			1	1					0–0.5, 2–4, 4–6, 10–12	10–15	Provide wider coverage of samples; one soil sample collected at soil/water interface of FWBZ.
Total OWSs and UST(R)		**5**	**20**	**6**	**20**	**20**	**20**	**0**	**20**	**20**	**4**	**4**	**6**	**6**	**6**	**0**	**0**	**6**	**6**	**2**	**0**	**2**	**2**			
SWMUs																										
54	**AOC 005** Adjacent to former location of UST 5-2 (see SWMU AST 005G) [SAOC5SB01] TBD[g]:[SAOC5B02–B03]	1	3	2	3	3	3		3	3			2	2	2			2	2					0–0.5, 2–4, 4–6	10–15, 25–30	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil and FWBZ; one soil sample collected at soil/water interface of FWBZ
54	**AST 005G** Adjacent to former locaton of UST 5-3 and downgradient of AST 005G [SAST5SB01] TBD[g]: [SAST5B02–B03]	1	3	2	3	3	3		3	3			2	2	2			2	2					0–0.5, 2–4, 4–6	10–15, 25–30	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil and FWBZ; one soil sample collected at soil/water interface of FWBZ

Table 1-3

Supplemental Remedial Investigation Activities and Rationales for OU-2C[a]: Soil and Discrete Groundwater Samples

Study Area/ EBS Parcel	Well and Boring Locations [Boring No.]	Total No. of Sampling Locations	NO. OF SAMPLES		ANALYSES FOR SOIL SAMPLES U.S. EPA Method								ANALYSES FOR DISCRETE GROUNDWATER SAMPLES U.S. EPA Method											Soil Sampling Depth Intervals[c] (feet bgs)	GW Sampling Depth Intervals[c] (feet bgs)	Rationale
			Soil	GW	VOCs	TPH	SVOCs including 1,4-Dioxane (no PAHs)	PAHs	PCBs	Metals	Hex Chrom	Cyanide	VOCs	TPH	SVOCs including 1,4-Dioxane (no PAHs)	1,4-Dioxane only	PAHs	PCBs	Metals	Hex Chrom	Mercury	Cyanide	TDS[b]			
					5035A/ 8260B	8015-M, 8015B-M	8270C	8270C SIM	8082	6010B/ 7000	7196A	9010B	5035A/ 8260B	8015-M, 8015B-M	8270C	8270C	8270C SIM	8082	6010B/ 7000	7196A	1631	9010B	160.1			
SWMUs (continued)																										
54	**M-01** Near former location of M-01 [SM01SB01] TBD[g]: [SM01SB02–B03]	1	3	2	3	3	3	3	3	3			2	2	2		2	2	2				2	0–0.5, 2–4, 4–6	10–15, 25–30	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil and FWBZ; one soil sample collected at soil/water interface of FWBZ
54	**M-02** Near former location of M-02 [SM02SB01] TBD[g]: [SM02SB02–B03]	1	3	2	3	3	3	3	3	3			2	2	2		2	2	2					0–0.5, 2–4, 4–6	10–15, 25–30	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil and FWBZ; one soil sample collected at soil/water interface of FWBZ
54	**M-05** At location of crack in floor [SM05SB01]	1	3	2	3	3	3	3	3	3			2	2	2		2	2	2				2	0–0.5, 2–4, 4–6	10–15, 25–30	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil and FWBZ; one soil sample collected at soil/water interface of FWBZ; two locations identified during April 18, 2006 site walk
54	**M-05** At location of joint in concrete [SM05SB02][d] TBD[g]: [SM05SB03–B04]	1	3	0	3	3	3	3	3	3														0–0.5, 2–4, 4–6		
52	**M-08** Near former location of M-08 [SM08SB01] TBD[g]: [SM08SB02–B03]	1	3	1	3	3	3		3	3			1	1	1		1	1	1				1	0–0.5, 2–4, 4–6	10–15	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil and shallower portion of FWBZ; one soil sample collected at soil/water interface of FWBZ
54	**M-09** On downgradient side of concrete berm [SM09SB01] TBD[g]: [SM09SB02–B03]	1	3	2	3	3	3	3	3	3	3	3	2	2	2		2	2	2	2		2		0–0.5, 2–4, 4–6	10–15, 25–30	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil and FWBZ; one soil sample collected at soil/water interface of FWBZ
54	**NADEP GAP 02** At former location of GAP [SND02SB01] TBD[g]: [SND02SB02–B03]	1	3	2	3	3	3	3	3	3			2	2	2		2	2	2					0–0.5, 2–4, 4–6	10–15, 25–30	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil and FWBZ; one soil sample collected at soil/water interface of FWBZ
54	**NADEP GAP 04** At former location of GAP [SND04SB01]	1	3	2	3	3	3	3	3	3			2	2	2		2	2	2					0–0.5, 2–4, 4–6	10–15, 25–30	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil and FWBZ; one soil sample collected at soil/water interface of FWBZ; sample second location identified during April 18, 2006 site walk
54	**NADEP GAP 04** Near former location of GAP [SND04SB02] TBD[g]: [SND04SB03–B04]	1	3	0	3	3	3	3	3	3														0–0.5, 2–4, 4–6		
54	**NADEP GAP 17** At former location of GAP [SND17SB01]	1	3	2	3	3	3	3	3	3			2	2	2		2	2	2					0–0.5, 2–4, 4–6	10–15, 25–30	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil and FWBZ; one soil sample collected at soil/water interface of FWBZ
54	**NADEP GAP 17** At former location of GAP [SND17S-B02] TBD[g]: [SND17SB03–B04]	1	3	0	3	3	3	3	3	3														0–0.5, 2–4, 4–6		
56	**NADEP GAP 20** At former location of GAP [SND20SB01] TBD[g]: [SND20SB02–B03]	1	3	2	3	3	3		3	3			2	2	2			2	2					0–0.5, 2–4, 4–6	10–15, 25–30	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil and FWBZ; one soil sample collected at soil/water interface of FWBZ
54	**NADEP GAP 25** At former location of GAP [SND25SB01] TBD[g]: [SND25SB02–B03]	1	3	0	3	3	3		3	3	3	3												0–0.5, 2–4, 4–6		Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, metals, hexavalent chromium, and cyanide in soil and FWBZ; one soil sample collected at soil/water interface of FWBZ

Table 1-3

Supplemental Remedial Investigation Activities and Rationales for OU-2C[a]: Soil and Discrete Groundwater Samples

Study Area/ EBS Parcel	Well and Boring Locations [Boring No.]	Total No. of Sampling Locations	NO. OF SAMPLES		ANALYSES FOR SOIL SAMPLES U.S. EPA Method								ANALYSES FOR DISCRETE GROUNDWATER SAMPLES U.S. EPA Method											Soil Sampling Depth Intervals[c] (feet bgs)	GW Sampling Depth Intervals[c] (feet bgs)	Rationale
			Soil	GW	VOCs	TPH	SVOCs including 1,4-Dioxane (no PAHs)	PAHs	PCBs	Metals	Hex Chrom	Cyanide	VOCs	TPH	SVOCs including 1,4-Dioxane (no PAHs)	1,4-Dioxane only	PAHs	PCBs	Metals	Hex Chrom	Mercury	Cyanide	TDS[b]			
					5035A/ 8260B	8015-M, 8015B-M	8270C	8270C SIM	8082	6010B/ 7000	7196A	9010B	5035A/ 8260B	8015-M, 8015B-M	8270C	8270C	8270C SIM	8082	6010B/ 7000	7196A	1631	9010B	160.1			
SWMUs (continued)																										
49	**NADEP GAP 27** At former location of GAP [SND27SB01]	1	3	2	3	3	3		3	3			2	2	2			2	2[f]		2			0–0.5, 2–4, 4–6	10–15, 25–30	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil and FWBZ; mercury at downgradient margin of site; one soil sample collected at soil/water interface of FWBZ
49	**NADEP GAP 27** At former location of GAP [SND27SB02] TBD[g]: [SND27SB03–B04]	1	3	0	3	3	3		3	3														0–0.5, 2–4, 4–6		
54	**NADEP GAP 31** At crack in floor near former location of GAP [SND31SB01] TBD[g]: [SND31SB03]	1	3	2	3	3	3	3	3	3			2	2	2		2	2	2					0–0.5, 2–4, 4–6	10–15, 25–30	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil and FWBZ; one soil sample collected at soil/water interface of FWBZ; location identified during April 18, 2006 site walk
54	**NADEP GAP 31** Within area of former location of GAP [SND31SB02]	1	3	0	3	3	3	3	3	3														0–0.5, 2–4, 4–6		Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil; one soil sample collected at soil/water interface of FWBZ; location identified during April 18, 2006 site walk
54	**NADEP GAP 57** At former location of GAP [SND57SB01] TBD[g]: [SND57SB02–B03]	1	3	2	3	3	3	3	3	3	3	3	2	2	2		2	2	2	2		2	2	0–0.5, 2–4, 4–6	10–15, 25–30	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, metals, hexavalent chromium, and cyanide in soil and FWBZ; one soil sample collected at soil/water interface of FWBZ
54	**NADEP GAP 70** At former location of GAP [SND70SB01] TBD[g]: [SND70SB02–B03]	1	3	2	3	3	3	3	3	3	3	3	2	2	2		2	2	2	2		2		0–0.5, 2–4, 4–6	10–15, 25–30	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, metals, hexavalent chromium, and cyanide in soil and FWBZ; one soil sample collected at soil/water interface of FWBZ
186	**NAS GAP 01** At former location of GAP [SNS01SB01] TBD[g]: [SNS01SB02–B03]	1	3	1	3	3	3		3	3			1	1	1			1	1					0–0.5, 2–4, 4–6	10–15	Assess any presence of VOCs, TPH, non-PAH SVOCs, PCBs, and metals in soil and FWBZ; one soil sample collected at soil/water interface of FWBZ
	Total SWMUs	**22**	**66**	**30**	**66**	**66**	**66**	**42**	**66**	**66**	**12**	**12**	**30**	**30**	**30**	**0**	**21**	**30**	**30**	**6**	**2**	**6**	**7**			
	(SWMU step-out sampling points if needed)	44	132	0	132	132	132	12	132	132	21	21												0–0.5, 2–4, 4–6		Confirm extent of chemicals if comparison criteria are exceeded at planned sampling locations
	(Discrete groundwater step-out sampling points if needed)	10		20									20	10	10		2	2	20	10	2	10			10–15, 25–30	Assess any presence of chemicals in FWBZ if chemicals in soil indicate a possible release to groundwater
TOTALS		**218**	**523**	**99**	**517**	**317**	**332**	**79**	**333**	**416**	**88**	**88**	**99**	**58**	**59**	**30**	**23**	**49**	**85**	**36**	**12**	**36**	**13**			

Table 1-3
Supplemental Remedial Investigation Activities and Rationales for OU-2C[a]: Soil and Discrete Groundwater Samples

Notes:

[a] this table presents samples for chemical analysis; Table 1-4 presents samples for radiological analysis
[b] groundwater samples will be collected for TDS analysis if sufficient sample volume can be collected from the boring; sample locations chosen to provide sitewide coverage for TDS
[c] groundwater samples targeted for the shallower portion of the FWBZ will be collected from approximately 5 to 10 feet below the water table to allow for sufficient sample volume
[d] collect soil sample within 2-to-4-foot depth interval from one boring for geotechnical parameter analysis; see QAPP Worksheet 19 for geotechnical analytical parameters
[e] some borings will be located near floor drains, if identified
[f] does not include mercury for those samples also being analyzed for low-detection-limit mercury under separate analysis
[g] step-out borings to be installed only if chemicals are detected at concentrations exceeding comparison criteria from initial sampling

Acronyms/Abbreviations:
AOC – area of concern
AST – aboveground storage tank
bgs – below ground surface
EBS – environmental baseline survey
FWBZ – first water-bearing zone
GAP – generator accumulation point
GW – groundwater
hex chrom – hexavalent chromium
IR – Installation Restoration (Program)
MCL – maximum contaminant level
NA – not applicable
NADEP – Naval Aviation Depot
NAS – Naval Air Station
OWS – oil/water separator
PAH – polynuclear aromatic hydrocarbon
PCB – polychlorinated biphenyl
SAP – sampling and analysis plan
SIM – selected ion monitoring
SVOC – semivolatile organic compound
SWMU – solid waste management unit
TBD – to be determined
TDS – total dissolved solids
TPH – total petroleum hydrocarbons (purgeable- and extractable-range, unless otherwise noted)
U.S. EPA – United States Environmental Protection Agency
UST – underground storage tank
VOC – volatile organic compound

Table 1-4
Supplemental Remedial Investigation Activities and Rationales for OU-2C: Radium in Soil and Groundwater Samples

Study Area/ EBS Parcel	Well and Boring Locations [Boring No.]	Total No. of Sampling Locations	No. of Soil Samples	Radium Analyses for Soil Samples by U.S. EPA Method 901.1	Soil Sampling Depth Intervals (feet bgs)	No. of Groundwater Samples	Radium Analyses for Groundwater Samples by U.S. EPA Methods 903.1 and 904.0	Groundwater Sampling Depth Intervals (feet bgs)	Rationale
Evaluation Area 1									
54	Near former AST 005H [EA3SB12]	1	0			1	1	10–15	Assess potential release of radium in the shallower portion of the FWBZ
54	Along industrial wastewater line [EA3SB29]	1	0			1	1	10–15	Assess potential release of radium in the shallower portion of the FWBZ
54	M-09 On downgradient side of concrete berm [SM09SB01]	1	0			1	1	10–15	Assess potential release of radium in the shallower portion of the FWBZ
54	NADEP GAP 57 At former location of GAP [SND57SB01]	1	0			1	1	10–15	Assess potential release of radium in the shallower portion of the FWBZ
54	NADEP GAP 70 At former location of GAP [SND70SB01]	1	0			1	1	10–15	Assess potential release of radium in the shallower portion of the FWBZ
Data Gap Building 44									
48	Within Building 44 [DG044SB01]	1	2	2	0–0.5, 2–4	0			Assess potential release of radium in soil
TOTALS		**6**	**2**	**2**		**5**	**5**		

Acronyms/Abbreviations:
AST – aboveground storage tank
bgs – below ground surface
EBS – environmental baseline survey
FWBZ – first water-bearing zone
GAP – generator accumulation point
NADEP – Naval Aviation Depot
PAH – polynuclear aromatic hydrocarbon
PCB – polychlorinated biphenyl
SVOC – semivolatile organic compound
U.S. EPA – United States Environmental Protection Agency
VOC – volatile organic compound

Table 1-5
Supplemental Remedial Investigation Activities and Rationales for OU-2C: Soil Gas Samples

Study Area/ EBS Parcel	Description of Sampling Locations [Station ID]	Total No. of Sampling Locations	No. of Soil Gas Samples Per Medium	VOC Analyses for Soil Gas Samples by U.S. EPA TO-15	Soil Gas Sampling Depth (feet bgs)	Rationale
Evaluation Area 1 – GW						
54	Building 5 subslab soil gas sampling points on 80-foot grid [EA1SG001–EA1SG100]	100	100	100	Directly beneath the building foundations, approximately 1.5 feet bgs (concrete slab approximately 14 inches thick)	Assess potential for migration of VOCs in groundwater beneath Building 5 to indoor air; collect data for risk assessment
TOTALS		**100**	**100**	**100**		

Acronyms/Abbreviations:
bgs – below ground surface
GW – groundwater
TO – toxic organics (method)
U.S. EPA – United States Environmental Protection Agency
VOC – volatile organic compound

Table 1-6
Data Quality Objectives for Evaluation Area 1 (Groundwater) at OU-2C

STEP 1 State the Problems	STEP 2 Identify the Decisions	STEP 3 Identify Decision Inputs	STEP 4 Define Study Boundaries	STEP 5 Develop Decision Rules	STEP 6 Specify Tolerable Limits on Decision Errors	STEP 7 Optimize the Sampling Design
OU-2C occupies approximately 47 acres at Alameda Point and consists of IR Sites 5, 10, and 12. RI data gap sampling is proposed for several areas within OU-2C identified by the Navy and regulatory agencies as needing further evaluation before proceeding to an FS. OU-2C includes the former aircraft rework facility (Building 5/5A), missile rework operations (Building 400), power plant (Building 10), metal treatment shop (Building 32), dry cleaning operation (eastern portion of Building 2), repair shop and steam cleaning facility (Building 6), plus a number of other smaller buildings that historically used or stored chemicals and a number of OWSs, USTs, and ASTs. Additionally, release of radium from operations in Building 5 between from the 1940s and early 1970s resulted in radiation-impacted storm sewer lines draining to Seaplane Lagoon at Outfall F. Areas requiring further evaluation were initially identified in the draft RI Report prepared by SulTech (2005) and on the basis of agency review comments on that draft RI Report. The report recommended further evaluation of several areas within OU-2C, and based on a combined assessment of the historical uses, the results of data evaluation, risk evaluation, and input received from regulatory agencies, further sampling was identified for 6 evaluation areas, 13 additional data gap areas, and 22 OWSs and SWMUs. Evaluation Area 1 represents groundwater that has been impacted by chlorinated VOCs, hexavalent chromium, other metals, and cyanide. The Navy and regulatory agencies refined the list of data gaps related to groundwater requiring additional evaluation and sampling as follows: • the horizontal and vertical limits of VOCs at concentrations exceeding MCLs at the western, downgradient margin of the plume that is centered beneath Building 5	Decisions will be based on a compilation of OU-2C specific data gathered during previous investigations and the proposed field investigation, and any data gathered during ongoing investigations or removal that are available at the time the draft RI is prepared . These data, along with results of a baseline risk assessment, will be used to complete the RI report for OU-2C and answer the following questions with respect to groundwater. • Has the characterization of the nature and extent of contamination in groundwater at OU-2C been completed by the results of the sampling and analysis program (described in Tables 1-2 through 1-5) for evaluation areas, data gap areas, and SWMUs? • Have the direction of groundwater flow at the western margin of OU-2C, the extent of tidal influence, and the direction of plume migration off-site, if any, been characterized? • Are contaminants present in groundwater at concentrations that pose unacceptable risk to potential future residents? • Are contaminants present in groundwater at concentrations that could pose unacceptable risk to potential aquatic receptors in Oakland Inner Harbor or Seaplane Lagoon?	Data inputs for the characterization of Evaluation Area 1 (groundwater) will be chemical, radiological, hydrogeological, and geotechnical data, including concentrations of target chemicals in groundwater collected during previous investigations and during the OU-2C RI supplemental sampling investigation. Data from adjacent IR sites will also be reviewed to assess whether contaminants are associated with these sites or historical OU-2C activities. Other data inputs included baseline risk assessment inputs, assumptions, and results. Results of subslab soil gas sampling for VOCs will be used as input to risk assessment calculations to evaluate the indoor air risk pathway for hypothetical future occupants of Building 5. (Note that the building is currently unoccupied.) Groundwater data will be compared to the following criteria to establish nature and extent: • MCLs for contaminants in groundwater (Tables A1-1 and A1-2, Appendix A1) • Water Board ESLs for petroleum-contaminated sites[a] (Table A1-3, Appendix A1) • California Toxics Rule for contaminants in groundwater at the downgradient margin of OU-2C if there is a potential for discharge to surface water bodies (Seaplane Lagoon or Oakland Inner Harbor) (Tables A1-1 and A1-2, Appendix A1) • Alameda Point background concentrations for metals in groundwater (Table A1-2, Appendix A1) • The Navy and regulatory agencies have initiated discussions to consider the background concentrations and the data set for	The boundaries of Evaluation Area 1 are as follows. • The lateral boundaries for the supplemental RI for Evaluation Area 1 will include approximately 36.8 acres encompassed by the boundaries of IR Site 5 on the north and west, Lexington Avenue on the east, and the line formed by the northern edge of Building 400 and the IR Site 5 boundary on the south. • The lateral boundaries for groundwater beneath areas outside of Evaluation Area 1 will be the boundaries of OU-2C. • The vertical groundwater boundary for the FWBZ will be approximately 35 feet bgs. • The vertical groundwater boundary for discrete groundwater samples will be 5 to 10 feet below the water table (to allow for sufficient sample volume), which is equivalent to 10 to 15 feet bgs for the shallower portion of FWBZ; and 25 to 30 feet bgs for the deeper portion of the FWBZ. • The vertical groundwater boundary for the SWBZ will be below the BSU (approximately 40 feet bgs) to 60 to 70 feet bgs. • The temporal boundary for the supplemental RI field work will be a 3-month period following approval of the Work Plan. • The temporal boundary for analytical data to be used for the RI report will be 1991 through 2007. This time period includes the data collected during the activities conducted under this Work Plan and historical analytical data from 1991 through 2004, which is included in this Work Plan. This time period also includes analytical data from other sampling activities between 2004 and 2007 that are available at the	Data from previous investigations and data collected during this investigation will be used to evaluate the nature and extent of contamination for Evaluation Area 1. The following general decision rules will be applied. • If characterization of nature and extent of groundwater contamination (based on the comparison criteria in Step 3 in this table, and Tables A1-1, A1-2, and A1-3 in Appendix A1) has been completed with the sampling and analysis program (described in Tables 1-2 through 1-5), no further remedial investigation will be recommended. • If analysis for 1,4-dioxane identifies any presence of this analyte in groundwater, or if soil and groundwater sampling at any SWMU identifies analytes not previously detected at OU-2C at concentrations exceeding comparison criteria, real-time decisions concerning installation and/or sampling of additional monitoring wells will be made in the field with regulatory agency involvement. Decisions will also be made to identify placement of planned monitoring wells, if needed, for Evaluation Area 2 in order to complete nature-and-extent characterization such that no further RI will be recommended. Human-health risk will be assessed for soil and groundwater combined for individual areas at OU-2C (and including both groundwater within Evaluation Area 1 and groundwater within OU-2C outside of Evaluation Area 1). The human-health risk assessment approach and a discussion of acceptable risk are presented in the Risk Assessment Work Plan, Attachment E to the Work Plan. The following general decision rules will be applied. • If human-health risk assessment results indicate acceptable risk, then no further action will be recommended. • If human-health risk assessment results indicate unacceptable risk, then further action will be recommended (e.g., removal action, inclusion of that area in the FS).	Site-specific sampling objectives limit the use of statistical methods for selecting sampling locations at OU-2C. Judgmental sampling has been chosen by the Navy and regulatory agencies to further assess the nature and extent of contamination in specific areas. Because judgmental sampling will be used, statistical limits on decision errors are not quantifiable. The most severe study decision error would be to conclude that action is not required when an unacceptable level of human-health or ecological risk actually exists. Data collected during the RI will be evaluated conservatively.	The sampling design was developed to generate data to meet the DQOs. The sampling strategy uses judgmental sampling to provide additional data for assessment of issues identified in various areas. Groundwater samples, subslab soil gas samples, soil samples for geotechnical analysis, and hydrogeological data to be collected during this investigation to complete the characterization of Evaluation Area 1 are summarized in Appendix A1 to this SAP. Samples will be analyzed using one or more of the following methods, as agreed to by the Navy and regulatory agencies: • VOCs, using U.S. EPA Methods 5035A and 8260B • TPH, using U.S. EPA Method 8015-M for purgeable-range hydrocarbons and U.S. EPA Method 8015B-M for extractable-range hydrocarbons • SVOCs including 1,4-dioxane, using U.S. EPA Method 8270C (with SIM for PAHs if needed) • PCBs, using U.S. EPA Method 8082 • metals, using U.S. EPA Method 6010B/7000 Series • hexavalent chromium, using U.S. EPA Method 7196A • cyanide, using U.S. EPA Method 9010B Groundwater samples taken from monitoring wells will also be analyzed for TDS using U.S. EPA Method 160.1. Selected groundwater samples may be analyzed for mercury using U.S. EPA Method 1631 to detect concentrations to 0.1 nanogram per liter. Groundwater samples taken from selected monitoring wells will also be analyzed for the following general water quality parameters to support fate-and-transport and FS evaluations:

Table 1-6 (continued)

STEP 1 State the Problems	STEP 2 Identify the Decisions	STEP 3 Identify Decision Inputs	STEP 4 Define Study Boundaries	STEP 5 Develop Decision Rules	STEP 6 Specify Tolerable Limits on Decision Errors	STEP 7 Optimize the Sampling Design
• the direction of groundwater flow at the western, downgradient margin of OU-2C • the direction of plume migration off-site, if any, at the western, downgradient margin of OU-2C • concentrations of VOCs immediately downgradient of the source area (former plating shop) for Plume 5-3 beneath the interior of Building 5 • concentrations of VOCs in the deeper FWBZ near the northeastern corner of Building 5 • concentrations of VOCs in the area of Plumes 5-2 and 5-4 • concentrations of VOCs in the area of Plume 5-1 following DNAPL removal action • concentrations of VOCs in the vicinity of former Building 348 south of Building 5 • concentrations of VOCs at the upgradient margin of OU-2C • the indoor air risk pathway to hypothetical future occupants of Building 5 from possible exposure to VOCs emanating from groundwater • the horizontal and vertical limits of hexavalent chromium, other metals, and cyanide at concentrations exceeding comparison criteria • concentrations of hexavalent chromium, other metals, and cyanide at the water table at the former locations of cyanide and chromium eductor sumps associated with the former plating shop • the horizontal and vertical extent of 1,4-dioxane, if present • possible release of radium-226 and radium-228 associated with previous operations in Building 5 to groundwater in the shallower portion of the FWBZ		Alameda Point at a meeting held on October 18, 2005[b]. The comparison criteria that will be used in the RI report will reflect any updated agreements reached by the time that the RI report is prepared.	time that the supplemental RI sampling results have been validated and verified, such as data from the ongoing basewide groundwater monitoring program and ongoing removal actions.	Risk to ecological receptors will be assessed for OU-2C as a whole and for soil and groundwater combined. Data from previous investigations and data collected during this investigation will be used to evaluate whether contaminants are present in groundwater at concentrations that potentially could pose unacceptable risk to potential aquatic receptors in Oakland Inner Harbor or Seaplane Lagoon. The ecological risk assessment approach and a discussion of acceptable risk are presented in the Risk Assessment Work Plan, Attachment E to the Work Plan. The following general decision rules will be applied. • If contaminant concentrations in groundwater at or near the discharge point to surface water are below ecological comparison criteria, then it will be concluded that risk to potential aquatic receptors is acceptable, and no further action will be recommended. • If contaminant concentrations in groundwater at or near the discharge point to surface water are above ecological comparison criteria, then further action may be recommended (e.g., additional sampling, modeling).		• dissolved gases • ferrous and ferric iron • oxidation reduction potential and pH • sulfate, nitrate, chloride, alkalinity, and total organic carbon. Discrete groundwater samples taken from selected locations will also be analyzed for radium-226 and radium-228 using U.S. EPA Methods 903.1 and 904.0, respectively. Subslab soil gas samples for VOC analysis by U.S. EPA Method TO-15 will be collected for use in modeling for indoor risk assessment calculations and evaluation. These data will be used to evaluate the indoor air risk pathway to hypothetical future occupants of Building 5 from possible exposure to VOCs emanating from groundwater. No attempt will be made to characterize the nature and extent of contamination using soil gas results because of the known shallow depth to groundwater (generally between 3 and 8 feet bgs). Soil samples from selected locations and depths within the saturated zone will be analyzed for the following physical (geotechnical) parameters to assess characteristics of aquifer materials and to support risk assessment modeling, fate-and-transport assessment, and FS evaluations: • density and moisture content • effective porosity • grain-size distribution • liquid limits • hydraulic conductivity • total organic carbon

Table 1-6 (continued)

STEP 1 State the Problems	STEP 2 Identify the Decisions	STEP 3 Identify Decision Inputs	STEP 4 Define Study Boundaries	STEP 5 Develop Decision Rules	STEP 6 Specify Tolerable Limits on Decision Errors	STEP 7 Optimize the Sampling Design
• the extent of VOCs at concentrations exceeding MCLs, if any, in the vicinity of the eastern portion of Building 2 (Evaluation Area 2) that formerly housed dry cleaning operations (including NAS GAP 005) • the amount of tidal influence in groundwater between OU-2C and Seaplane Lagoon (located to the south of OU-2C) • lithological and geotechnical characteristics of the FWBZ, BSU, and SWBZ • possible release to groundwater of chemicals associated with Data Gap buildings and SWMUs						

Notes:
[a] RWQCB 2005
[b] DON 2005a

Acronyms/Abbreviations:
AST – aboveground storage tank
BGMP – basewide groundwater monitoring program
bgs – below ground surface
BSU – Bay Sediment Unit
DON – Department of the Navy
DNAPL – dense nonaqueous-phase liquid
DQO – data quality objective
ESL – environmental screening level
FS – feasibility study
FWBZ – first water-bearing zone
GAP – generator accumulation point
IR – Installation Restoration (Program)
MCL – maximum contaminant level
NAS – Naval Air Station
OU – operable unit
OWS – oil/water separator
PAH – polynuclear aromatic hydrocarbon
PCB – polychlorinated biphenyl
RI – remedial investigation
RWQCB – (California) Regional Water Quality Control Board
SAP – sampling and analysis plan
SIM – selected ion monitoring
SVOC – semivolatile organic compound
SWBZ – second water-bearing zone
SWMU – solid waste management unit
TDS – total dissolved solids
TPH – total petroleum hydrocarbons
U.S. EPA – United States Environmental Protection Agency
UST – underground storage tank
VOC – volatile organic compound

Table 1-7
Data Quality Objectives for Evaluation Areas 2 through 6 at OU-2C

STEP 1 State the Problems	STEP 2 Identify the Decisions	STEP 3 Identify Decision Inputs	STEP 4 Define Study Boundaries	STEP 5 Develop Decision Rules	STEP 6 Specify Tolerable Limits on Decision Errors	STEP 7 Optimize the Sampling Design
OU-2C occupies approximately 47 acres at Alameda Point and consists of IR Sites 5, 10, and 12. RI data gap sampling is proposed for several areas within OU-2C identified by the Navy and regulatory agencies as needing further evaluation before proceeding to an FS. OU-2C includes the former aircraft rework facility (Building 5/5A), missile rework operations (Building 400), power plant (Building 10), metal treatment shop (Building 32), dry cleaning operation (eastern portion of Building 2), repair shop and steam cleaning facility (Building 6), plus a number of other smaller buildings that historically used or stored chemicals and a number of OWSs, USTs, and ASTs. Additionally, release of radium from operations in Building 5 between from the 1940s and early 1970s resulted in radiation-impacted storm sewer lines draining to Seaplane Lagoon at Outfall F. Areas requiring further evaluation were initially identified in the draft RI Report prepared by SulTech (2005) and on the basis of agency review comments on that draft RI Report. The report recommended further evaluation of several areas within OU-2C, and based on a combined assessment of the historical uses, the results of data evaluation, risk evaluation, and input received from regulatory agencies, further sampling was identified for 6 Evaluation Areas 13 additional data gap areas and 22 OWSs and SWMUs. Evaluation Areas 2 through 6 represent areas in which soil may have been impacted by chlorinated VOCs, TPH, hexavalent chromium, other metals or cyanide. The Navy and regulatory agencies refined the list of data gaps related to soil requiring additional evaluation and sampling as follows: • Evaluation Area 2: Soil in the vicinity of the eastern portion of Building 2 that formerly housed dry cleaning operations (including NAS GAP 005) to be evaluated for VOCs	Decisions will be based on a compilation of OU-2C-specific data gathered during previous investigations and the proposed field investigation. These data, along with results of a baseline risk assessment, will be used to complete the RI report for OU-2C and answer the following questions with respect to soil. • Has the characterization of the nature and extent of contamination at OU-2C been completed by the results of the sampling and analysis program (described in Tables 1-3 through 1-5) for Evaluation Areas 2 through 6? • Are contaminants present in soil at concentrations that pose unacceptable risk to potential future residents or ecological receptors?	Data inputs for the characterization of Evaluation Areas 2 through 6 will be chemical and geotechnical data, including concentrations of target chemicals in soil collected during previous investigations and the during the OU-2C RI supplemental sampling investigation. Data from adjacent IR sites will also be reviewed to assess whether contaminants are associated with these sites or historical OU-2C activities. Other data inputs included baseline risk assessment inputs, assumptions, and results. Soil data will be compared to the following criteria to establish nature and extent: • Alameda Point comparison criteria for PAHs in soil: 620 µg/kg for residential and 2,100 µg/kg for industrial (DON 2001a) • Water Board ESLs for petroleum-contaminated sites (RWQCB 2005) (Table A1-3 Appendix A1) • U.S. EPA Region 9 or California-modified residential PRGs for contaminants in soil (U.S. EPA 2004) (Tables A1-1 and A1-2, Appendix A1) • Alameda Point background concentrations for metals in soil (Table A1-2, Appendix A1)	The boundaries of Evaluation Areas 2 through 6 for the supplemental RI sampling are as follows, with all five areas being within the lateral boundaries of Evaluation Area 1. • Evaluation Area 2: The lateral boundaries will include soil in an approximate 0.9-acre area within the boundaries of EBS Parcel 45A that encompasses the eastern portion of Building 2, which contained a dry cleaning facility and NAS GAP 05. • Evaluation Area 3: The lateral boundaries will include soil beneath the southern portion of Building 5. • Evaluation Area 4 (Aircraft Maintenance Line and adjoining shop area): the lateral boundaries will include soil beneath the northern portion of Building 5, which is east of the former aircraft paint west bay. • Evaluation Area 5: the lateral boundaries will include soil in an area south of Building 5 bounded by Building 5 on the north, extending from the eastern margin of Building 5 to a point west of the former location of IWTP 5, and bounded by the line formed by the northern edge of Building 400 and the IR Site 5 boundary on the south. • Evaluation Area 6: the lateral boundaries will include soil within the area bounded by Lexington Avenue on the east, Building 5 on the west, and extending from Building 62 to the north to the southern margin of Building 5 on the south. • The vertical soil boundary will be the vadose zone, which extends to between 4 and 6 feet bgs.	Data from previous investigations and data collected during this investigation will be used to evaluate the nature and extent of contamination. The following general decision rules will be applied. • If characterization of nature and extent of contamination (based on the comparison criteria in Step 3 in this table and Tables A1-1 through A1-3 in Appendix A1) has been completed with the sampling and analysis program (described in Tables 1-2 through 1-5), no further remedial investigation will be recommended. • If analysis for 1,4-dioxane identifies any presence of this analyte in soil, or if soil sampling identifies analytes not previously reported at OU-2C at concentrations exceeding comparison criteria, real-time decisions concerning discrete groundwater sampling, and, if needed, installation and/or sampling of additional monitoring wells will be made in the field, with regulatory agency involvement. Human-health risk will be assessed for soil and groundwater combined for individual areas at OU-2C (and including both soil within Evaluation Areas and soil in the remainder of OU-2C outside of Evaluation Areas). The human-health risk assessment approach and a discussion of acceptable risk are presented in the Risk Assessment Work Plan, Attachment E to the Work Plan. The following general decision rules will be applied. • If human-health risk assessment results indicate acceptable risk, then no further action will be recommended. • If human-health risk assessment results indicate unacceptable risk, then further action will be recommended (e.g., removal action, inclusion of that area in the FS).	Site-specific sampling objectives limit the use of statistical methods for selecting sampling locations at OU-2C. Judgmental sampling has been chosen by the Navy and regulatory agencies to further assess the nature and extent of contamination in specific areas. Because judgmental sampling will be used, statistical limits on decision errors are not quantifiable. The most severe study decision error would be to conclude that action is not required when an unacceptable level of human-health or ecological risk actually exists. Data collected during the RI will be evaluated conservatively.	The sampling design was developed to generate data to meet the DQOs. The sampling strategy uses judgmental sampling to provide additional data for assessment of issues identified in various areas. Soil samples to be collected during this investigation are summarized for each Evaluation Area in Appendix A1 to this SAP. Samples will be analyzed using one or more of the following methods, as agreed to by the Navy and regulatory agencies: • VOCs, using U.S. EPA Methods 5035A and 8260B • TPH, using U.S. EPA Method 8015-M for purgeable-range hydrocarbons and U.S. EPA Method 8015B-M for extractable-range hydrocarbons • SVOCs including 1,4-dioxane, using U.S. EPA Method 8270C (with SIM for PAHs if needed) • PCBs, using U.S. EPA Method 8082 • metals, using U.S. EPA Method 6010B/7000 Series • hexavalent chromium, using U.S. EPA Method 7196A • cyanide, using U.S. EPA Method 9010B • radium in soil, using U.S. EPA Method 901.1 (data gap at Building 44) Soil samples from selected locations and depths will be analyzed for the following physical (geotechnical) soil characteristics to support risk assessment modeling, fate-and-transport assessment, and FS evaluations: • air permeability • density and moisture content • effective porosity • grain-size distribution • liquid limits • hydraulic conductivity • total organic carbon

Table 1-7 (continued)

STEP 1 State the Problems	STEP 2 Identify the Decisions	STEP 3 Identify Decision Inputs	STEP 4 Define Study Boundaries	STEP 5 Develop Decision Rules	STEP 6 Specify Tolerable Limits on Decision Errors	STEP 7 Optimize the Sampling Design
• Evaluation Area 3: Soil beneath the southern portion of Building 5 (plating shop and adjacent areas and including locations of industrial wastewater drains, former foundry and heat treatment area, and former rubber shop) – Soil to be evaluated for VOCs – Soil near former AST 005H to be evaluated for TPH, SVOCs, PAHs, PCBs, hexavalent chromium, other metals, and cyanide, in addition to VOCs – Soil along industrial wastewater drains and at the former location of the cyanide eductor sump to be evaluated for chromium, lead, vanadium, hexavalent chromium, and cyanide, in addition to VOCs – Soil beneath the eastern portion of Building 5 (including the former foundry and heat treatment area) to be evaluated for metals, in addition to VOCs – Soil beneath the former foundry and heat treatment area and the former rubber shop to be evaluated for SVOCs, PAHs, PCBs, hexavalent chromium, and cyanide, in addition to VOCs and metals – Soil at locations of five SWMUs (see DQO Table 1-9) • Evaluation Area 4 (Aircraft Maintenance Line and adjoining shop area): Soil beneath the northern portion of Building 5 – Soil to be evaluated for metals due to the presence of arsenic, lead, and thallium at concentrations exceeding comparison criteria – Soil from at least one location adjacent to a utility vault and one location adjacent to an aircraft tie-down to be evaluated for metals – Soil at location of battery acid shop to be evaluated for VOCs, SVOCs, hexavalent chromium, and cyanide, in addition to metals – Soil at locations of three SWMUs and former paint-mixing area (see DQO Table 1-9)		• The Navy and regulatory agencies have initiated discussions to consider the background concentrations and the data set for Alameda Point at a meeting held on October 18, 2005 (DON 2005a). The comparison criteria that will be used in the RI report will reflect any updated agreements reached by the time that the RI report is prepared.	• For sampling locations where TPH is a potential contaminant of concern, the vertical boundary includes vadose zone soil and soil collected at the water table. • The temporal boundary for the supplemental RI field work will be a 3-month period following approval of the Work Plan. • The temporal boundary for analytical data to be used for the RI report will be 1991 through 2007. This time period includes the data collected during the activities conducted under this Work Plan and historical analytical data from 1991 through 2004, which is included in this Work Plan. This time period also includes analytical data from other sampling activities between 2004 and 2007 that are available at the time that the supplemental RI sampling results have been validated and verified, such as data from the ongoing basewide groundwater monitoring program and ongoing removal actions.	Risk to ecological receptors will be assessed for OU-2C as a whole. Data from previous investigations and data collected during this investigation will be used to evaluate whether soil contains contaminants that potentially could pose unacceptable risk to potential terrestrial receptors or that may migrate to groundwater at concentrations that potentially could pose unacceptable risk to potential aquatic receptors in Oakland Inner Harbor or Seaplane Lagoon. The ecological risk assessment approach and a discussion of acceptable risk are presented in the Risk Assessment Work Plan, Attachment E to the Work Plan.		

Table 1-7 (continued)

STEP 1 State the Problems	STEP 2 Identify the Decisions	STEP 3 Identify Decision Inputs	STEP 4 Define Study Boundaries	STEP 5 Develop Decision Rules	STEP 6 Specify Tolerable Limits on Decision Errors	STEP 7 Optimize the Sampling Design
• Evaluation Area 5: Soil south of Building 5 (including former location of Buildings 261 and 348, former IWTP, industrial wastewater drain and pretreatment area, and former hazardous waste storage area) – Soil to be evaluated for VOCs – Soil in vicinity of industrial wastewater drains, and former Buildings 261 and 348 to be evaluated for hexavalent chromium, other metals, and cyanide, in addition to VOCs – Soil at locations of OWS, SWMU, and Data Gap Building 415 and former hazardous waste storage area (see DQO Tables 1-8 and 1-9) • Evaluation Area 6: Soil east of Building 5 – Soil to be evaluated for VOCs, PCBs, and lead – Soil at locations near three SWMUs and Data Gap Buildings 34 and 500 (see DQO Table 1-9)						

Acronyms/Abbreviations:

AST – aboveground storage tank
B(a)P – benzo(a)pyrene
BGMP – basewide groundwater monitoring program
bgs – below ground surface
BSU – Bay Sediment Unit
CAA – corrective action area
DQO – data quality objective
EBS – environmental baseline survey
ESL – environmental screening level
FS – feasibility study
FWBZ – first water-bearing zone
IR – Installation Restoration (Program)
IWTP – industrial waste treatment plant
MCL – maximum contaminant level
µg/kg – micrograms per kilogram
OU – operable unit
OWS – oil/water separator
PAH – polynuclear aromatic hydrocarbon
PCB – polychlorinated biphenyl
PRG – preliminary remediation goal
RI – remedial investigation
SAP – sampling and analysis plan
SI – site inspection
SIM – selected ion monitoring
SVOC – semivolatile organic compound
SWBZ – second water-bearing zone
TDS – total dissolved solids
TPH – total petroleum hydrocarbons
U.S. EPA – United States Environmental Protection Agency
UST – underground storage tank
VOC – volatile organic compound

Table 1-8
Data Quality Objectives for Oil/Water Separators and Underground Storage Tanks at OU-2C

STEP 1 State the Problems	STEP 2 Identify the Decisions	STEP 3 Identify Decision Inputs	STEP 4 Define Study Boundaries	STEP 5 Develop Decision Rules	STEP 6 Specify Tolerable Limits on Decision Errors	STEP 7 Optimize the Sampling Design
The draft RI (SulTech 2005) and/or regulatory agencies requested further evaluation of the following OWSs and one UST in OU-2C (these five SWMUs could have been a source of subsurface releases), as part of the RI: • OWS 005 (located in Evaluation Area 5) • OWS 006A (located in EBS Parcel 68, northwest of Building 6) • OWS 006B (located in EBS Parcel 68, south of Building 6) • OWS 010 (located in IR Site 12) • UST(R)-02 (located in IR Site 5) All OWSs are proposed for removal by the Navy or City of Alameda in preparation for site redevelopment. It is anticipated that impacted soil will be removed and that soil samples will be collected and analyzed as part of these removal activities. The timing for removal of the OWSs, however, has not been determined and the soil data generated may not be available for this RI. Groundwater will need to be sampled and analyzed to determine whether releases have occurred at the OWS sites. The Work Plan, therefore, includes the collection and analysis of targeted soil and groundwater samples to assess whether a release associated with OWSs had occurred. For the one additional OWS located within OU-2C (OWS 615), sufficient soil and groundwater samples have been collected during previous investigations. The former location of USTs at UST(R)-02 will be treated in the same manner as the OWSs.	Decisions regarding OWSs in OU-2C will be based on evaluation of analytical results generated from targeted soil samples. These data will be used to make the following decision: • Are contaminants present in soil that indicate releases from the OWSs? Groundwater data targeting the OWSs will be combined with other area-specific data to evaluate the nature and extent of contamination and human-health risk. These data, along with the results of human-health risk assessments, will be used to make the following decisions. • Has the characterization of the nature and extent of contamination at OU-2C been completed by the results of the sampling and analysis program (described in Table 1-3) for OWSs and USTs? • Are contaminants present at concentrations that contribute to an unacceptable risk to potential future residents?	Data inputs will be chemical and geotechnical data, including concentrations of target chemicals in soil and groundwater collected during previous investigations and during the OU-2C RI. Data inputs also include risk assessment inputs, assumptions, and results. Data associated with the OWSs will be compared with the following criteria to establish the nature and extent of contamination: • Water Board ESLs for petroleum-contaminated sites (RWQCB 2005) (Table A1-2 of Appendix A1) • U.S. EPA Region 9 or California-modified residential PRGs for soil (U.S. EPA 2004) (Tables A1-1 and A1-2 of Appendix A1) • MCLs for contaminants in groundwater (Tables A1-1 and A1-2 of Appendix A1) • Alameda Point background concentrations for metals in soil and groundwater (Table A1-2 of Appendix A1). The Navy and regulatory agencies have initiated discussions to reconsider the background concentrations and the data set for Alameda Point established at a meeting held on October 18, 2005 (DON 2005a). The comparison criteria that will be used in the RI report will reflect any updated agreements reached by the time that the RI report is prepared. None of the OWSs are located near surface water; therefore, groundwater results will not be compared to surface water criteria.	The boundaries associated with OWSs at OU-2C are the following. • The lateral boundaries for the supplemental RI sampling for OWSs and USTs will include soil and groundwater within 50 feet of each unit identified for sampling and analysis. • The vertical soil boundary will be the vadose zone, with the deepest sample collected at the water table. An additional soil sample will be collected at a depth below the bottom of the OWS (up to 10 to 12 feet bgs), which is expected to be in the saturated zone. • The vertical groundwater boundary for discrete groundwater samples will be 5 to 10 feet below the water table (to allow for sufficient sample volume), or the bottom of the OWS, if it is deeper than 10 feet bgs. For OWSs at locations within Evaluation Area 1, the vertical groundwater boundary will be 25 to 30 feet bgs. • The temporal boundary for the supplemental RI fieldwork will be a 3-month period following approval of the Work Plan. • The temporal boundary for analytical data to be used for the RI report will be 1991 through 2007. This time period includes the data collected during the activities conducted under this Work Plan and historical analytical data from 1991 through 2004, which is included in this Work Plan. This time period also includes analytical data from other sampling activities between 2004 and 2007 that are available at the time that the supplemental RI sampling results have been validated and verified, such as data from the ongoing basewide groundwater monitoring program and ongoing removal actions.	Soil results will be compared to criteria listed in Step 3. The following general decision rules will be applied. • If soil contaminant concentrations are below comparison criteria (Tables A1-1, A1-2, and A1-3 in Appendix A1), then removal of additional soil during the OWS removal will not be necessary. • If soil contaminant concentrations are above comparison criteria (Tables A1-1, A1-2, and A1-3 in Appendix A1), then removal of additional soil during the OWS removal may be recommended. Any additional characterization of the extent of contamination will be performed at that time. Discrete groundwater sampling results will be combined with other area-specific data to evaluate the nature and extent of contamination. The following general decision rules will be applied. • If characterization of the nature and extent of contamination (based on comparison criteria in Step 3 of this table and Tables A1-1 through A1-3 in Appendix A1) has been completed with data from the sampling and analysis program (described in Table 1-3), no further remedial investigation will be recommended. • If soil and groundwater sampling at any OWS identifies analytes not previously reported at OU-2C at concentrations exceeding comparison criteria, real-time decisions will be made in the field with regulatory agency involvement. Decisions will also be made to identify step-out sampling locations for OWSs (up to 50 feet) in order to complete nature-and-extent characterization, such that no further remedial investigation will be recommended. Discrete groundwater results will be combined with other area-specific data to evaluate human-health risk. Human-health risk will be assessed for individual areas at OU-2C. Risk to ecological receptors will be assessed for OU-2C as a whole. The human-health risk	Site-specific sampling objectives limit the use of statistical methods for selecting sampling locations to target OWSs. Judgmental sampling has been chosen by the Navy and regulatory agencies to further assess whether soil or groundwater has been impacted by possible releases from OWSs. Because judgmental sampling will be used, statistical limits on decision errors are not quantifiable. The most severe study decision error would be to conclude that action is not required when an unacceptable level of human-health risk actually exists. Data collected during the RI will be evaluated conservatively.	The sampling design was developed to generate data to meet the DQOs and in accordance with regulatory agency requests. Soil and discrete groundwater samples will be collected (using the direct-push sampling method) from one boring adjacent to and on the estimated downgradient side (where possible) of each OWS; three or four soil samples will be collected from each boring (0 to 0.5, 2 to 4, 4 to 6, and 10 to 12 feet bgs). A groundwater sample will be collected from a soil boring beneath each OWS using a HydroPunch or an equivalent sampling method. For OWSs within Evaluation Area 1, an additional groundwater sample will be collected at 25 to 30 feet bgs. Soil and discrete groundwater samples will be analyzed for some or all of the following chemicals, as agreed to by the Navy and regulatory agencies: • VOCs, using U.S. EPA Methods 5035A and 8260B • TPH, using U.S. EPA Method 8015B-M for extractable-range hydrocarbons • SVOCs including 1,4-dioxane, using U.S. EPA Method 8270C (with SIM for PAHs if needed) • PCBs, using U.S. EPA Method 8082 • metals, using U.S. EPA Method 6010B/7000 Series

Table 1-8 (continued)

STEP 1 State the Problems	STEP 2 Identify the Decisions	STEP 3 Identify Decision Inputs	STEP 4 Define Study Boundaries	STEP 5 Develop Decision Rules	STEP 6 Specify Tolerable Limits on Decision Errors	STEP 7 Optimize the Sampling Design
				assessment approach, the ecological risk assessment approach, and a discussion of acceptable risk are presented in the Risk Assessment Work Plan, which is Attachment E to the Work Plan. Since it is presumed that impacted soil associated with OWSs will be removed, these data will not be included in the evaluation of human-health risk. The following general decision rules will be applied. • If human-health and ecological risk assessment results indicate acceptable risk, then no further action will be recommended. • If human-health or ecological risk assessment results indicate unacceptable risk, then further action will be recommended (e.g., removal action, inclusion of the area in the FS).		

Acronyms/Abbreviations:
AOC – area of concern
bgs – below ground surface
DQO – data quality objective
EDC – economic development conveyance
ESL – environmental screening level
IR – Installation Restoration (Program)
MCL – maximum contaminant level
OWS – oil/water separator
PRG – preliminary remediation goal
RI – remedial investigation
SWMU – solid waste management unit
TDS – total dissolved solids
TPH – total petroleum hydrocarbons
U.S. EPA – United States Environmental Protection Agency
UST – underground storage tank
VOC – volatile organic compound

Table 1-9
Data Quality Objectives for Data Gap Areas and SWMUs at OU-2C

STEP 1 State the Problem	STEP 2 Identify the Decisions	STEP 3 Identify Decision Inputs	STEP 4 Define Study Boundaries	STEP 5 Develop Decision Rules	STEP 6 Specify Tolerable Limits on Decision Errors	STEP 7 Optimize the Sampling Design
OU-2C occupies approximately 47 acres at Alameda Point and consists of IR Sites 5, 10, and 12. RI data gap sampling is proposed for several areas within OU-2C identified by the Navy and regulatory agencies as needing further evaluation before proceeding to an FS. OU-2C includes the former aircraft rework facility (Building 5/5A), missile rework operations (Building 400), power plant (Building 10), metal treatment shop (Building 32), dry cleaning operation (eastern portion of Building 2), repair shop and steam cleaning facility (Building 6), plus a number of other smaller buildings that historically used or stored chemicals and a number of OWSs, USTs, and ASTs. Areas requiring further evaluation were initially identified in the draft RI Report prepared by SulTech (2005) and on the basis of agency review comments on that draft RI Report. The report recommended further evaluation of several areas within OU-2C, and based on a combined assessment of the historical uses, the results of data evaluation, risk evaluation, and input received from regulatory agencies, further sampling was identified for 12 of the smaller buildings, which are referred to as data gap areas, one area of previous PAH sampling and former materials storage (identified by review of photographs), and 22 OWSs and SWMUs. The Navy and regulatory agencies refined the list of data gap area buildings and SWMUs requiring sampling for sampling under OU-2C as follows: Twelve data gap areas at IR Site 5 (Buildings 6, 34, 43, 44, 102, 282, 347, 400, 405, 415, 500, and 505 and the PAH area) and one data gap area	Decisions regarding data gap areas and SWMUs will be based on evaluation of the analytical results generated from targeted samples. These data will be used to make the following decision. • Are contaminants present in soil or groundwater that indicate releases from the SWMUs? Soil and groundwater data targeting the data gap areas and SWMUs will be combined with other area-specific data to evaluate the nature and extent of contamination and will be used to make the following decision. • Has the characterization of the nature and extent of contamination at OU-2C been completed by the results of the sampling and analysis (described in Tables 1-3 and 1-4) for data gap areas and SWMUs?	Data inputs will be chemical data, including concentrations of target analytes in soil and discrete groundwater collected during previous investigations and during the OU-2C RI supplemental sampling investigation. Constituents in soil and groundwater associated with the data gap areas and SWMUs may be compared to the following criteria for characterization of nature and extent of contamination: • Water Board ESLs for petroleum-contaminated sites (RWQCB 2005) (Table A1-2 of Appendix A1) • U.S. EPA Region 9 or California-modified residential PRGs for soil (U.S. EPA 2004) (Tables A1-1 and A1-2 of Appendix A1) • MCLs for contaminants in groundwater (Tables A1-1 and A1-2 of Appendix A1) • Alameda Point background concentrations for metals in soil and groundwater (Table A1-3 of Appendix A1) The Navy and regulatory agencies have initiated discussions to consider background concentrations and the data set established for Alameda Point at a meeting held on October 18, 2005 (DON 2005a). The comparison criteria that will be used in the RI report will reflect any updated agreements reached by the time that the RI report is prepared. None of the data gap areas or SWMUs are located near surface water; therefore, groundwater results will not be compared to surface water criteria.	The boundaries associated with data gap areas and SWMUs are the following. • The lateral boundaries for the supplemental RI for data gap areas will include soil within the footprints of Buildings 6, 347, 405, and 500; the hangar area of Building 400; and, in the case of Building 415, the boundaries of the former Hazardous Waste Storage Area; and will include soil and groundwater within the footprints of Buildings 34, 43, 44, 102, 282, and 505. • The lateral boundary for the PAH data gap area will include soil within 50 feet of previous sampling locations 030-S05-009 and C3S005B048. • The lateral boundaries for the Supplemental RI for SWMUs will include soil and groundwater within 50 feet of each SWMU identified for sampling and analysis. • The vertical soil boundary will be the vadose zone underlying the immediate vicinity of the Data Gap Building or SWMU. • In the event that contaminant concentrations in soil at the water table (4 to 6 feet bgs) are found to exceed comparison criteria at SWMU locations, the vertical soil boundary will be 30 feet bgs (within the FWBZ). • The vertical boundary for the PAH data gap area will be soil to a depth of 8 feet, which is consistent with previous PAH investigations at Alameda Point. • For sampling locations where TPH is a potential contaminant of concern, the vertical boundary includes vadose zone soil and soil collected at the water table.	Soil and discrete groundwater results will be compared to criteria listed in Step 3. If the only contaminants present above comparison criteria are petroleum-related constituents, then the following general decision rules will be applied. • If contaminants are present in soil and groundwater at concentrations below Water Board ESLs (Table A1-3 in Appendix A1) for petroleum-contaminated sites, then no further action will be recommended. • If contaminants are present in soil or groundwater at concentrations above Water Board ESLs (Table A1-3 in Appendix A1) for petroleum-contaminated sites, then the SWMU, AST, or UST may be recommended for further evaluation under the Alameda Point TPH Program. If nonpetroleum contaminants are present, then the following general decision rules will be applied regarding nature and extent. • If characterization of nature and extent of contamination (based on comparison criteria in Step 3 in this table, and Tables A1-1 through A1-3 in Appendix A1) has been completed with the data from the sampling and analysis program (described in Table 1-3), no further remedial investigation will be recommended • If soil and groundwater sampling at data gap areas or SWMUs identifies analytes not previously reported at OU-2C at concentrations exceeding comparison criteria, real-time decisions will be made in the field with regulatory agency involvement. Decisions will also be made to identify step-out sampling locations for data gap areas and SWMUs (up to 50 feet) in order to complete nature-and-extent characterization, such that no further remedial investigation will be recommended.	Site-specific sampling objectives limit the use of statistical methods for selecting sampling locations to target data gap areas and SWMUs. Judgmental sampling has been chosen by the Navy and regulatory agencies to further assess whether soil or groundwater has been impacted by possible releases from these data gap areas and SWMUs. Because judgmental sampling will be used, statistical limits on decision errors are not quantifiable. The most severe study decision error would be to conclude that action is not required when an unacceptable level of human-health risk actually exists. Data collected during the RI will be evaluated conservatively.	The sampling design was developed to generate data to meet the DQOs and in accordance with regulatory agency requests. Soil and discrete groundwater samples will be collected (using direct-push sampling method) from one boring at each data gap area and SWMU and two borings at the each SWMU with no nearby historical or current sampling. For data gap buildings, the borings will be within the building footprint and, for existing buildings, through the building floor. The borings will be adjacent to and on the estimated downgradient side (where possible) of each SWMU. Soil samples will be collected at two depths from each boring (0 to 0.5 foot and 2 to 4 feet bgs). The groundwater samples will be collected (using a HydroPunch or an equivalent sampling method) from the soil borings at a depth of approximately 5 to 10 feet below the groundwater table, and 25 to 30 feet bgs. For the PAH data gap area, one boring will be installed 25 feet west of previous sampling location 030-S05-009 and two borings will be installed 15 feet northeast and northwest of previous sampling location C3S005B048. Soil samples will be collected and homogenized from 4 depths (0–0.5 foot bgs, 0.5 foot–2 feet bgs, 2–4 feet bgs, and 4–8 feet bgs) in accordance with a previous PAH investigation protocols. For the two borings near C3S005B048 (located within the former materials storage area); soil samples collected from 3 depths (0–0.5 foot bgs, 2–4 feet bgs, and 4–8 feet bgs) will also be analyzed for VOCs, TPH, SVOCs, PCBs, and metals. Soil and discrete groundwater samples will be analyzed using one or more of the following methods, as agreed to by the Navy and regulatory agencies: • VOCs, using U.S. EPA Methods 5035A and 8260B

Table 1-9 (continued)

STEP 1 State the Problem	STEP 2 Identify the Decisions	STEP 3 Identify Decision Inputs	STEP 4 Define Study Boundaries	STEP 5 Develop Decision Rules	STEP 6 Specify Tolerable Limits on Decision Errors	STEP 7 Optimize the Sampling Design
at IR Site 10 (Building 400), and 17 SWMUs (AOC 005, AST 005G, M-01, M-02, M-05, M-08, M-09; NADEP GAP 02, 04, 17, 20, 25, 27, 31, 57, and 70; NAS GAP 01). This Work Plan proposes the collection and analysis of soil and groundwater samples to assess possible impact from these 12 data gap buildings, the PAH data gap area, and 17 SWMUs due to a release to surface soil.			• The vertical groundwater boundary for discrete groundwater samples will be 5 to 10 feet below the water table (to allow for sufficient sample volume), which is equivalent to 10 to 15 feet bgs for the shallower portion of FWBZ; and 25 to 30 feet bgs for the deeper portion of the FWBZ • The temporal boundary for the Supplemental RI field work will be a 3-month period following approval of the Work Plan. • The temporal boundary for analytical data to be used for the RI report will be 1991 through 2007. This time period includes the data collected during the activities conducted under this Work Plan and historical analytical data from 1991 through 2004, which is included in this Work Plan. This time period also includes analytical data from other sampling activities between 2004 and 2007 that are available at the time that the supplemental RI sampling results have been validated and verified, such as data from the ongoing basewide groundwater monitoring program and ongoing removal actions.			• TPH, using U.S. EPA Method 8015-M for purgeable-range hydrocarbons and U.S. EPA Method 8015B-M for extractable-range hydrocarbons • SVOCs including 1,4-dioxane, using U.S. EPA Method 8270C (with SIM for PAHs if needed) • PCBs, using U.S. EPA Method 8082 • metals, using U.S. EPA Method 6010B/7000 Series • hexavalent chromium, using U.S. EPA Method 7196A • cyanide, using U.S. EPA Method 9010B Activities planned to address data gaps include: • Building 6 – installation of three borings for collection of soil samples (See Table 1-8 for groundwater sampling at locations of OWSs associated with this building) • Buildings 34, 43, 44, 102, 282, and 505 – installation of one boring for collection of soil and discrete groundwater samples at each building • Building 347 – installation of three borings for collection of soil samples (building is adjacent to monitoring well location) • Building 400 hangar area – installation of eight borings for collection of soil samples • Buildings 405 and 415 – installation of two borings for collection of soil samples at each building • Building 500 – installation of one boring for collection of soil samples • PAH data gap area including former materials storage area – installation of three borings for collection of soil samples • All SWMUs – installation of one boring at each SWMU for collection of soil and discrete groundwater samples.

Table 1-9 (continued)

STEP 1 State the Problem	STEP 2 Identify the Decisions	STEP 3 Identify Decision Inputs	STEP 4 Define Study Boundaries	STEP 5 Develop Decision Rules	STEP 6 Specify Tolerable Limits on Decision Errors	STEP 7 Optimize the Sampling Design
						• SWMU M-05 – an additional boring to collect soil samples at the location of a crack in the concrete identified during the April 2006 site visit • SWMU NADEP GAP 04 – an additional boring to collect soil samples in the former paint mixing area identified during the site visit SWMUs NADEP GAP 17, NADEP GAP 27, and NADEP GAP 31 – an additional boring at each of these SWMUS for which there are no historical sampling points within 50 feet.

Acronyms/Abbreviations:
AST – aboveground storage tank
bgs – below ground surface
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
DQO – data quality objective
DTSC – (California Environmental Protection Agency) Department of Toxic Substances Control
EDC – economic development conveyance
ESL – environmental screening level
FS – feasibility study
GAP – generator accumulation point
IR – Installation Restoration (Program)
NADEP – Naval Aviation Depot
NAS – Naval Air Station
PRG – preliminary remediation goal
RI – remedial investigation
SWMU – solid waste management unit
TDS – total dissolved solids
TPH – total petroleum hydrocarbons
U.S. EPA – United States Environmental Protection Agency
UST – underground storage tank
VOC – volatile organic compound

Table 2-1
Groundwater Monitoring Well Construction Information

Well Identifier	Screened Interval (feet bgs)
First Water-Bearing Zone[a]	
1MW6S	9.5–14.5
1MW7S	9–14
282-MW1	3.5–13.5
282-MW2	5–15
282-MW3	5–15
2MW8S	8.5–13.5
3MW10S	—[b]
400MJ-MW1	—[b]
400MJ-MW2	—[b]
400MJ-MW3	—[b]
M05-01	4–14
M05-02	4–14
M05-03	4–12
M05-04	5–15
M05-05	4–14
M05-06	3–13
M05-07[c]	6.5–17
M05-08	6.5–15
M05-09	5–15
M05-10[c]	5–15
M05-11	5–15
M05-12	5.5–15.5
M05BS-01	5–15
M05HW-01	5–15
M08-07	3.5–13.5
M10-01	4–14
M10-02	3–13
M10-03	3–13
M117-E	8–18
M12-01	5–15
M12-02	5–15
M12-03	4–14
M12-04	4–14
MLS-1	—[b]
MLS-7	—[b]

Table 2-1 (continued)

Well Identifier	Screened Interval (feet bgs)
MRW-1[c]	—[b]
MRW-2[c]	—[b]
MRW-3[c]	—[b]
MRW-4[c]	—[b]
P-5-1-MWD1	25–30
P-5-1-MWD2	25–30
P-5-1-MWD3	25–30
P-5-1-MWD4	25–30
P-5-1-MWD5	25–30
P-5-1-MWI1	18–21
P-5-1-MWI2	18.5–21.5
P-5-1-MWI3	19–22
P-5-1-MWI4	19–22
P-5-1-MWI5	18.5–21.5
Second Water-Bearing Zone[d]	
D05-01	60–70
D05-02[c]	57–67
D05-03	57–67
D05-04	65–70
D05-05	65–70
D05-06	65.6–70.6
D05-07	65–70
D05-08	65–70
D10A-01	60–70
D12-01	60–70

Notes:

[a] the approximate depth of the first water-bearing zone wells is assumed to be 15 feet bgs, unless otherwise noted in the Screened Interval column

[b] not known, based on currently available information

[c] well identifiers in bold type are known to be abandoned wells

[d] the approximate depth of the second water-bearing zone wells is assumed to be 70 feet bgs, unless otherwise noted in the Screened Interval column

Acronym/Abbreviation:

bgs – below ground surface

Table 2-2
Method Reporting Limits Compared With Regulatory Criteria

Analyte	U.S. EPA Method	TARGET METHOD REPORTING LIMIT Water (µg/L)	TARGET METHOD REPORTING LIMIT Soil (µg/kg)	REGULATORY CRITERIA: SOIL Residential PRG[a] (µg/kg)	REGULATORY CRITERIA: WATER (GROUNDWATER) MCL[a] (µg/L)	REGULATORY CRITERIA: WATER (ECOLOGICAL) CTR[b,c,d] (µg/L)	REGULATORY CRITERIA: WATER (HUMAN-HEALTH CONSUMPTION OF ORGANISMS) U.S. EPA NRWQC[e] (µg/L)
Volatile Organic Compounds							
acetone	8260B	2	100	1.4E+07	—[f]	—	—
benzene	8260B	0.5	5	640	1	—	51
bromobenzene	8260B	0.5	5	28,000	—	—	—
bromochloromethane	8260B	0.5	5	820	—	—	—
bromodichloromethane	8260B	0.5	5	820	100 (total THM)	—	17
bromoform	8260B	0.5	5	62,000	100 (total THM)	—	140
bromomethane	8260B	0.5	10	3,900	—	—	—
2-butanone	8260B	2	100	2.2E+07	—	—	—
n-butylbenzene	8260B	0.5	20	2.4E+05	—	—	—
sec-butylbenzene	8260B	0.5	20	2.2E+05	—	—	—
tert-butylbenzene	8260B	0.5	20	3.9E+05	—	—	—
carbon disulfide	8260B	0.5	100	3.6E+05	—	—	—
carbon tetrachloride	8260B	0.5	5	250	0.5	—	1.6
chlorobenzene	8260B	0.5	5	1.5E+05	70	—	1,600
chloroethane	8260B	0.5	5	3,000	—	—	—
chloroform	8260B	0.5	5	220	100 (total THM)	—	470
1-chlorohexane	8260B	0.5	NA	—		—	—
chloromethane	8260B	0.5	10	47,000		—	—
2-chlorotoluene	8260B	0.5	20	1.6E+05		—	—
4-chlorotoluene	8260B	0.5	20	—		—	—
dibromochloromethane	8260B	0.5	5	1,100	100 (total THM)	—	13
1,2-dibromo-3-chloropropane	8260B	**2**[g]	20	460	**0.2**[g]	—	—
1,2-dibromoethane	8260B	0.5	20	32	0.5	—	—

Table 2-2 (continued)

Analyte	U.S. EPA Method	TARGET METHOD REPORTING LIMIT Water (µg/L)	TARGET METHOD REPORTING LIMIT Soil (µg/kg)	REGULATORY CRITERIA: SOIL Residential PRG[a] (µg/kg)	REGULATORY CRITERIA: WATER (GROUNDWATER) MCL[a] (µg/L)	REGULATORY CRITERIA: WATER (ECOLOGICAL) CTR[b,c] (µg/L)	REGULATORY CRITERIA: WATER (HUMAN-HEALTH CONSUMPTION OF ORGANISMS) U.S. EPA NRWQC[d] (µg/L)
Volatile Organic Compounds (continued)							
dibromomethane	8260B	0.5	5	67,000	—	—	—
1,2-dichlorobenzene	8260B	0.5	5	6.0E+05	600	—	1,300
1,3-dichlorobenzene	8260B	0.5	5	5.3E+05	—	—	960
1,4-dichlorobenzene	8260B	0.5	5	3,400	5	—	190
dichlorodifluoromethane	8260B	0.5	10	94,000	—	—	—
1,1-dichloroethane	8260B	0.5	5	2,800	5	—	—
1,2-dichloroethane	8260B	0.5	5	280	0.5	—	37
1,1-dichloroethene	8260B	0.5	5	1.2E+05	6	—	7,100
cis-1,2-dichloroethene	8260B	0.5	5	43,000	6	—	—
trans-1,2-dichloroethene	8260B	0.5	5	69,000	10	—	10,000
1,2-dichloropropane	8260B	0.5	5	340	5	—	15
1,3-dichloropropane	8260B	0.5	5	1.0E+05	—	—	—
2,2-dichloropropane	8260B	0.5	5	—	—	—	—
1,1-dichloropropene	8260B	0.5	5	—	—	—	—
cis-1,3-dichloropropene	8260B	0.5	5	780	0.5 (total DCP)	—	21 (total DCP)
trans-1,3-dichloropropene	8260B	0.5	5	780	0.5 (total DCP)	—	21 (total DCP)
ethylbenzene	8260B	0.5	20	4.0E+05	300	—	2,100
hexachlorobutadiene	8260B	0.5	50	6,200	—	—	—
2-hexanone	8260B	5	20	—	—	—	—
isopropylbenzene	8260B	0.5	20	5.7E+05	—	—	—
p-isopropyltoluene	8260B	0.5	5	—	—	—	—
methylene chloride	8260B	1	50	9,100	5	—	590
4-methyl-2-pentanone	8260B	5	20	5.3E+06	—	—	—
methyl tert butyl ether	8260B	0.5	40	1.67E+04	13	—	—

Table 2-2 (continued)

Analyte	U.S. EPA Method	TARGET METHOD REPORTING LIMIT Water (µg/L)	TARGET METHOD REPORTING LIMIT Soil (µg/kg)	REGULATORY CRITERIA: SOIL PRG[a] Residential PRG[a] (µg/kg)	REGULATORY CRITERIA: WATER (GROUNDWATER) MCL[a] (µg/L)	REGULATORY CRITERIA: WATER (ECOLOGICAL) CTR[b,c,d] (µg/L)	REGULATORY CRITERIA: WATER (HUMAN-HEALTH CONSUMPTION OF ORGANISMS) U.S. EPA NRWQC[e] (µg/L)
Volatile Organic Compounds (continued)							
n-propylbenzene	8260B	0.5	5	2.4E+05	—	—	—
styrene	8260B	0.5	5	1.7E+06	100	—	—
1,1,1,2-tetrachloroethane	8260B	0.5	5	32,000	—	—	—
1,1,2,2-tetrachloroethane	8260B	0.5	5	410	1	—	4.0
tetrachloroethene	8260B	0.5	5	480	5	—	3.3
toluene	8260B	0.5	5	5.2E+05	150	—	15,000
1,2,3-trichlorobenzene	8260B	0.5	20	—	—	—	—
1,2,4-trichlorobenzene	8260B	0.5	20	62,000	5	—	70
1,1,1-trichloroethane	8260B	0.5	5	1.2E+06	200	—	—
1,1,2-trichloroethane	8260B	0.5	5	730	5	—	16
trichloroethene	8260B	0.5	5	53	5	—	30
trichlorofluoromethane	8260B	0.5	10	3.9E+05	150	—	—
1,2,3-trichloropropane	8260B	2	20	34	—	—	—
1,2,4-trimethylbenzene	8260B	0.5	20	52,000	—	—	—
1,3,5-trimethylbenzene	8260B	0.5	20	21,000	—	—	—
2,2,4-trimethylpentane	8260B	2	NA	NA	—	—	—
vinyl chloride	8260B	0.5	10	79	0.5	—	530
xylene, o-	8260B	0.5	5	2.7E+05	1,750 (total xylenes)	—	—
xylenes, m,p-	8260B	0.5	5	2.7E+05	1,750 (total xylenes)	—	—

Table 2-2 (continued)

Analyte	U.S. EPA Method	TARGET METHOD REPORTING LIMIT Water (µg/L)	TARGET METHOD REPORTING LIMIT Soil (µg/kg)	REGULATORY CRITERIA: SOIL Residential PRG[a] (µg/kg)	REGULATORY CRITERIA: WATER (GROUNDWATER) MCL[a] (µg/L)	REGULATORY CRITERIA: WATER (ECOLOGICAL) CTR[b,c,d] (µg/L)	REGULATORY CRITERIA: WATER (HUMAN-HEALTH CONSUMPTION OF ORGANISMS) U.S. EPA NRWQC[e] (µg/L)
Total Petroleum Hydrocarbons							
diesel	8015-M, 8015B-M	50	1,000	100,000	100	640	—
gasoline	8015-M, 8015B-M	100	1,000	100,000	100	500	—
JP-5	8015-M, 8015B-M	50	1,000	100,000	100	500	—
motor oil	8015-M, 8015B-M	**500[g]**	10,000	500,000	**100[g]**	640	—
Semivolatile Organic Compounds						—	
aniline	8270C	10	1,000	85,000	—	—	—
benzoic acid	8270C	10	2,000	1.0E+08	—	—	—
benzyl alcohol	8270C	10	300	1.8E+07	—	—	—
bis(2-chloroethoxy)methane	8270C	10	300	—	—	—	—
bis(2-chloroethyl)ether	8270C	**10[g]**	**300[g]**	**220[g]**	—	—	**0.53[g]**
bis(2-chloroisopropyl)ether	8270C	10	300	2,900	—	—	65,000
bis(2-ethylhexyl)phthalate	8270C	**10[g]**	300	35,000	**4[g]**	—	**2.2[g]**
4-bromophenyl phenyl ether	8270C	10	300	—	—	—	—
butyl benzylphthalate	8270C	10	300	1.2E+07	—	—	1,900
carbazole	8270C	10	600	24,000	—	—	—
4-chloroaniline	8270C	10	300	2.4E+05	—	—	—
4-chloro-3-methylphenol	8270C	10	300	—	—	—	—
2-chloronaphthalene	8270C	10	300	4.9E+06	—	—	1,600
2-chlorophenol	8270C	10	300	63,000	—	—	150
4-chlorophenyl phenyl ether	8270C	10	300	—	—	—	—
dibenzofuran	8270C	10	300	1.5E+05	—	—	—

Table 2-2 (continued)

Analyte	U.S. EPA Method	TARGET METHOD REPORTING LIMIT Water (µg/L)	TARGET METHOD REPORTING LIMIT Soil (µg/kg)	REGULATORY CRITERIA: SOIL Residential PRG[a] (µg/kg)	REGULATORY CRITERIA: WATER (GROUNDWATER) MCL[a] (µg/L)	REGULATORY CRITERIA: WATER (ECOLOGICAL) CTR[b,c,d] (µg/L)	REGULATORY CRITERIA: WATER (HUMAN-HEALTH CONSUMPTION OF ORGANISMS) U.S. EPA NRWQC[e] (µg/L)
Semivolatile Organic Compounds (continued)							
3,3′-dichlorobenzidine	8270C	**25[g]**	**2,000[g]**	**1,100[g]**	—	—	**0.028[g]**
2,4-dichlorophenol	8270C	10	300	1.8E+05	—	—	290
diethyl phthalate	8270C	10	300	4.9E+07	—	—	44,000
2,4-dimethylphenol	8270C	10	300	1.2E+06	—	—	850
dimethyl phthalate	8270C	10	300	1.0E+08	—	—	1,100,000
di-n-butyl phthalate	8270C	10	300	6.1E+06	—	—	4,500
di-n-octylphthalate	8270C	10	300	2.4E+06	—	—	—
4,6-dinitro-2-methylphenol	8270C	25	2,000	—	—	—	280
2,4-dinitrophenol	8270C	25	2,000	1.2E+05	—	—	5,300
2,4-dinitrotoluene	8270C	**10[g]**	300	1.2E+05	—	—	**3.4[g]**
2,6-dinitrotoluene	8270C	10	300	61,000	—	—	—
1,4-dioxane	8270C	1	10,000	4.4E+04	3	—	—
hexachlorobenzene	8270C	**10[g]**	300	300	**1[g]**	—	**0.00029[g]**
hexachlorobutadiene	8270C	10	300	6,200	—	—	18
hexachlorocyclopentadiene	8270C	10	300	3.7E+05	50	—	1,100
hexachloroethane	8270C	**10[g]**	300	35,000	—	—	**3.3[g]**
isophorone	8270C	10	300	5.1E+05	—	—	960
2-methylphenol	8270C	10	300	3.1E+06	—	—	—
4-methylphenol	8270C	10	300	3.1E+05	—	—	—
2-nitroaniline	8270C	25	2,000	1.8E+05	—	—	—
3-nitroaniline	8270C	25	2,000	18,000	—	—	—
4-nitroaniline	8270C	25	2,000	23,000	—	—	—
nitrobenzene	8270C	10	300	20,000	—	—	690
2-nitrophenol	8270C	10	300	—	—	—	—
4-nitrophenol	8270C	25	2,000	—	—	—	—
N-nitrosodimethylamine	8270C	**25[g]**	**2,000[g]**	**9.5[g]**	—	—	**3[g]**

Table 2-2 (continued)

Analyte	U.S. EPA Method	TARGET METHOD REPORTING LIMIT Water (µg/L)	TARGET METHOD REPORTING LIMIT Soil (µg/kg)	REGULATORY CRITERIA: SOIL Residential PRG[a] (µg/kg)	REGULATORY CRITERIA: WATER (GROUNDWATER) MCL[a] (µg/L)	REGULATORY CRITERIA: WATER (ECOLOGICAL) CTR[b,c,d] (µg/L)	REGULATORY CRITERIA: WATER (HUMAN-HEALTH CONSUMPTION OF ORGANISMS) U.S. EPA NRWQC[e] (µg/L)
Semivolatile Organic Compounds (continued)							
N-nitrosodi-n-propylamine	8270C	**10[g]**	**300[g]**	**69[g]**	—	—	**0.51[g]**
N-nitrosodiphenylamine	8270C	**10[g]**	300	99,000	—	—	**6.0[g]**
pentachlorophenol	8270C	**25[g]**	2,000	3,000	**1[g]**	**7.9[g]**	**3.0[g]**
phenol	8270C	10	300	1.8E+07	—	—	1,700,000
pyridine	8270C	50	300	61,000	—	—	—
2,4,5-trichlorophenol	8270C	10	300	6.1E+06	—	—	—
2,4,6-trichlorophenol	8270C	**10[g]**	300	6,100	—	—	**2.4[g]**
Polynuclear Aromatic Compounds							
acenaphthene	8270C SIM	0.2	5	3.7E+06	—	—	990
acenaphthylene	8270C SIM	0.2	5	—	—	—	—
anthracene	8270C SIM	0.2	5	2.2E+07	—	—	40,000
benz(a)anthracene	8270C SIM	**0.2[g]**	5	620	—	—	**0.018[g]**
benzo(a)pyrene	8270C SIM	**0.2[g]**	5	62	0.2	—	**0.018[g]**
benzo(b)fluoranthene	8270C SIM	**0.2[g]**	5	620	—	—	**0.018[g]**
benzo(k)fluoranthene	8270C SIM	**0.2[g]**	5	380	—	—	**0.018[g]**
benzo(g,h,i)perylene	8270C SIM	0.2	5	—	—	—	—
chrysene	8270C SIM	**0.2[g]**	5	3,800	—	—	**0.018[g]**
dibenz(a,h)anthracene	8270C SIM	**0.2[g]**	5	62	—	—	**0.018[g]**
fluoranthene	8270C SIM	0.2	5	2.3E+06	—	—	140
fluorene	8270C SIM	0.2	5	2.7E+06	—	—	5,300
indeno(1,2,3-cd)pyrene	8270C SIM	**0.2[g]**	5	620	—	—	**0.018[g]**
2-methylnaphthalene	8270C SIM	0.2	5	—	—	—	—
naphthalene	8270C SIM	0.2	5	1,700	—	—	—
phenanthrene	8270C SIM	0.2	5	—	—	—	—
pyrene	8270C SIM	0.2	5	2.3E+06	—	—	4,000

Table 2-2 (continued)

Analyte	U.S. EPA Method	TARGET METHOD REPORTING LIMIT Water (µg/L)	TARGET METHOD REPORTING LIMIT Soil (µg/kg)	REGULATORY CRITERIA: SOIL Residential PRG[a] (µg/kg)	REGULATORY CRITERIA: WATER (GROUNDWATER) MCL[a] (µg/L)	REGULATORY CRITERIA: WATER (ECOLOGICAL) CTR[b,c,d] (µg/L)	REGULATORY CRITERIA: WATER (HUMAN-HEALTH CONSUMPTION OF ORGANISMS) U.S. EPA NRWQC[e] (µg/L)
Polychlorinated Biphenyls							
Aroclor 1016	8082	**0.2[g]**	100	220	0.5	**0.03[g]**	**0.000064[g]**
Aroclor 1221	8082	**0.4[g]**	200	3,900	0.5	**0.03[g]**	**0.000064[g]**
Aroclor 1232	8082	**0.2[g]**	100	220	0.5	**0.03[g]**	**0.000064[g]**
Aroclor 1242	8082	**0.2[g]**	100	220	0.5	**0.03[g]**	**0.000064[g]**
Aroclor 1248	8082	**0.2[g]**	100	220	0.5	**0.03[g]**	**0.000064[g]**
Aroclor 1254	8082	**0.2[g]**	100	220	0.5	**0.03[g]**	**0.000064[g]**
Aroclor 1260	8082	**0.2[g]**	100	220	0.5	**0.03[g]**	**0.000064[g]**
Metals[h]							
aluminum	6010B	100	10,000	7.6E+07	1,000	—	—
antimony	6010B	5	500	31,000	6	—	640
arsenic	6010B	**5[g]**	**500[g]**	**62[g]**	10	36	**0.14[g]**
barium	6010B	5	500	5.4E+06	1,000	—	—
beryllium	6010B	2	200	1.5E+05	4	—	—
cadmium	6010B	5	500	37,000	5	9.3	—
chromium (total)	6010B	5	500	2.1E+05	50	—	—
chromium (hexavalent)	7196A	20	500	30,000	50	50	—
cobalt	6010B	5	500	9.0E+05	—	—	—
copper	6010B	**5[g]**	500	3.1E+06	—	**3.1[g]**	—
iron	6010B	50	5,000	2.3E+07	—	NA	NL
lead	6010B ICP	5	500	1.5E+05	15	8.1	—
manganese	6010B	5	500	1.8E+06	—	—	—

Table 2-2 (continued)

Analyte	U.S. EPA Method	TARGET METHOD REPORTING LIMIT Water (µg/L)	TARGET METHOD REPORTING LIMIT Soil (µg/kg)	REGULATORY CRITERIA: SOIL Residential PRG[a] (µg/kg)	REGULATORY CRITERIA: WATER (DRINKING WATER) MCL[a] (µg/L)	REGULATORY CRITERIA: WATER (ECOLOGICAL) CTR[b,c,d] (µg/L)	REGULATORY CRITERIA: WATER (HUMAN-HEALTH CONSUMPTION OF ORGANISMS) U.S. EPA NRWQC[e] (µg/L)
Metals[g] (continued)							
mercury	7470/7471A	**0.2[g]**	100	23,000	2	0.025	—
mercury – water only	1631	0.0004	NA	NA	2	0.025	0.051
nickel	6010B	5	500	1.6E+06	100	8.2	4,600
selenium	6010B	5	500	3.9E+05	50	71	4,200
silver	6010B	1	100	3.9E+05	—	—	—
thallium	6010B	**5[g]**	2,000	5,200	**2[g]**	—	**0.47[g]**
vanadium	6010B	5	500	78,000	—	—	—
zinc	6010B	50	5,000	2.3E+07	—	81	26,000
Other Analyses							
cyanide	9010B	**10[g]**	500	1.2E+06	150	**1[e]**	140
radium (226 and 228)	901.1 (soil); 903.1 and 904.0 (groundwater)	1 pCi/L	—	0.5 pCi/g	5 pCi/L[i]	—	—

Notes:

[a] residential soil PRG values (U.S. EPA 2004b) and MCL values presented are the lower of U.S. EPA or California-modified values; if the residential PRGs include both cancer and noncancer values, only the more conservative cancer values are presented here; during the FS, RAOs that are specific to future use will be considered; Water Board ESL values for shallow soil and groundwater, respectively, used for TPH

[b] saltwater aquatic life 4-day average

[c] 4-day average unless otherwise noted

[d] Water Board ESL for surface water (RWQCB 2005) used for TPH

[e] Human-Health Protection for Consumption of Organisms Only (U.S. EPA 2003)

[f] dash indicates no value established

[g] bold type indicate analytes with regulatory standards currently less than the method reporting limit; the method reporting limit will be used as the decision threshold

[h] calcium, magnesium, potassium, and sodium are not included in the list of metals because these analytes are considered essential nutrients rather than potential contaminants

[i] MCL of 5 pCi/L is for radium-226 and radium-228 combined

Table 2-2 (continued)

Acronyms/Abbreviations:

BHC – benzene hexachloride
CTR – California Toxics Rule
DCP – dichloropropene
ICP – inductively coupled argon plasma
µg/kg – micrograms per kilogram
µg/L – micrograms per liter
mg/L – milligrams per liter
NA – not applicable
NL – not listed
NRWQC – (U.S. EPA) National Recommended Water Quality Criteria
pCi/g – picocuries per gram
pCi/L – picocuries per liter
PRG – preliminary remediation goal
RAO – remedial action objective
THM - trihalomethanes
U.S. EPA – United States Environmental Protection Agency

Table 2-3
Navy CLEAN Program Analytical Data Quality Objectives

Analytical Category and Parameter	Method	MS/MSD ACCURACY CRITERIA (percent recovery)		LCS ACCURACY CRITERIA[a] (percent recovery)		PRECISION (maximum RPD)	
		Soil	Water	Soil	Water	Soil	Water
VOCs	**U.S. EPA Methods 5035A and 8260B (EPA SW-846)**						
benzene[b]		75–125	80–120	75–125	80–120	20	20
chlorobenzene		75–125	80–120	75–125	80–120	20	20
1,2-dichloroethane		70–135	70–130	70–135	70–130	20	20
1,1-dichloroethene[b]		65–135	70–130	65–135	70–130	20	25
trans-1,2-dichloroethene		65–135	60–140	65–135	60–140	20	20
ethylbenzene		75–125	75–125	75–125	75–125	20	20
tetrachloroethene		65–140	45–150	65–140	45–150	20	20
toluene[b]		70–125	75–120	70–125	75–120	20	20
1,1,1-trichloroethane		70–135	65–130	70–135	65–130	20	20
trichloroethene[b]		75–125	70–125	75–125	70–125	20	20
xylenes (total)		80–125	75–130	80–125	75–130	20	20
Surrogates							
bromofluorobenzene		85–120	75–120	85–120	75–120	NA	NA
1,2-dichloroethane-d_4		52–149	70–120	52–149	70–120	NA	NA
toluene-d_8		85–115	85–120	85–115	85–120	NA	NA
TPH	**U.S. EPA Methods 8015-M/8015B-M (CA-LUFT Manual)/EPA SW-846**						
gasoline		67–136	67–136	67–136	67–136	30	30
diesel		47–146	23–132	47–146	23–132	30	25
Surrogates							
bromofluorobenzene	TPH-gasoline	64–148	74–138	64–148	74–138	NA	NA
ocatacosane	TPH-extractable	47–140	28–142	47-140	28–142	NA	NA
terphenyl	TPH-extractable	58–128	49–128	58-128	49–128	NA	NA
SVOCs	**U.S. EPA Method 8270C (EPA SW-846)**						
4-chloro-3-methylphenol		45–115	20–120	45–115	45–110	25	30
2-chlorophenol		35–105	25–120	35–105	35–105	25	25
2,4-dinitrotoluene		50–115	50–120	50-115	50–120	25	30
4-nitrophenol		15–145	10–125	15–140	10–125	30	30
N-nitroso-di-n-propylamine		40–115	35–130	40-115	35–130	25	25
pentachlorophenol		50–115	40–115	50–115	40-115	25	30
phenol		40–100	10–115	40–100	10–115	25	25
Surrogates							
2-fluorobiphenyl		45–105	50–100	45–105	50–110	NA	NA
2-fluorophenol		35–105	20–110	35–105	20–110	NA	NA
nitrobenzene-d_5		35–100	40–110	35-100	40–110	NA	NA

Table 2-3 (continued)

Analytical Category and Parameter	Method	MS/MSD ACCURACY CRITERIA (percent recovery)		LCS ACCURACY CRITERIA[a] (percent recovery)		PRECISION (maximum RPD)	
		Soil	Water	Soil	Water	Soil	Water
SVOCs (continued)							
Surrogates (continued)							
phenol-d_5		40–100	10–115	40–100	10–115	NA	NA
p-terphenyl-d_{14}		30–125	50–135	30–125	50–135	NA	NA
2,4,6-tribromophenol		35–125	40–125	35–125	40–125	NA	NA
PAHs	**U.S. EPA Method 8270C SIM (EPA SW-846)**						
acenaphthene		45–110	45–110	45–110	45–110	30	30
acenaphthylene		45–105	50–105	45–105	50–105	30	30
anthracene		55–105	55–110	55–105	55–110	30	30
benz(a)anthracene		50–110	55–110	50–110	55–110	30	30
benzo(b)fluoranthene		45–115	45–120	45–115	45–120	30	30
benzo(k)fluoranthene		45–125	45–125	45–125	45–125	30	30
benzo(g,h,i)perylene		40–125	40–125	40–125	40–125	30	30
benzo(a)pyrene		50–110	55–110	50–110	55–110	30	30
chrysene		55–110	55–110	55–110	55–110	30	30
dibenz(a,h)anthracene		40–125	40–125	40–125	40–125	30	30
fluorathene		55–115	55–115	55–115	55–115	30	30
fluorene		50–110	50–110	50–110	50–110	30	30
indeno(1,2,3-cd)pyrene		40–120	45–125	40–120	45–125	30	30
2-methylnaphthalene		45–105	45–105	45–105	45–105	30	30
naphthalene		40–105	40–100	40–105	40–100	30	30
phenanthrene		50–110	50–115	50–110	50–115	30	30
pyrene		45–125	50–130	45–125	50–130	30	30
Surrogates							
2-fluorobiphenyl		45–105	50–110	45–105	50–110	NA	NA
nitrobenzene-d_3		35–100	40–110	35–100	40–110	NA	NA
terphenyl-d_{14}		30–125	50–135	30–125	50–135	NA	NA
PCBs	**U.S. EPA Method 8082 (EPA SW-846)**						
Aroclor 1016		40–140	25–145	40–140	25–145	30	25
Aroclor 1260		60–130	40–140	60–130	40–140	30	25
Surrogates							
DCB		60–125	40–135	60–125	40–135	NA	NA

Table 2-3 (continued)

Analytical Category and Parameter	Method	MS/MSD ACCURACY CRITERIA (percent recovery)		LCS ACCURACY CRITERIA[a] (percent recovery)		PRECISION (maximum RPD)	
		Soil	Water	Soil	Water	Soil	Water
Metals[d]	**U.S. EPA Method 6010B/7000 Series and 1631 (for analysis of mercury in groundwater)**						
aluminum		80–120	80–120	80–120	80–120	20	20
antimony		80–120	80–120	80–120	80–120	20	20
arsenic		80–120	80–120	80–120	80–120	20	20
barium		80–120	80–120	80–120	80–120	20	20
beryllium		80–120	80–120	80–120	80–120	20	20
cadmium		80–120	80–120	80–120	80–120	20	20
chromium (total)		80–120	80–120	80–120	80–120	20	20
chromium (hexavalent)		80–120	80–120	80–120	80–120	20	20
cobalt		80–120	80–120	80–120	80–120	20	20
copper		80–120	80–120	80–120	80–120	20	20
iron		80–120	80–120	80–120	80–120	20	20
lead (total)		80–120	80–120	80–120	80–120	20	20
manganese		80–120	80–120	80–120	80–120	20	20
mercury[e]		80–120	80–120	80–120	80–120	20	20
nickel		80–120	80–120	80–120	80–120	20	20
selenium		80–120	80–120	80–120	80–120	20	20
silver		80–120	80–120	80–120	80–120	20	20
thallium		80–120	80–120	80–120	80–120	20	20
vanadium		80–120	80–120	80–120	80–120	20	20
zinc		80–120	80–120	80–120	80–120	20	20
Cyanide	**U.S. EPA Method 9010B**						
cyanide		75–125	75–125	75–125	75–125	20	20
Radium	**U.S. EPA Method 901.1 (for soil) and U.S. EPA Methods 903.1 and 904.0 (for groundwater)**						
radium (226 and 228)		NE	NE	NE	NE	NE	20
Dissolved Gases	**U.S. EPA RSK Method 175**						
ethane[f]		NA	70–130	NA	70–130	NA	30
ethene[f]		NA	70–130	NA	70–130	NA	30
methane[f]		NA	70–130	NA	70–130	NA	30
General Water Quality Parameters							
chloride	U.S. EPA Method 300	80–120	80–120	80–120	80–120	20	20
nitrate as nitrogen	U.S. EPA Method 300	80–120	80–120	80–120	80–120	20	20
nitrite as nitrogen	U.S. EPA Method 300	80–120	80–120	80–120	80–120	20	20
sulfate	U.S. EPA Method 300	80–120	80–120	80–120	80–120	20	20

Table 2-3 (continued)

Notes:

[a] accuracy criteria are for guidance only; laboratory specific limits are determined utilizing control charts generated during the analysis of CLEAN Program samples; use these limits until sufficient data are generated

[b] for all sample QC associated with CLEAN Program samples, at a minimum, these compounds must be spiked

[c] gamma isomer of benzene hexachloride

[d] the QC criteria for metals apply to all analyses by U.S. EPA Method 6010B/7000 Series

[e] concentrations of mercury in groundwater samples will be analyzed using U.S. EPA Method 1631

[f] programmatic data quality objectives have not been established for this parameter; laboratory-generated criteria will be used

Acronyms/Abbreviations:

BHC – benzene hydrochloride
CLEAN – Comprehensive Long-Term Environmental Action Navy
DCB – decachlorobiphenyl
DDT – dichlorodiphenyltrichloroethane
LCS – laboratory control sample
LUFT – leaking underground fuel tank
MS – matrix spike
MSD – matrix spike duplicate
NA – not applicable
NE – not established
PAH – polynuclear aromatic hydrocarbon
PCB – polychlorinated biphenyl
QC – quality control
RSK – Robert S. Kerr Environmental Research Laboratory
RPD – relative percent difference
SIM – selected ion monitoring
SVOC – semivolatile organic compound
SW – solid waste
TCMX – tetrachloro-m-xylene
TFT – trifluorotoluene
TPH – total petroleum hydrocarbons
U.S. EPA – United States Environmental Protection Agency
VOC – volatile organic compound

QAPP Worksheet 6
Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure
Project management	Project Manager	Janet Argyres	(415) 768-9917	Project Manager will manage field and project personnel.
Technical oversight	CTOL	Eric Johansen	(619) 744-3091	Communication of relevant technical information to Project Manager and field team.
Coordination and communication of fieldwork activities related to sampling	Project Geologist	Cathie Stumpenhaus	(415) 768-4248	Project Geologist will communicate relevant field information to the Project Manager and Laboratory Services Supervisor.
Coordination of laboratory supplies for field activities	Database/Laboratory Services Supervisor	Toni Kuzmack	(619) 744-3056	Laboratory Services Supervisor will contact the laboratory to provide all necessary sample containers and appropriate shipping materials (such as coolers and bubble wrap) to be delivered on site prior to commencement of field sampling activities and throughout the course of the project.
Submittal of samples to the laboratory	Sampling Personnel	Bob Schilling (Field Manager)	(310) 308-6343	Sampling personnel will package and ship samples in accordance with this SAP.
Daily COC reports and shipping documentation	Sampling Personnel	Bob Schilling (Field Manager)	(310) 308-6343	COCs and shipping documentation will be submitted via fax or e-mail to the LSS at the end of each day that samples are collected.
Reporting laboratory data quality issues	Laboratory Project Manager	Diane Anderson	(559) 275-2175	All QA/QC issues will be reported by the Laboratory Project Manager to the Laboratory Services Supervisor in writing within 2 business days.
Field and analytical corrective actions	QA Manager	Anil Dharmapal	(619) 744-3099	The Laboratory Services Supervisor and/or the CTOL will immediately notify the QA Manager in writing of any field or analytical procedures that were not performed in accordance with this SAP. The QA Manager will complete documentation of the nonconformance and corrective actions to be taken. The QA Manager will verify that the corrective actions have been implemented.

QAPP Worksheet 6 (continued)

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure
Release of analytical data	Database/Laboratory Services Supervisor	Toni Kuzmack	(619) 744-3056	The Laboratory Services Supervisor will fax/e-mail data to verify that data quality is met as described in this SAP prior to releasing the data. Analytical data will be released to the Project Manager (or their designee) after the Laboratory Services Supervisor has verified that the data is in accordance with the SAP requirements
SAP procedure revision during field activities	QA Manager	Anil Dharmapal	(619) 744-3099	The QA Manager will prepare a FCR for any changes in sampling procedures that occur due to conditions in the field.
SAP amendments	QA Manager	Anil Dharmapal	(619) 744-3099	Any changes to the SAP will require that the QA Manager prepare an addendum which will be approved by NAVFAC SW prior to any field activities.

Acronyms/Abbreviations:
- COC – chain-of-custody
- CTOL – contract task order leader
- FCR – field change request
- NAVFAC SW – Naval Facilities Engineering Command, Southwest
- QA – quality assurance
- QC – quality control
- SAP – sampling and analysis plan

QAPP Worksheet 6
Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure
Project management	Project Manager	Janet Argyres	(415) 768-9917	Project Manager will manage field and project personnel.
Technical oversight	CTOL	Eric Johansen	(619) 744-3091	Communication of relevant technical information to Project Manager and field team.
Coordination and communication of fieldwork activities related to sampling	Project Geologist	Cathie Stumpenhaus	(415) 768-4248	Project Geologist will communicate relevant field information to the Project Manager and Laboratory Services Supervisor.
Coordination of laboratory supplies for field activities	Database/Laboratory Services Supervisor	Toni Kuzmack	(619) 744-3056	Laboratory Services Supervisor will contact the laboratory to provide all necessary sample containers and appropriate shipping materials (such as coolers and bubble wrap) to be delivered on site prior to commencement of field sampling activities and throughout the course of the project.
Submittal of samples to the laboratory	Sampling Personnel	Bob Schilling (Field Manager)	(310) 308-6343	Sampling personnel will package and ship samples in accordance with this SAP.
Daily COC reports and shipping documentation	Sampling Personnel	Bob Schilling (Field Manager)	(310) 308-6343	COCs and shipping documentation will be submitted via fax or e-mail to the LSS at the end of each day that samples are collected.
Reporting laboratory data quality issues	Laboratory Project Manager	Diane Anderson	(559) 275-2175	All QA/QC issues will be reported by the Laboratory Project Manager to the Laboratory Services Supervisor in writing within 2 business days.
Field and analytical corrective actions	QA Manager	Anil Dharmapal	(619) 744-3099	The Laboratory Services Supervisor and/or the CTOL will immediately notify the QA Manager in writing of any field or analytical procedures that were not performed in accordance with this SAP. The QA Manager will complete documentation of the nonconformance and corrective actions to be taken. The QA Manager will verify that the corrective actions have been implemented.

QAPP Worksheet 6 (continued)

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure
Release of analytical data	Database/Laboratory Services Supervisor	Toni Kuzmack	(619) 744-3056	The Laboratory Services Supervisor will fax/e-mail data to verify that data quality is met as described in this SAP prior to releasing the data. Analytical data will be released to the Project Manager (or their designee) after the Laboratory Services Supervisor has verified that the data is in accordance with the SAP requirements
SAP procedure revision during field activities	QA Manager	Anil Dharmapal	(619) 744-3099	The QA Manager will prepare a FCR for any changes in sampling procedures that occur due to conditions in the field.
SAP amendments	QA Manager	Anil Dharmapal	(619) 744-3099	Any changes to the SAP will require that the QA Manager prepare an addendum which will be approved by NAVFAC SW prior to any field activities.

Acronyms/Abbreviations:
- COC – chain-of-custody
- CTOL – contract task order leader
- FCR – field change request
- NAVFAC SW – Naval Facilities Engineering Command, Southwest
- QA – quality assurance
- QC – quality control
- SAP – sampling and analysis plan

QAPP Worksheet 12
Measurement Performance Criteria – Field Quality Control Samples

Quality Control Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	Quality Control Sample Assesses Error for Sampling (S), Analytical (A), or Both (S&A)
Field duplicate	VOCs, TPH, SVOCs (including 1,4-dioxane), PAHs, PCBs, metals, cyanide, radium, dissolved gases, common ions, total organic carbon, and total dissolved solids	One duplicate per 10 samples	Precision	Relative Percent Difference (See Table 2-3 of the SAP)	S
MS/MSD	VOCs, TPH, SVOCs (including 1,4-dioxane), PAHs, PCBs, metals, cyanide, radium, dissolved gases, common ions, total organic carbon, and total dissolved solids	One set per 20 samples	Accuracy	Percent Recovery (See Table 2-3 of the SAP)	A
Source blank	VOCs, TPH, SVOCs (including 1,4-dioxane), PAHs, PCBs, metals, cyanide, radium, dissolved gases, common ions, total organic carbon, and total dissolved solids	One blank from each source water location	Accuracy	No detection of target compounds; trace levels of metals (from source water) may be acceptable.	S

QAPP Worksheet 12 (continued)

Quality Control Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	Quality Control Sample Assesses Error for Sampling (S), Analytical (A), or Both (S&A)
Equipment rinsate	VOCs, TPH, SVOCs (including 1,4-dioxane), PAHs, PCBs, metals, cyanide, radium, dissolved gases, common ions, total organic carbon, and total dissolved solids	A minimum of one set per day.	Accuracy	No detection of target compounds; trace levels of metals (from source water) may be acceptable.	S
Trip blank	VOCs	One per cooler bearing VOC samples	Accuracy	No detection of VOC target compounds	S

Acronyms/Abbreviations:
- MS/MSD – matrix spike/matrix spike duplicate
- PAH – polynuclear aromatic hydrocarbon
- PCB – polychlorinated biphenyl
- QAPP - Quality Assurance Project Plan
- SAP – Sampling and Analysis Plan
- SVOC – semivolatile organic compound
- TPH – total petroleum hydrocarbons
- VOC – volatile organic compound

QAPP Worksheet 15 – Soil
Reference Limits for Soil

Analytical Group	Analyte	CAS Number	Project Quantitation Limit[a] (µg/kg)	Analytical Method Detection Limit[b] (µg/kg)	Analytical Method Reporting Limit[a] (µg/kg)	Project Action Limit[c] (µg/kg)
VOCs/U.S. EPA Methods 5035A & 8260B	acetone	67-64-1	100	2.8	100	1.4E+07
VOCs/U.S. EPA Methods 5035A & 8260B	benzene	71-43-2	5	0.63	5	640
VOCs/U.S. EPA Methods 5035A & 8260B	bromobenzene	108-86-1	5	0.76	5	28,000
VOCs/U.S. EPA Methods 5035A & 8260B	bromochloromethane	74-97-5	5	0.81	5	820
VOCs/U.S. EPA Methods 5035A & 8260B	bromodichloromethane	75-27-4	5	0.69	5	820
VOCs/U.S. EPA Methods 5035A & 8260B	bromoform	75-25-2	5	0.80	5	62,000
VOCs/U.S. EPA Methods 5035A & 8260B	bromomethane	74-83-9	10	1.6	10	3,900
VOCs/U.S. EPA Methods 5035A & 8260B	2-butanone	78-93-3	100	0.71	100	2.2E+07
VOCs/U.S. EPA Methods 5035A & 8260B	n-butylbenzene	104-51-8	20	0.52	20	2.4E+05
VOCs/U.S. EPA Methods 5035A & 8260B	sec-butylbenzene	135-98-8	20	0.93	20	2.2E+05
VOCs/U.S. EPA Methods 5035A & 8260B	tert-butylbenzene	98-06-6	20	0.45	20	3.9E+05
VOCs/U.S. EPA Methods 5035A & 8260B	carbon disulfide	75-15-0	100	1.08	100	3.6E+05
VOCs/U.S. EPA Methods 5035A & 8260B	carbon tetrachloride	56-23-5	5	0.8	5	250
VOCs/U.S. EPA Methods 5035A & 8260B	chlorobenzene	108-90-7	5	0.49	5	1.5E+05
VOCs/U.S. EPA Methods 5035A & 8260B	chloroethane	75-00-3	5	1.55	5	3,000
VOCs/U.S. EPA Methods 5035A & 8260B	chloroform	67-66-3	5	1.43	5	220
VOCs/U.S. EPA Methods 5035A & 8260B	1-chlorohexane	544-10-5	5		5	—[d]
VOCs/U.S. EPA Methods 5035A & 8260B	chloromethane	74-87-3	10	1.82	10	47,000
VOCs/U.S. EPA Methods 5035A & 8260B	2-chlorotoluene	95-49-8	20	0.99	20	1.6E+05
VOCs/U.S. EPA Methods 5035A & 8260B	4-chlorotoluene	106-43-4	20	1.05	20	—
VOCs/U.S. EPA Methods 5035A & 8260B	dibromochloromethane	124-48-1	5	0.85	5	1,100
VOCs/U.S. EPA Methods 5035A & 8260B	1,2-dibromo-3-chloropropane	96-12-8	20	2.19	20	460
VOCs/U.S. EPA Methods 5035A & 8260B	1,2-dibromoethane	106-93-4	20	1.41	20	32
VOCs/U.S. EPA Methods 5035A & 8260B	dibromomethane	74-95-3	5	0.65	5	67,000

Analytical Group	Analyte	CAS Number	Project Quantitation Limit[a] (µg/kg)	Analytical Method Detection Limit[b] (µg/kg)	Analytical Method Reporting Limit[a] (µg/kg)	Project Action Limit[c] (µg/kg)
VOCs/U.S. EPA Methods 5035A & 8260B	1,2-dichlorobenzene	95-50-1	5	0.46	5	6.0E+05
VOCs/U.S. EPA Methods 5035A & 8260B	1,3-dichlorobenzene	541-73-1	5	0.67	5	5.3E+05
VOCs/U.S. EPA Methods 5035A & 8260B	1,4-dichlorobenzene	106-46-7	5	0.67	5	3,400
VOCs/U.S. EPA Methods 5035A & 8260B	dichlorodifluoromethane	75-71-8	10	0.83	10	94,000
VOCs/U.S. EPA Methods 5035A & 8260B	1,1-dichloroethane	75-34-3	5	0.34	5	2,800
VOCs/U.S. EPA Methods 5035A & 8260B	1,2-dichloroethane	107-06-2	5	0.14	5	280
VOCs/U.S. EPA Methods 5035A & 8260B	1,1-dichloroethene	75-35-4	5	0.76	5	1.2E+05
VOCs/U.S. EPA Methods 5035A & 8260B	cis-1,2-dichloroethene	156-59-2	5	0.22	5	43,000
VOCs/U.S. EPA Methods 5035A & 8260B	trans-1,2-dichloroethene	156-60-5	5	0.34	5	69,000
VOCs/U.S. EPA Methods 5035A & 8260B	1,2-dichloropropane	78-87-5	5	0.62	5	340
VOCs/U.S. EPA Methods 5035A & 8260B	1,3-dichloropropane	142-28-9	5	0.65	5	1.0E+05
VOCs/U.S. EPA Methods 5035A & 8260B	2,2-dichloropropane	594-20-7	5	0.67	5	—
VOCs/U.S. EPA Methods 5035A & 8260B	1,1-dichloropropene	563-58-6	5	0.55	5	—
VOCs/U.S. EPA Methods 5035A & 8260B	cis-1,3-dichloropropene	10061-01-5	5	0.47	5	780
VOCs/U.S. EPA Methods 5035A & 8260B	trans-1,3-dichloropropene	10061-02-6	5	0.43	5	780
VOCs/U.S. EPA Methods 5035A & 8260B	ethylbenzene	100-41-4	20	0.64	20	4.0E+05
VOCs/U.S. EPA Methods 5035A & 8260B	hexachlorobutadiene	87-68-3	50	0.60	50	6,200
VOCs/U.S. EPA Methods 5035A & 8260B	2-hexanone	591-78-6	20	0.16	20	—
VOCs/U.S. EPA Methods 5035A & 8260B	isopropylbenzene	98-82-8	20	1.11	20	5.7E+05
VOCs/U.S. EPA Methods 5035A & 8260B	p-isopropyltoluene	99-87-6	5	0.45	5	—
VOCs/U.S. EPA Methods 5035A & 8260B	methylene chloride	75-09-2	50	4.58	50	9,100
VOCs/U.S. EPA Methods 5035A & 8260B	4-methyl-2-pentanone	108-10-1	20	0.93	20	5.3E+06
VOCs/U.S. EPA Methods 5035A & 8260B	methyl tert butyl ether	1634-04-4	40	0.13	40	1.67E+04
VOCs/U.S. EPA Methods 5035A & 8260B	n-propylbenzene	103-65-1	5	0.42	5	2.4E+05
VOCs/U.S. EPA Methods 5035A & 8260B	styrene	100-42-5	5	0.69	5	1.7E+06
VOCs/U.S. EPA Methods 5035A & 8260B	1,1,1,2-tetrachloroethane	630-20-6	5	0.6	5	32,000
VOCs/U.S. EPA Methods 5035A & 8260B	1,1,2,2-tetrachloroethane	79-34-5	5	1.2	5	410

Analytical Group	Analyte	CAS Number	Project Quantitation Limit[a] (µg/kg)	Analytical Method Detection Limit[b] (µg/kg)	Analytical Method Reporting Limit[a] (µg/kg)	Project Action Limit[c] (µg/kg)
VOCs/U.S. EPA Methods 5035A & 8260B	tetrachloroethene	127-18-4	5	0.54	5	480
VOCs/U.S. EPA Methods 5035A & 8260B	toluene	108-88-3	5	0.65	5	5.2E+05
VOCs/U.S. EPA Methods 5035A & 8260B	1,2,3-trichlorobenzene	87-61-6	20	0.28	20	—
VOCs/U.S. EPA Methods 5035A & 8260B	1,2,4-trichlorobenzene	120-82-1	20	0.52	20	62,000
VOCs/U.S. EPA Methods 5035A & 8260B	1,1,1-trichloroethane	71-55-6	5	0.4	5	1.2E+06
VOCs/U.S. EPA Methods 5035A & 8260B	1,1,2-trichloroethane	79-00-5	5	0.27	5	730
VOCs/U.S. EPA Methods 5035A & 8260B	trichloroethene	79-01-6	5	0.94	5	53
VOCs/U.S. EPA Methods 5035A & 8260B	trichlorofluoromethane	75-69-4	10	1.26	10	3.9E+05
VOCs/U.S. EPA Methods 5035A & 8260B	1,2,3-trichloropropane	96-18-4	20	1.24	20	34
VOCs/U.S. EPA Methods 5035A & 8260B	1,2,4-trimethylbenzene	95-63-6	20	1.18	20	52,000
VOCs/U.S. EPA Methods 5035A & 8260B	1,3,5-trimethylbenzene	108-67-8	20	0.97	20	21,000
VOCs/U.S. EPA Methods 5035A & 8260B	2,2,4-trimethylpentane	540-84-1	20		20	—
VOCs/U.S. EPA Methods 5035A & 8260B	vinyl chloride	75-01-4	10	3.4	10	79
VOCs/U.S. EPA Methods 5035A & 8260B	xylene, o-	95-47-6	5	0.61	5	2.7E+05
VOCs/U.S. EPA Methods 5035A & 8260B	xylenes, m-,p-	108-38-3/ 106-42-3	5	0.43	5	2.7E+05
TPH/U.S. EPA Methods 8015-M & 8015B-M	diesel	NA	1,000	646	1,000	1.0E+05
TPH/U.S. EPA Methods 8015-M & 8015B-M	gasoline	NA	1,000	300	1,000	1.0E+05
TPH/U.S. EPA Methods 8015-M & 8015B-M	JP-5	NA	1,000	657	1,000	1.0E+05
TPH/U.S. EPA Methods 8015-M & 8015B-M	motor oil	NA	10,000	3,510	10,000	5.0E+05

Analytical Group	Analyte	CAS Number	Project Quantitation Limit[a] (µg/kg)	Analytical Method Detection Limit[b] (µg/kg)	Analytical Method Reporting Limit[a] (µg/kg)	Project Action Limit[c] (µg/kg)
SVOCs/U.S. EPA Method 8270C	aniline	62-53-3	1,000	31	1,000	85,000
SVOCs/U.S. EPA Method 8270C	benzoic acid	65-85-0	2,000	29.6	2,000	1.0E+08
SVOCs/U.S. EPA Method 8270C	benzyl alcohol	100-51-6	300	55.8	300	1.8E+07
SVOCs/U.S. EPA Method 8270C	bis(2-chloroethoxy)methane	111-91-1	300	49.9	300	—
SVOCs/U.S. EPA Method 8270C	bis(2-chloroethyl)ether	111-44-4	**300[e]**	50	**300[e]**	**220[e]**
SVOCs/U.S. EPA Method 8270C	bis(2-chloroisopropyl)ether	39638-32-9	300	47.3	300	2,900
SVOCs/U.S. EPA Method 8270C	bis(2-ethylhexyl)phthalate	117-81-7	300	61.6	300	35,000
SVOCs/U.S. EPA Method 8270C	4-bromophenyl phenyl ether	101-55-3	300	56.6	300	—
SVOCs/U.S. EPA Method 8270C	butyl benzylphthalate	85-68-7	300	55.5	300	1.2E+07
SVOCs/U.S. EPA Method 8270C	carbazole	86-74-8	600	81.6	600	24,000
SVOCs/U.S. EPA Method 8270C	4-chloroaniline	106-47-8	300	16.5	300	2.4E+05
SVOCs/U.S. EPA Method 8270C	4-chloro-3-methylphenol	59-50-7	300	58.8	300	—
SVOCs/U.S. EPA Method 8270C	2-chloronaphthalene	91-58-7	300	52.4	300	4.9E+06
SVOCs/U.S. EPA Method 8270C	2-chlorophenol	95-57-8	300	44.3	300	63,000
SVOCs/U.S. EPA Method 8270C	4-chlorophenyl phenyl ether	7005-72-3	300	60.7	300	—
SVOCs/U.S. EPA Method 8270C	dibenzofuran	132-64-9	300	57.3	300	1.5E+05
SVOCs/U.S. EPA Method 8270C	3,3′-dichlorobenzidine	91-94-1	**2,000[e]**	56.3	**2,000[e]**	**1,100[e]**
SVOCs/U.S. EPA Method 8270C	2,4-dichlorophenol	120-83-2	300	50.5	300	1.8E+05
SVOCs/U.S. EPA Method 8270C	diethyl phthalate	84-66-2	300	62.1	300	4.9E+07
SVOCs/U.S. EPA Method 8270C	2,4-dimethylphenol	105-67-9	300	43.9	300	1.2E+06
SVOCs/U.S. EPA Method 8270C	dimethyl phthalate	131-11-3	300	63.3	300	1.0E+08
SVOCs/U.S. EPA Method 8270C	di-n-butyl phthalate	84-74-2	300	65.9	300	6.1E+06
SVOCs/U.S. EPA Method 8270C	di-n-octylphthalate	117-84-0	300	58.4	300	2.4E+06
SVOCs/U.S. EPA Method 8270C	4,6-dinitro-2-methylphenol	534-52-1	2,000	56.4	2,000	—
SVOCs/U.S. EPA Method 8270C	2,4-dinitrophenol	51-28-5	2,000	53.7	2,000	1.2E+05
SVOCs/U.S. EPA Method 8270C	2,4-dinitrotoluene	121-14-2	300	63.8	300	1.2E+05

Analytical Group	Analyte	CAS Number	Project Quantitation Limit[a] (µg/kg)	Analytical Method Detection Limit[b] (µg/kg)	Analytical Method Reporting Limit[a] (µg/kg)	Project Action Limit[c] (µg/kg)
SVOCs/U.S. EPA Method 8270C	2,6-dinitrotoluene	606-20-2	300	60.6	300	61,000
SVOCs/U.S. EPA Method 8270C	1,4-dioxane	123-91-1	10,000	11.7	10,000	4.4E+04
SVOCs/U.S. EPA Method 8270C	hexachlorobenzene	118-74-1	300	60.3	300	300
SVOCs/U.S. EPA Method 8270C	hexachlorobutadiene	87-68-3	300	51.7	300	6,200
SVOCs/U.S. EPA Method 8270C	hexachlorocyclopentadiene	77-47-4	300	44	300	3.7E+05
SVOCs/U.S. EPA Method 8270C	hexachloroethane	67-72-1	300	49.9	300	35,000
SVOCs/U.S. EPA Method 8270C	isophorone	78-59-1	300	57	300	5.1E+05
SVOCs/U.S. EPA Method 8270C	2-methylphenol	95-48-7	300	45.2	300	3.1E+06
SVOCs/U.S. EPA Method 8270C	4-methylphenol	106-44-5	300	46.4	300	3.1E+05
SVOCs/U.S. EPA Method 8270C	2-nitroaniline	88-74-4	2,000	62.4	2,000	1.8E+05
SVOCs/U.S. EPA Method 8270C	3-nitroaniline	99-09-2	2,000	61.1	2,000	18,000
SVOCs/U.S. EPA Method 8270C	4-nitroaniline	100-01-6	2,000	72.8	2,000	23,000
SVOCs/U.S. EPA Method 8270C	nitrobenzene	98-95-3	300	49.8	300	20,000
SVOCs/U.S. EPA Method 8270C	2-nitrophenol	88-75-5	300	47.8	300	—
SVOCs/U.S. EPA Method 8270C	4-nitrophenol	100-02-7	2,000	59.8	2,000	—
SVOCs/U.S. EPA Method 8270C	N-nitrosodimethylamine	62-75-9	**2,000[e]**	87.4	**2,000[e]**	**9.5[e]**
SVOCs/U.S. EPA Method 8270C	N-nitrosodi-n-propylamine	621-64-7	**300[e]**	54.9	**300[e]**	**69[e]**
SVOCs/U.S. EPA Method 8270C	N-nitrosodiphenylamine	86-30-6	300	50.6	300	99,000
SVOCs/U.S. EPA Method 8270C	pentachlorophenol	87-86-5	2,000	58.7	2,000	3,000
SVOCs/U.S. EPA Method 8270C	phenol	108-95-2	300	43.0	300	1.8E+07
SVOCs/U.S. EPA Method 8270C	pyridine	110-86-1	300	110	300	61,000
SVOCs/U.S. EPA Method 8270C	2,4,5-trichlorophenol	95-95-4	300	60.1	300	6.1E+06
SVOCs/U.S. EPA Method 8270C	2,4,6-trichlorophenol	88-06-2	300	48.3	300	6,100

Analytical Group	Analyte	CAS Number	Project Quantitation Limit[a] (µg/kg)	Analytical Method Detection Limit[b] (µg/kg)	Analytical Method Reporting Limit[a] (µg/kg)	Project Action Limit[c] (µg/kg)
PAHs/U.S. EPA Method 8270C SIM	acenaphthene	83-32-9	5	1.22	5	3.7E+06
PAHs/U.S. EPA Method 8270C SIM	acenaphthylene	208-96-8	5	1.29	5	—
PAHs/U.S. EPA Method 8270C SIM	anthracene	120-12-7	5	1.09	5	2.2E+07
PAHs/U.S. EPA Method 8270C SIM	benz(a)anthracene	56-55-3	5	1.81	5	620
PAHs/U.S. EPA Method 8270C SIM	benzo(a)pyrene	50-32-8	5	1.37	5	62
PAHs/U.S. EPA Method 8270C SIM	benzo(b)fluoranthene	205-99-2	5	1.33	5	620
PAHs/U.S. EPA Method 8270C SIM	benzo(k)fluoranthene	207-08-9	5	1.84	5	380
PAHs/U.S. EPA Method 8270C SIM	benzo(g,h,i)perylene	191-24-2	5	1.52	5	—
PAHs/U.S. EPA Method 8270C SIM	chrysene	218-01-9	5	1.68	5	3,800
PAHs/U.S. EPA Method 8270C SIM	dibenz(a,h)anthracene	53-70-3	5	1.37	5	62
PAHs/U.S. EPA Method 8270C SIM	fluoranthene	206-44-0	5	1.88	5	2.3E+06
PAHs/U.S. EPA Method 8270C SIM	fluorene	86-73-7	5	1.37	5	2.7E+06
PAHs/U.S. EPA Method 8270C SIM	indeno(1,2,3-cd)pyrene	193-39-5	5	1.98	5	620
PAHs/U.S. EPA Method 8270C SIM	2-methylnaphthalene	91-57-6	5	0.8	5	—
PAHs/U.S. EPA Method 8270C SIM	naphthalene	91-20-3	5	0.886	5	1,700
PAHs/U.S. EPA Method 8270C SIM	phenanthrene	85-01-8	5	1.70	5	—
PAHs/U.S. EPA Method 8270C SIM	pyrene	129-00-0	5	1.56	5	2.3E+06
PCBs/U.S. EPA Method 8082	Aroclor 1016	12674-11-2	100	9.8	100	220
PCBs/U.S. EPA Method 8082	Aroclor 1221	11104-28-2	200	5.5	200	3,900
PCBs/U.S. EPA Method 8082	Aroclor 1232	11141-16-5	100	4.0	100	220
PCBs/U.S. EPA Method 8082	Aroclor 1242	53469-21-9	100	2.6	100	220
PCBs/U.S. EPA Method 8082	Aroclor 1248	12672-29-6	100	1.4	100	220
PCBs/U.S. EPA Method 8082	Aroclor 1254	11097-69-1	100	1.6	100	220
PCBs/U.S. EPA Method 8082	Aroclor 1260	11096-82-5	100	3.6	100	220

Analytical Group	Analyte	CAS Number	Project Quantitation Limit[a] (µg/kg)	Analytical Method Detection Limit[b] (µg/kg)	Analytical Method Reporting Limit[a] (µg/kg)	Project Action Limit[c] (µg/kg)
Metals[f]/U.S. EPA Method 6010B	aluminum	7429-90-5	10,000	4,011	10,000	7.6E+07
Metals[f]/U.S. EPA Method 6010B	antimony	7440-36-0	500	207	500	31,000
Metals[f]/U.S. EPA Method 6010B	arsenic	7440-38-2	**500[e]**	174	**500[e]**	**62[e]**
Metals[f]/U.S. EPA Method 6010B	barium	7440-39-3	500	47	500	5.4E+06
Metals[f]/U.S. EPA Method 6010B	beryllium	7440-41-7	200	44	200	1.5E+05
Metals[f]/U.S. EPA Method 6010B	cadmium	7440-43-9	500	28	500	37,000
Metals[f]/U.S. EPA Method 6010B	chromium (total)	7440-47-3	500	29	500	2.1E+05
Metals[f]/U.S. EPA Method 7196A	chromium (hexavalent)	18540-29-9	200	60	200	30,000
Metals[f]/U.S. EPA Method 6010B	cobalt	7440-48-4	500	51	500	9.0E+05
Metals[f]/U.S. EPA Method 6010B	copper	7440-50-8	500	94	500	3.1E+06
Metals[f]/U.S. EPA Method 6010B	iron	7439-89-6	5,000	1,632	5,000	2.3E+07
Metals[f]/U.S. EPA Method 6010B	lead	7439-92-1	500	92	500	1.5E+05
Metals[f]/U.S. EPA Method 6010B	manganese	7439-96-5	500	130	500	1.8E+06
Metals[f]/U.S. EPA Method 7470/7471A	mercury	7439-97-6	100	16.9	100	23,000
Metals[f]/U.S. EPA Method 6010B	nickel	7440-02-0	500	68	500	1.6E+06
Metals[f]/U.S. EPA Method 6010B	selenium	7782-49-2	500	244	500	3.9E+05
Metals[f]/U.S. EPA Method 6010B	silver	7440-22-4	100	36	100	3.9E+05
Metals[f]/U.S. EPA Method 6010B	thallium	7440-28-0	2,000	206	2,000	5,200
Metals[f]/U.S. EPA Method 6010B	vanadium	7440-62-2	500	56	500	78,000
Metals[f]/U.S. EPA Method 6010B	zinc	7440-66-6	5,000	1,145	5,000	2.3E+07
Cyanide/U.S. EPA Method 9010B	cyanide	57-12-5	500	280	500	1.2E+06
Radium (226 and 228)/ U.S. EPA Method 901.1	radium	7440-14-4	—	—	—	0.5 pCi/g

Notes:

[a] project quantitation limit values are the same as the analytical method reporting limit values used by the analytical laboratory

[b] based on the Agriculture and Priority Pollutants Laboratories, Inc., most current method detection limit studies

[c] project action limit values presented are the lower of U.S. EPA or California-modified values of the residential or industrial PRGs summarized in Table 2-2 of the Sampling and Analysis Plan; values presented are used as conservative tools to delineate nature and extent of contamination; Water Board ESLs (RWQCB 2005) used for TPH

[d] dash indicates no value established

[e] bold type indicates analytes with project action limit values currently below the project quantitation limit and analytical method reporting limit values; the project quantitation limit values will be used as the decision threshold

[f] calcium, magnesium, potassium, and sodium are not included in the list of metals because these analytes are considered essential nutrients rather than potential contaminants

Acronyms/Abbreviations:

CAS – Chemical Abstracts Service
ESL – Environmental Screening Level
ICP – inductively coupled argon plasma
µg/kg – micrograms per kilogram
NA – not applicable
PAH – polynuclear aromatic hydrocarbon
pCi/g – picocuries per gram
PRG – preliminary remediation goal
RWQCB –Regional Water Quality Control Board
SVOC – semivolatile organic compound
TPH – total petroleum hydrocarbons
U.S. EPA – United States Environmental Protection Agency
VOC – volatile organic compound

QAPP Worksheet 15 – Water
Reference Limits for Water

Analytical Group	Analyte	CAS Number	Project Quantitation Limit[a] (µg/L)	Analytical Method Detection Limit[b] (µg/L)	Analytical Method Reporting Limit[a] (µg/L)	Project Action Limit[c] (µg/L)
VOCs/U.S. EPA Method 8260B	acetone	67-64-1	2	0.95	2	700 (ESL)
VOCs/U.S. EPA Method 8260B	benzene	71-43-2	0.5	0.16	0.5	1
VOCs/U.S. EPA Method 8260B	bromobenzene	108-86-1	0.5	0.16	0.5	—[d]
VOCs/U.S. EPA Method 8260B	bromochloromethane	74-97-5	0.5	0.15	0.5	—
VOCs/U.S. EPA Method 8260B	bromodichloromethane	75-27-4	0.5	0.14	0.5	17
VOCs/U.S. EPA Method 8260B	bromoform	75-25-2	0.5	0.14	0.5	100
VOCs/U.S. EPA Method 8260B	bromomethane	74-83-9	0.5	0.24	0.5	9.8 (ESL)
VOCs/U.S. EPA Method 8260B	2-butanone	78-93-3	2	0.60	2	4,200 (ESL)
VOCs/U.S. EPA Method 8260B	n-butylbenzene	104-51-8	0.5	0.15	0.5	—
VOCs/U.S. EPA Method 8260B	sec-butylbenzene	135-98-8	0.5	0.12	0.5	—
VOCs/U.S. EPA Method 8260B	tert-butylbenzene	98-06-6	0.5	0.13	0.5	—
VOCs/U.S. EPA Method 8260B	carbon disulfide	75-15-0	0.5	0.20	0.5	—
VOCs/U.S. EPA Method 8260B	carbon tetrachloride	56-23-5	0.5	0.10	0.5	0.5
VOCs/U.S. EPA Method 8260B	chlorobenzene	108-90-7	0.5	0.21	0.5	70
VOCs/U.S. EPA Method 8260B	chloroethane	75-00-3	1	0.21	0.5	12 (ESL)
VOCs/U.S. EPA Method 8260B	chloroform	67-66-3	0.5	0.16	0.5	100
VOCs/U.S. EPA Method 8260B	1-chlorohexane	544-10-5	0.5	0.17	0.5	—
VOCs/U.S. EPA Method 8260B	chloromethane	74-87-3	0.5	0.31	0.5	2.7 (ESL)
VOCs/U.S. EPA Method 8260B	2-chlorotoluene	95-49-8	0.5	0.14	0.5	—
VOCs/U.S. EPA Method 8260B	4-chlorotoluene	106-43-4	0.5	0.13	0.5	—
VOCs/U.S. EPA Method 8260B	dibromochloromethane	124-48-1	0.5	0.19	0.5	13
VOCs/U.S. EPA Method 8260B	1,2-dibromo-3-chloropropane	96-12-8	2	0.76	2	0.2
VOCs/U.S. EPA Method 8260B	1,2-dibromoethane	106-93-4	0.5	0.20	0.5	0.5
VOCs/U.S. EPA Method 8260B	dibromomethane	74-95-3	0.5	0.20	0.5	—

Analytical Group	Analyte	CAS Number	Project Quantitation Limit[a] (µg/L)	Analytical Method Detection Limit[b] (µg/L)	Analytical Method Reporting Limit[a] (µg/L)	Project Action Limit[c] (µg/L)
VOCs/U.S. EPA Method 8260B	1,2-dichlorobenzene	95-50-1	0.5	0.17	0.5	600
VOCs/U.S. EPA Method 8260B	1,3-dichlorobenzene	541-73-1	0.5	0.11	0.5	960
VOCs/U.S. EPA Method 8260B	1,4-dichlorobenzene	106-46-7	0.5	0.19	0.5	5
VOCs/U.S. EPA Method 8260B	dichlorodifluoromethane	75-71-8	0.5	0.19	0.5	—
VOCs/U.S. EPA Method 8260B	1,1-dichloroethane	75-34-3	0.5	0.19	0.5	5
VOCs/U.S. EPA Method 8260B	1,2-dichloroethane	107-06-2	0.5	0.14	0.5	0.5
VOCs/U.S. EPA Method 8260B	1,1-dichloroethene	75-35-4	0.5	0.30	0.5	6
VOCs/U.S. EPA Method 8260B	cis-1,2-dichloroethene	156-59-2	0.5	0.16	0.5	6
VOCs/U.S. EPA Method 8260B	trans-1,2-dichloroethene	156-60-5	0.5	0.19	0.5	10
VOCs/U.S. EPA Method 8260B	1,2-dichloropropane	78-87-5	0.5	0.17	0.5	5
VOCs/U.S. EPA Method 8260B	1,3-dichloropropane	142-28-9	0.5	0.17	0.5	—
VOCs/U.S. EPA Method 8260B	2,2-dichloropropane	594-20-7	0.5	0.22	0.5	—
VOCs/U.S. EPA Method 8260B	1,1-dichloropropene	563-58-6	0.5	0.2	0.5	—
VOCs/U.S. EPA Method 8260B	cis-1,3-dichloropropene	10061-01-5	0.5	0.15	0.5	0.5 (total DCP)
VOCs/U.S. EPA Method 8260B	trans-1,3-dichloropropene	10061-02-6	0.5	0.18	0.5	0.5 (total DCP)
VOCs/U.S. EPA Method 8260B	ethylbenzene	100-41-4	0.5	0.23	0.5	300
VOCs/U.S. EPA Method 8260B	hexachlorobutadiene	87-68-3	0.5	0.19	0.5	0.21 (ESL)
VOCs/U.S. EPA Method 8260B	2-hexanone	591-78-6	5	0.92	5	—
VOCs/U.S. EPA Method 8260B	isopropylbenzene	98-82-8	0.5	0.16	0.5	—
VOCs/U.S. EPA Method 8260B	p-isopropyltoluene	99-87-6	0.5	0.12	0.5	—
VOCs/U.S. EPA Method 8260B	methylene chloride	75-09-2	1	0.35	1	590
VOCs/U.S. EPA Method 8260B	4-methyl-2-pentanone	108-10-1	5	1.9	5	—
VOCs/U.S. EPA Method 8260B	n-propylbenzene	103-65-1	0.5	0.21	0.5	—

Analytical Group	Analyte	CAS Number	Project Quantitation Limit[a] (µg/L)	Analytical Method Detection Limit[b] (µg/L)	Analytical Method Reporting Limit[a] (µg/L)	Project Action Limit[c] (µg/L)
VOCs/U.S. EPA Method 8260B	styrene	100-42-5	0.5	0.25	0.5	100
VOCs/U.S. EPA Method 8260B	1,1,1,2-tetrachloroethane	630-20-6	0.5	0.13	0.5	1.3 (ESL)
VOCs/U.S. EPA Method 8260B	1,1,2,2-tetrachloroethane	79-34-5	0.5	0.27	0.5	1
VOCs/U.S. EPA Method 8260B	tetrachloroethene	127-18-4	0.5	0.15	0.5	3.3
VOCs/U.S. EPA Method 8260B	toluene	108-88-3	0.5	0.17	0.5	150
VOCs/U.S. EPA Method 8260B	1,2,3-trichlorobenzene	87-61-6	0.5	0.29	0.5	—
VOCs/U.S. EPA Method 8260B	1,2,4-trichlorobenzene	120-82-1	0.5	0.21	0.5	5
VOCs/U.S. EPA Method 8260B	1,1,1-trichloroethane	71-55-6	0.5	0.14	0.5	200
VOCs/U.S. EPA Method 8260B	1,1,2-trichloroethane	79-00-5	0.5	0.20	0.5	5
VOCs/U.S. EPA Method 8260B	trichloroethene	79-01-6	0.5	0.16	0.5	5
VOCs/U.S. EPA Method 8260B	trichlorofluoromethane	75-69-4	0.5	0.24	0.5	150
VOCs/U.S. EPA Method 8260B	1,2,3-trichloropropane	96-18-4	2	0.39	2	—
VOCs/U.S. EPA Method 8260B	1,2,4-trimethylbenzene	95-63-6	0.5	0.19	0.5	—
VOCs/U.S. EPA Method 8260B	1,3,5-trimethylbenzene	108-67-8	0.5	0.12	0.5	—
VOCs/U.S. EPA Method 8260B	2,2,4-trimethylpentane	540-84-1	2	0.67	2	—
VOCs/U.S. EPA Method 8260B	vinyl chloride	75-01-4	0.5	0.23	0.5	0.5
VOCs/U.S. EPA Method 8260B	xylene, o-	95-47-6	0.5	0.19	0.5	1,750 (total xylenes)
VOCs/U.S. EPA Method 8260B	xylenes, m-,p-	108-38-3/ 106-42-3	0.5	0.19	0.5	1,750 (total xylenes)
TPH/U.S. EPA Methods 8015-M & 8015B-M	diesel	NA	50	40.4	50	100 (ESL)
TPH/U.S. EPA Methods 8015-M & 8015B-M	gasoline	NA	100	8.6	100	100 (ESL)
TPH/U.S. EPA Methods 8015-M & 8015B-M	JP-5	NA	50	33	50	100 (ESL)
TPH/U.S. EPA Methods 8015-M & 8015B-M	motor oil	NA	**500[e]**	**106[e]**	**500[e]**	**100[e]** (ESL)

Analytical Group	Analyte	CAS Number	Project Quantitation Limit[a] (µg/L)	Analytical Method Detection Limit[b] (µg/L)	Analytical Method Reporting Limit[a] (µg/L)	Project Action Limit[c] (µg/L)
SVOCs/U.S. EPA Method 8270C	aniline	62-53-3	10	7.0	10	—
SVOCs/U.S. EPA Method 8270C	benzoic acid	65-85-0	10	1.0	10	—
SVOCs/U.S. EPA Method 8270C	benzyl alcohol	100-51-6	10	2.0	10	—
SVOCs/U.S. EPA Method 8270C	bis(2-chloroethoxy)methane	111-91-1	10	2.4	10	—
SVOCs/U.S. EPA Method 8270C	bis(2-chloroethyl)ether	111-44-4	**10[e]**	2.2	**10[e]**	**0.53[e]**
SVOCs/U.S. EPA Method 8270C	bis(2-chloroisopropyl)ether	39638-32-9	10	2.0	10	65,000
SVOCs/U.S. EPA Method 8270C	bis(2-ethylhexyl)phthalate	117-81-7	**10[e]**	2.9	**10[e]**	**2.2[e]**
SVOCs/U.S. EPA Method 8270C	4-bromophenyl phenyl ether	101-55-3	10	2.6	10	—
SVOCs/U.S. EPA Method 8270C	butyl benzylphthalate	85-68-7	10	2.8	10	1,900
SVOCs/U.S. EPA Method 8270C	carbazole	86-74-8	10	3.3	10	—
SVOCs/U.S. EPA Method 8270C	4-chloroaniline	106-47-8	**10[e]**	2.7	**10[e]**	**5[e]** (ESL)
SVOCs/U.S. EPA Method 8270C	4-chloro-3-methylphenol	59-50-7	10	2.6	10	—
SVOCs/U.S. EPA Method 8270C	2-chloronaphthalene	91-58-7	10	2.6	10	1,600
SVOCs/U.S. EPA Method 8270C	2-chlorophenol	95-57-8	10	2.0	10	150
SVOCs/U.S. EPA Method 8270C	4-chlorophenyl phenyl ether	7005-72-3	10	2.6	10	—
SVOCs/U.S. EPA Method 8270C	dibenzofuran	132-64-9	10	2.4	10	—
SVOCs/U.S. EPA Method 8270C	3,3′-dichlorobenzidine	91-94-1	**25[e]**	3.0	**25[e]**	**0.028[e]**
SVOCs/U.S. EPA Method 8270C	2,4-dichlorophenol	120-83-2	10	2.5	10	290
SVOCs/U.S. EPA Method 8270C	diethyl phthalate	84-66-2	10	3.0	10	44,000
SVOCs/U.S. EPA Method 8270C	2,4-dimethylphenol	105-67-9	10	2.4	10	850
SVOCs/U.S. EPA Method 8270C	dimethyl phthalate	131-11-3	10	2.9	10	1.1E+06
SVOCs/U.S. EPA Method 8270C	di-n-butylphthalate	84-74-2	10	3.2	10	4,500
SVOCs/U.S. EPA Method 8270C	di-n-octylphthalate	117-84-0	10	2.6	10	—
SVOCs/U.S. EPA Method 8270C	4,6-dinitro-2-methylphenol	534-52-1	25	2.2	25	280
SVOCs/U.S. EPA Method 8270C	2,4-dinitrophenol	51-28-5	25	1.8	25	5,300

Analytical Group	Analyte	CAS Number	Project Quantitation Limit[a] (µg/L)	Analytical Method Detection Limit[b] (µg/L)	Analytical Method Reporting Limit[a] (µg/L)	Project Action Limit[c] (µg/L)
SVOCs/U.S. EPA Method 8270C	2,4-dinitrotoluene	121-14-2	**10[e]**	2.7	**10[e]**	**3.4[e]**
SVOCs/U.S. EPA Method 8270C	2,6-dinitrotoluene	606-20-2	10	2.7	10	—
SVOCs/U.S. EPA Method 8270C	1,4-dioxane	123-91-1	1	0.162	1	3
SVOCs/U.S. EPA Method 8270C	hexachlorobenzene	118-74-1	**10[e]**	2.7	**10[e]**	**0.00029[e]**
SVOCs/U.S. EPA Method 8270C	hexachlorobutadiene	87-68-3	10	0.9	10	18
SVOCs/U.S. EPA Method 8270C	hexachlorocyclopentadiene	77-47-4	10	0.8	10	50
SVOCs/U.S. EPA Method 8270C	hexachloroethane	67-72-1	**10[e]**	0.8	**10[e]**	**3.3[e]**
SVOCs/U.S. EPA Method 8270C	isophorone	78-59-1	10	2.5	10	960
SVOCs/U.S. EPA Method 8270C	2-methylphenol	95-48-7	10	1.9	10	—
SVOCs/U.S. EPA Method 8270C	4-methylphenol	106-44-5	10	1.7	10	—
SVOCs/U.S. EPA Method 8270C	2-nitroaniline	88-74-4	25	2.4	25	—
SVOCs/U.S. EPA Method 8270C	3-nitroaniline	99-09-2	25	3.0	25	—
SVOCs/U.S. EPA Method 8270C	4-nitroaniline	100-01-6	25	2.5	25	—
SVOCs/U.S. EPA Method 8270C	nitrobenzene	98-95-3	10	2.1	10	690
SVOCs/U.S. EPA Method 8270C	2-nitrophenol	88-75-5	10	2.1	10	—
SVOCs/U.S. EPA Method 8270C	4-nitrophenol	100-02-7	25	0.8	25	—
SVOCs/U.S. EPA Method 8270C	N-nitrosodimethylamine	62-75-9	**25[e]**	1.7	**25[e]**	**3[e]**
SVOCs/U.S. EPA Method 8270C	N-nitrosodi-n-propylamine	621-64-7	**10[e]**	2.2	**10[e]**	**0.51[e]**
SVOCs/U.S. EPA Method 8270C	N-nitrosodiphenylamine	86-30-6	**10[e]**	2.7	**10[e]**	**6[e]**
SVOCs/U.S. EPA Method 8270C	pentachlorophenol	87-86-5	**25[e]**	2.8	**25[e]**	**1[e]**
SVOCs/U.S. EPA Method 8270C	phenol	108-95-2	10	1.0	10	1.7E+06
SVOCs/U.S. EPA Method 8270C	pyridine	110-86-1	50	5.0	50	—
SVOCs/U.S. EPA Method 8270C	2,4,5-trichlorophenol	95-95-4	10	2.3	10	—
SVOCs/U.S. EPA Method 8270C	2,4,6-trichlorophenol	88-06-2	**10[e]**	2.5	**10[e]**	**2.4[e]**

Analytical Group	Analyte	CAS Number	Project Quantitation Limit[a] (µg/L)	Analytical Method Detection Limit[b] (µg/L)	Analytical Method Reporting Limit[a] (µg/L)	Project Action Limit[c] (µg/L)
PAHs/U.S. EPA Method 8270C SIM	acenaphthene	83-32-9	0.2	0.0612	0.2	990
PAHs/U.S. EPA Method 8270C SIM	acenaphthylene	208-96-8	0.2	0.0657	0.2	30 (ESL)
PAHs/U.S. EPA Method 8270C SIM	anthracene	120-12-7	0.2	0.110	0.2	40,000
PAHs/U.S. EPA Method 8270C SIM	benz(a)anthracene	56-55-3	**0.2[e]**	0.0689	**0.2[e]**	**0.018[e]**
PAHs/U.S. EPA Method 8270C SIM	benzo(a)pyrene	50-32-8	**0.2[e]**	0.0577	**0.2[e]**	**0.018[e]**
PAHs/U.S. EPA Method 8270C SIM	benzo(b)fluoranthene	205-99-2	**0.2[e]**	0.0621	**0.2[e]**	**0.018[e]**
PAHs/U.S. EPA Method 8270C SIM	benzo(k)fluoranthene	207-08-9	**0.2[e]**	0.0947	**0.2[e]**	**0.018[e]**
PAHs/U.S. EPA Method 8270C SIM	benzo(g,h,i)perylene	191-24-2	**0.2[e]**	0.0785	**0.2[e]**	**0.1[e]** (ESL)
PAHs/U.S. EPA Method 8270C SIM	chrysene	218-01-9	**0.2[e]**	0.0837	**0.2[e]**	**0.018[e]**
PAHs/U.S. EPA Method 8270C SIM	dibenz(a,h)anthracene	53-70-3	**0.2[e]**	0.0650	**0.2[e]**	**0.018[e]**
PAHs/U.S. EPA Method 8270C SIM	fluoranthene	206-44-0	0.2	0.0823	0.2	140
PAHs/U.S. EPA Method 8270C SIM	fluorene	86-73-7	0.2	0.0724	0.2	5,300
PAHs/U.S. EPA Method 8270C SIM	indeno(1,2,3-cd)pyrene	193-39-5	**0.2[e]**	0.0644	**0.2[e]**	**0.018[e]**
PAHs/U.S. EPA Method 8270C SIM	2-methylnaphthalene	91-57-6	0.2	0.06	0.2	2.1 (ESL)
PAHs/U.S. EPA Method 8270C SIM	naphthalene	91-20-3	0.2	0.0536	0.2	21 (ESL)
PAHs/U.S. EPA Method 8270C SIM	phenanthrene	85-01-8	0.2	0.0788	0.2	4.6 (ESL)
PAHs/U.S. EPA Method 8270C SIM	pyrene	129-00-0	0.2	0.0845	0.2	4,000

Analytical Group	Analyte	CAS Number	Project Quantitation Limit[a] (µg/L)	Analytical Method Detection Limit[b] (µg/L)	Analytical Method Reporting Limit[a] (µg/L)	Project Action Limit[c] (µg/L)
PCBs/U.S. EPA Method 8082	Aroclor 1016	12674-11-2	**0.2[e]**	0.12	**0.2[e]**	**0.000064[e]**
PCBs/U.S. EPA Method 8082	Aroclor 1221	11104-28-2	**0.4[e]**	0.08	**0.4[e]**	**0.000064[e]**
PCBs/U.S. EPA Method 8082	Aroclor 1232	11141-16-5	**0.2[e]**	0.12	**0.2[e]**	**0.000064[e]**
PCBs/U.S. EPA Method 8082	Aroclor 1242	53469-21-9	**0.2[e]**	0.12	**0.2[e]**	**0.000064[e]**
PCBs/U.S. EPA Method 8082	Aroclor 1248	12672-29-6	**0.2[e]**	0.09	**0.2[e]**	**0.000064[e]**
PCBs/U.S. EPA Method 8082	Aroclor 1254	11097-69-1	**0.2[e]**	0.20	**0.2[e]**	**0.000064[e]**
PCBs/U.S. EPA Method 8082	Aroclor 1260	11096-82-5	**0.2[e]**	0.09	**0.2[e]**	**0.000064[e]**
Dissolved Gases/U.S. EPA RSK Method 175[f]	various	various	NA	NA	NA	NA
Metals[f]/U.S. EPA Method 6010B	aluminum	7429-90-5	100	19.3	100	1,000
Metals[f]/U.S. EPA Method 6010B	antimony	7440-36-0	5	1.84	5	6
Metals[f]/U.S. EPA Method 6010B	arsenic	7440-38-2	**5[e]**	2.45	**5[e]**	**0.14[e]**
Metals[f]/U.S. EPA Method 6010B	barium	7440-39-3	5	0.75	5	1,000
Metals[f]/U.S. EPA Method 6010B	beryllium	7440-41-7	2	0.24	2	4
Metals[f]/U.S. EPA Method 6010B	cadmium	7440-43-9	5	0.51	5	5
Metals[f]/U.S. EPA Method 6010B	chromium (total)	7440-47-3	5	1.37	5	50
Metals[f]/U.S. EPA Method 7196A	chromium (hexavalent)	18540-29-9	20	6	20	2
Metals[f]/U.S. EPA Method 6010B	cobalt	7440-48-4	**5[e]**	0.63	**5[e]**	**3[e]** (ESL)
Metals[f]/U.S. EPA Method 6010B	copper	7440-50-8	**5[e]**	0.97	**5[e]**	**3.1[e]**
Metals[f]/U.S. EPA Method 6010B	iron	7439-89-6	50	25.8	50	—
Metals[f]/U.S. EPA Method 6010B ICP	lead	7439-92-1	5	1.85	5	8.1
Metals[f]/U.S. EPA Method 6010B	manganese	7439-96-5	5	1.23	5	—
Metals[f]/U.S. EPA Method 7470/7471	mercury	7439-97-6	**0.2[e]**	0.041	**0.2[e]**	**0.025[e]**
Metals[f]/U.S. EPA Method 1631	mercury	7439-97-6	0.0004	0.00015	0.0004	0.025

Analytical Group	Analyte	CAS Number	Project Quantitation Limit[a] (µg/L)	Analytical Method Detection Limit[b] (µg/L)	Analytical Method Reporting Limit[a] (µg/L)	Project Action Limit[c] (µg/L)
Metals[f]/U.S. EPA Method 6010B	nickel	7440-02-0	5	3.61	5	8.2
Metals[f]/U.S. EPA Method 6010B	selenium	7782-49-2	5	3.17	5	50
Metals[f]/U.S. EPA Method 6010B	silver	7440-22-4	**1**[e]	**0.73**[e]	**1**[e]	**0.19**[e] (ESL)
Metals[f]/U.S. EPA Method 6010B	thallium	7440-28-0	**5**[e]	1.97	**5**[e]	**0.47**[e]
Metals[f]/U.S. EPA Method 6010B	vanadium	7440-62-2	5	0.97	5	15 (ESL)
Metals[f]/U.S. EPA Method 6010B	zinc	7440-66-6	50	2.3	50	81
General Chemistry Parameters[f]/ U.S. EPA Methods 160.1, 300 series, 310.1, 376.2, and 415.1	various	various	NA	NA	NA	NA
Cyanide/U.S. EPA Method 9010B	cyanide	57-12-5	**10**[e]	**5.0**[e]	**10**[e]	**1**[e]
Radium/U.S. EPA Methods 903.1 and 904.0	radium-226 and radium-228	13982-63-3 and 15262-20-1	1 pCi/L	NA	1 pCi/L	5 pCi/L

Notes:

[a] project quantitation limit values are the same as the analytical method reporting limit values used by the analytical laboratory

[b] based on the Agriculture and Priority Pollutants Laboratories, Inc., most current method detection limit studies

[c] project action limit values presented are the lower of MCL, CTR, or NRWQC values summarized in Table 2-2 of the Sampling and Analysis Plan; values presented are used as conservative tools to delineate nature and extent of contamination; Water Board ESLs (RWQCB 2005) used for TPH and for analytes for which no MCL, CTR or NRWQC values are available.

[d] dash indicates no value established

[e] bold type indicates analytes with project action limit values currently less than the project quantitation limit and analytical method reporting limit values; project quantitation limit values will be used as the decision threshold

[f] dissolved gases are not included in this table because these analytes are indicators of natural attenuation rather than potential contaminants; calcium, magnesium, potassium, and sodium are not included in the list of metals because these analytes are considered essential nutrients rather than potential contaminants; general chemistry parameters are not included in this table because they are indicators of groundwater chemistry rather than potential contaminants

Acronyms/Abbreviations:

CAS – Chemical Abstracts Service
CTR – California Toxics Rule
DCP – dichloropropene
ESL – environmental screening level
ICP – inductively coupled argon plasma
µg/kg – micrograms per kilogram
µg/L – micrograms per liter
NA – not applicable
PAH – polynuclear aromatic hydrocarbon
PCB – polychlorinated biphenyl
pCi/L – picocuries per liter
NRWQC – (U.S. EPA) National Recommended Water Quality Criteria
RSK – Robert S. Kerr Environmental Laboratory, Inc.
RWQCB – Regional Water Quality Control Board
SVOC – semivolatile organic compound
VOC – volatile organic compound
TPH – total petroleum hydrocarbons
U.S. EPA – United States Environmental Protection Agency

QAPP Worksheet 18
Sampling Locations/IDs, Sample Depths, Sample Analyses and Sampling Procedures[1]

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Sampling SOP Reference[2]
New wells west of Building 5 [M05-13, L05-01]	Soil	TBD[3]	Geotechnical analysis[4]	SOP 4 and SAP Sections 2.1.2 and 2.2.1
New wells west of Building 5 [M05-13, L05-01]	Groundwater	10–15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000, 7196A, 1631, 9010B, 160.1, general water quality analysis[4]	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
New wells west of Building 5, adjacent to existing well M05-02 [L05-02, D05-09]	Groundwater	25-30, 60-70	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000, 7196A, 1631, 9010B, 160.1, general water quality analysis	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
Existing well west of Building 5 [M05-02[5]]	Groundwater	10-15	5035A/8260B, 8270C (1,4-dioxane only), 6010B/7000, 7196A, 1631, 9010B	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
New wells west of Building 5 [M05-14, L05-03]	Groundwater	10–15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000, 7196A, 1631, 9010B, 160.1, general water quality analysis	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
Existing wells west of Building 5 [M05-06[5], D05-03[5]]	Groundwater	10-15, 60-70	5035A/8260B, 8015-M, 8015B-M, 8270C (1,4-dioxane only), 6010B/7000, 7196A, 1631, 9010B	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
New wells inside Building 5 [M05-15, L05-04]	Soil	TBD	Geotechnical analysis	SOP 4 and SAP Sections 2.1.2 and 2.2.1
New wells inside Building 5 [M05-15, L05-04]	Groundwater	10–15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000, 7196A, 9010B, 160.1, general water quality analysis	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
Existing well inside of Building 5 [D05-04[5]]	Groundwater	60-70	5035A/8260B, 8270C (1,4-dioxane only), 6010B/7000, 7196A, 9010B; general water quality analysis	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
New wells east of Building 5 [M05-16, L05-05]	Soil	TBD	Geotechnical analysis	SOP 4 and SAP Sections 2.1.2 and 2.2.1

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Sampling SOP Reference[2]
New wells east of Building 5 [M05-16, L05-05]	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000, 7196A, 9010B, 160.1, general water quality analysis	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
Existing wells north of Building 5 [M05-01]	Groundwater	10-15	5035A/8260B, 8270C (1,4-dioxane only), 6010B/7000, 7196A, 9010B	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
Existing wells north of Building 5 [M05-09[5], D05-01[5]]	Groundwater	10-15, 60-70	5035A/8260B, 8015-M, 8015B-M, 8270C (1,4-dioxane only), 6010B/7000, 7196A, 9010B; general water quality analysis	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
Existing well south of Building 5 [M05-03]	Groundwater	10-15	5035A/8260B, 8015-M, 8015B-M , 8270C (1,4-dioxane only), 6010B/7000, 7196A, 9010B	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
Existing well south of Building 5 [400MJ-MW2 or 400MJ-MW3]	Groundwater	10-15	5035A/8260B, 8015-M, 8015B-M , 8270C (1,4-dioxane only), 6010B/7000, 7196A, 9010B	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
New well northeast of Building 5 adjacent to existing well M05-05 [L05-06]	Groundwater	25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000, 7196A, 9010B, 160.1, general water quality analysis	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
Existing wells northeast of Building 5 [M05-05[5]]	Groundwater	10-15	5035A/8260B, 8015-M, 8015B-M, 8270C (1,4-dioxane only), 6010B/7000, 7196A, 9010B, general water quality analysis	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
Existing wells northeast of Building 5 [D05-05[5]]	Groundwater	10-15, 60-70	5035A/8260B, 8270C (1,4-dioxane only), 6010B/7000, 7196A, 9010B, general water quality analysis	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
Existing wells east of Building 5 [P-5-1-MW4S, P-5-1-MW4I, P-5-1-MW4D]	Groundwater	10–15, 18-22, 25-30	5035A/8260B, 8270C (1,4-dioxane only), 6010B/7000, 7196A, 9010B	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
New wells south of Building : [M05-19, M05-20]	Groundwater	10-15	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000, 7196A, 9010B, 160.1, general water quality analysis	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
TBD[6]: Wells north and south of Building 2 [M05-17, M05-18]	Groundwater	10-15	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000, 7196A, 9010B, 160.1, general water quality analysis	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Sampling SOP Reference[2]
Around Building 2 [EA2SB01-B02, EA2SB05-B07]	Soil	0–0.5, 2–4	5035A/8260B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
Around Building 2 [EA2SB01-B07]	Groundwater	10–15, 25-30	5035A/8260B , 8270C (1,4-dioxane only)	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
Western portion of EA 5 inside Building 5 [EA3SB01-B11]	Soil	0-0.5, 2-4	5035A/8260B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
Near former AST 005H [EA3SB12]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000, 7196A, 9010B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
Near former AST 005H [EA3SB12]	Groundwater	10-15, 25-30	5035A 8260B, 8015-M, 8015B-M, 8270C, 6010B/7000, 7196A, 9010B, 160.1, 903.1, 904.0	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
TBD: Within VOC removal action area [EA3SB13-B16]	Soil	0-0.5, 2-4	5035A/8260B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
Eastern Building 5 [EA3SB17-SB27]	Soil	0-0.5, 2-4	5035A/8260B, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
Along industrial wastewater lines [EA3SB28-B35][7]	Soil	0-0.5, 2-4	5035A/8260B , 8270C, 6010B/7000, 7196A, 9010B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
Along industrial wastewater lines [EA3SB29, EA3SB40-41]	Soil	0–0.5, 2–4	5035A/8260B , 8270C, 6010B/7000, 7196A, 9010B,	SOP 4 and SAP Sections 2.1.2 and 2.2.1
Along industrial wastewater lines [EA3SB29]	Groundwater	10-15, 25-30	5035A/8260B, 8270C (1,4-dioxane only), 6010B/7000, 7196A, 9010B, 903.1, 904.0	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
Along industrial wastewater lines [EA3SB40-41]	Groundwater	10-15, 25-30	5035A/8260B, 8270C (1,4-dioxane only), 6010B/7000, 7196A, 9010B	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
Along industrial wastewater line, former location of cyanide eductor sump [EA3SB42]	Soil	0-0.5; 2-4	5035A/8260B , 8270C, 6010B/7000, 7196A, 9010B,	SOP 4 and SAP Sections 2.1.2 and 2.2.1

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Sampling SOP Reference[2]
Along industrial wastewater line, former location of cyanide eductor sump [EA3SB42]	Groundwater	4-8	5035A/8260B, 8270C (1,4-dioxane only), 6010B/7000, 7196A, 9010B	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
Along industrial wastewater line, former location of chromium eductor sump within excavated area [EA3SB043]	Groundwater	4-8	5035A/8260B, 8270C (1,4-dioxane only), 6010B/7000, 7196A, 9010B	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
Foundry floor drains and reddish dirt pile [EA3SB36-B37]	Soil	0-0.5, 2-4	5035A/8260B, 8270C, 8270C SIM, 8082, 6010B/7000, 7196A, 9010B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
Rubber shop former chemical tanks and chemical mixing operations [EA3SB38-B39]	Soil	0-0.5, 2-4	5035A/8260B, 8270C, 8270C SIM, 8082, 6010B/7000, 7196A, 9010B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
Aircraft Maintenance Line [EA4SB01-B20; EA4SB23-B29] at least one location to be adjacent to utility vault and one location to be adjacent to aircraft tie-down structure	Soil	0-0.5, 2-4 0.05; 2-4; 4-6	5035A/8260B , 6010B/7000 5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
Battery Acid Shop [EA4SB21]	Soil	0-0.5, 2-4	5035A/8260B, 6010B/7000, 7196A, 9010B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
Battery Acid Shop [EA4SB21]	Groundwater	10-15, 25-30	5035A/8260B, 8270C (1,4-dioxane only), 6010B/7000, 7196A, 9010B	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
Battery Acid Shop [EA4SB22]	Soil	0-0.5, 2-4	5035A/8260B, 6010B/7000, 7196A, 9010B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
EA5SB01-B07	Soil	0-0.5, 2-4	5035A/8260B	SOP 4 and SAP Sections 2.1.2 and 2.2.1

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Sampling SOP Reference[2]
EA5SB08	Soil	0-0.5, 2-4	5035A/8260B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
EA5SB09-B10	Soil	0-0.5, 2-4	5035A/8260B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
EA5SB11-B12	Soil	0-0.5, 2-4	5035A/8260B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
EA5SB13	Soil	0-0.5, 2-4	5035A/8260B, 6010B/7000, 7196A, 9010B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
EA5SB14-B16	Soil	0-0.5, 2-4	5035A/8260B, 6010B/7000, 7196A, 9010B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
EA5SB17	Soil	0-0.5, 2-4	5035A/8260B, 6010B/7000, 7196A, 9010B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
EA5SB17	Groundwater	10-15, 25-30	5035A/8260B, 8270C (1,4-dioxane only), 6010B/7000, 7196A, 9010B	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
Along industrial wastewater lines [EA5SB18-B19]	Soil	0-0.5, 2-4	5035A/8260B, 8270C, 6010B/7000, 7196A, 9010B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
Along industrial wastewater lines [EA5SB18-B19]	Groundwater	10-15, 25-30	5035A/8260B, 8270C (1,4-dioxane only), 6010B/7000, 7196A, 9010B	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
EA5SB20-B21	Soil	0-0.5, 2-4	5035A/8260B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
EA6SB01-B08	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8082	SOP 4 and SAP Sections 2.1.2 and 2.2.1
EA6SB09	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8082	SOP 4 and SAP Sections 2.1.2 and 2.2.1
Within Building 6 [DG006SB01-B03]	Soil	0-0.5, 2-4	5035A/8260B, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
DG034SB01	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
DG034SB01	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000, 160.1	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Sampling SOP Reference[2]
Within Building 43 [DG043SB01]	Soil	0-0.5, 2-4	5035A/8260B, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
Within Building 43 [DG043SB01]	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000, 1631	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
Within Building 44 [DG044SB01]	Soil	0-0.5, 2-4	5035A/8260B, 8270C, 8082, 6010B/7000; 901.1	SOP 4 and SAP Sections 2.1.2 and 2.2.1
Within Building 44 [DG044SB01]	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000, 1631	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
Within Building 102 [DG102SB01]	Soil	0-0.5, 2-4	5035A/8260B, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
Within Building 102 [DG102SB01]	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M,,8270C, 8082, 6010B/7000, 1631	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
At former location of Building 282 [DG282SB01]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
At former location of Building 282 [DG282SB01]	Groundwater	10-15	5035A/8260B, 8270C, 8082, 6010B/7000	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
One within and two adjacent to Building 347 [DG347SB01-B03]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
Within Hangar Area of Building 400 [DG400SB01-B08]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
Within Building 405 [DG405SB01-B02]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
At former location of Building 415 and former Hazardous Waste Storage Area [DG415SB01-B02]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000, 7196A, 9010B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
Within northern portion of Building 500 [DG500SB01]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Sampling SOP Reference[2]
Through concrete pad at former location of Building 505 [DG505SB01]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
Through concrete pad at former location of Building 505 [DG505SB01]	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000, 1631	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
PAH data gap area [DGPAHSB01]	Soil	0-0.5, 0.5-2, 2-4, 4-8	8270C SIM	SOP 4 and SAP Sections 2.1.2 and 2.2.1
PAH data gap area [DGPAHSB02-B03]	Soil	0-0.5, 0.5-2, 2-4, 4-8	8270C SIM Plus 5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000 (for 0–0.5, 2–4, and 4–6 feet bgs)	SOP 4 and SAP Sections 2.1.2 and 2.2.1
OWS 005 Adjacent to location of reportedly existing OWS [SOW5SB01] TBD[8]: [S0W5SB02-B03]	Soil	0-0.5, 2-4, 4-6; 10-12	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000, 7196A, 9010B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
OWS 005 Adjacent to location of reportedly existing OWS [SOW5SB01] TBD[8]: [S0W5SB02-B03]	Groundwater	10-15, 25-30	8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000, 7196A, 9010B, 160.1	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
OWS 006A Adjacent to location of existing OWS [SOW6ASB01]	Soil	0-0.5, 2-4, 4-6; 10-12	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
OWS 006A Adjacent to location of existing OWS [SOW6ASB01]	Groundwater	10-15	8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
OWS 006B Adjacent to location of existing OWS [SOW6BSB01] TBD[8]: [SOW6BSB02-B03]	Soil	0-0.5, 2-4, 4-6; 10-12	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Sampling SOP Reference[2]
OWS 006B Adjacent to location of existing OWS [SOW6BSB01] TBD[8]: [SOW6BSB02-B03]	Groundwater	10-15	8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
OWS 010 Adjacent to location of existing OWS [SOW10SB01]	Soil	0-0.5, 2-4, 4-6; 10-12	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
OWS 010 Adjacent to location of existing OWS [SOW10SB01]	Groundwater	10-15	8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
UST(R)-02 Adjacent to former location of USTs [SUSTSB01]	Soil	0-0.5, 2-4, 4-6; 10-12	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
UST(R)-02 Adjacent to former location of USTs [SUSTSB01]	Groundwater	10-15	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
AOC 005 Adjacent to former location of UST 5-2 (see SWMU AST 005G) [SAOC5SB01] TBD[8]:[SAOC5B02-B03]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
AOC 005 Adjacent to former location of UST 5-2 (see SWMU AST 005G) [SAOC5SB01] TBD[8]:[SAOC5B02-B03]	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Sampling SOP Reference[2]
AST 005G Adjacent to former location of UST 5-3 and downgradient of former location of AST [SAST5SB01] TBD[8]: [SAST5B02-B03]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
AST 005G Adjacent to former location of UST 5-3 and downgradient of former location of AST [SAST5SB01] TBD[8]: [SAST5B02-B03]	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
M-01 Near former location of M-01 [SM01SB01] TBD[8]: [SM01SB02-B03]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
M-01 Near former location of M-01 [SM01SB01] TBD[8]: [SM01SB02-B03]	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000, 160.1	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
M-02 Near former location of M-02 [SM02SB02] TBD[8]: [SM02SB02-B03]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
M-02 Near former location of M-02 [SM02SB02] TBD[8]: [SM02SB02-B03]	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
M-05 At location of crack in floor [SM05SB01]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Sampling SOP Reference[2]
M-05 At location of crack in floor [SM05SB01]	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000, 160.1	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
M-05 At location of joint in concrete [SM05SB02] TBD[8]: [SM05SB03-B04]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
M-08 Near former location of M-08 [SM08SB02] TBD[8]: [SM08SB02-B03]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
M-08 Near former location of M-08 [SM08SB02] TBD[8]: [SM08SB02-B03]	Groundwater	10-15	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000, 160.1	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
M-09 On downgradient side of concrete berm [SM09SB01] TBD[8]: [SM09SB02-B03]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000, 7196A, 9010B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
M-09 On downgradient side of concrete berm [SM09SB01] TBD[8]: [SM09SB02-B03]	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000, 7196A, 9010B, 903.1, 904.0	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
NADEP GAP 02 At former location of GAP [SND02SB01] TBD[8]: [SND02SB02-B03]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Sampling SOP Reference[2]
NADEP GAP 02 At former location of GAP [SND02SB01] TBD[8]: [SND02SB02-B03]	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
NADEP GAP 04 At former location of GAP [SND04SB01]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
NADEP GAP 04 At former location of GAP [SND04SB01]	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
NADEP GAP 04 Near former location of GAP [SND04SB02] TBD[8]: [SND04SB03-B04]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
NADEP GAP 17 At former location of GAP [SND17SB01]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
NADEP GAP 17 At former location of GAP [SND17SB01]	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
NADEP GAP 17 At former location of GAP [SND17S-B02] TBD[8]: [SND17SB03-B04]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
NADEP GAP 20 At former location of GAP [SND20SB01] TBD[8]: [SND20SB02-B03]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Sampling SOP Reference[2]
NADEP GAP 20 At former location of GAP [SND20SB01] TBD[8]: [SND20SB02-B03]	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
NADEP GAP 25 At former location of GAP [SND25SB01] TBD[8]: [SND25SB02-B03]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000, 7196A, 9010B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
NADEP GAP 27 At former location of GAP [SND27SB01]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
NADEP GAP 27 At former location of GAP [SND27SB01]	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000, 1631	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
NADEP GAP 27 At former location of GAP [SND27SB02] TBD[8]: [SND27SB03-B04]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
NADEP GAP 31 At crack in floor near former location of GAP [SND31SB01] TBD[8]: [SND31SB03]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
NADEP GAP 31 At crack in floor near former location of GAP [SND31SB01] TBD[8]: [SND31SB03]	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2

Sampling Location/ID Number	Matrix	Depth (feet bgs)	Analytical Group	Sampling SOP Reference[2]
NADEP GAP 31 Within area of former location of GAP [SND31SB02]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
NADEP GAP 57 At former location of GAP [SND57SB01] TBD[8]: [SND57SB02-B03]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000, 7196A, 9010B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
NADEP GAP 57 At former location of GAP [SND57SB01] TBD[8]: [SND57SB02-B03]	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000, 7196A, 9010B, 160.1, 903.1, 904.0	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
NADEP GAP 70 At former location of GAP [SND70SB01] TBD[8]: [SND70SB02-B03]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000, 7196A, 9010B	SOP 4 and SAP Sections 2.1.2 and 2.2.1
NADEP GAP 70 At former location of GAP [SND70SB01] TBD[8]: [SND70SB02-B03]	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000, 7196A, 9010B, 903.1, 904.0	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
NAS GAP 01 At former location of GAP [SNS01SB01] TBD[8]: [SNS01SB02-B03]	Soil	0-0.5, 2-4; 4-6	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 4 and SAP Sections 2.1.2 and 2.2.1
NAS GAP 01 At former location of GAP [SNS01SB01] TBD[8]: [SNS01SB02-B03]	Groundwater	10-15	5035A/8260B, 8015-M, 8015B-M, 8270C, 8082, 6010B/7000	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2
(Discrete groundwater step-out sampling points if needed)	Groundwater	10-15, 25-30	5035A/8260B, 8015-M, 8015B-M, 8270C, 8270C SIM, 8082, 6010B/7000, 7196A, 1631, 9010B	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2

Notes:

[1] refer to Tables 1-2 through 1-5 in the SAP for number of samples and sampling rationale
[2] SOP or SAP section that describes the sample collection procedures
[3] depth to be determined in the field
[4] refer to QAPP Worksheet 19 for geotechnical and general water quality analytical methods
[5] wells included in BGMP for which spring 2007 sampling is to be conducted under the Work Plan for Supplemental RI Sampling at OU-2C
[6] wells will be installed only if VOCs are detected at concentrations exceeding MCLs in discrete groundwater samples
[7] some borings will be located near floor drains, if identified
[8] step-out borings to be installed only if chemicals are detected at concentrations exceeding comparison criteria from initial sampling

Acronyms/Abbreviations:

AST – aboveground storage tank
BGMP – basewide groundwater monitoring program
bgs – below ground surface
GAP – generator accumulation point
MCL – maximum contaminant level
OU – operable unit
OWS – oil-water separator
QAPP – Quality Assurance Project Plan
RI – remedial investigation
SIM – selected ion monitoring
SAP – sampling and analysis plan
SOP – standard operating procedure
SWMU – solid waste management unit
TBD – to be determined
UST – underground storage tank
VOC – volatile organic compound

QAPP Worksheet 19
Analytical Methods, Containers, Preservatives, and Holding Times

Matrix	Analytical Group	Analytical and Preparation Method	Containers (number, size, type)	Preservation Requirements (chemical, temperature, etc.)	Maximum Holding Time (preparation/analysis)
Soil	VOCs	U.S. EPA 5035A and 8260B	Three 5-gram EnCore or similar airtight sampling devices	Cool 4 ± 2 °C	48 hours
Soil	TPH-gasoline	U.S. EPA 8015-M	Three 5-gram EnCore or similar airtight sampling devices	Cool 4 ± 2 °C	48 hours
Soil	TPH-ff	U.S. EPA 8015B-M with silica gel cleanup	6-inch stainless steel, brass, or acetate liner	Cool 4 ± 2 °C	7 days until extraction; 40 days after extraction
Soil	SVOCs, including 1,4-dioxane (non-PAHs)	U.S. EPA 8270C	6-inch stainless steel, brass, or acetate liner	Cool 4 ± 2 °C	7 days until extraction; 40 days after extraction
Soil	PAHs	U.S. EPA 8270C SIM	6-inch stainless steel, brass, or acetate liner; 8-ounce glass jar	Cool 4 ± 2 °C	7 days until extraction; 40 days after extraction
Soil	TCL PCBs	U.S. EPA 8082	6-inch stainless steel, brass, or acetate liner	Cool 4 ± 2 °C	7 days until extraction; 40 days after extraction
Soil	TAL metals	U.S. EPA 6010B/7000 Series	6-inch stainless steel, brass, or acetate liner	Cool 4 ± 2 °C	6 months; 28 days until extraction for mercury
Soil	Hexavalent chromium	U.S. EPA 7196A	6-inch stainless steel, brass, or acetate liner	Cool 4 ± 2 °C	30 days
Soil	Lead	U.S. EPA 6010B ICP	6-inch stainless steel, brass, or acetate liner	Cool 4 ± 2 °C	6 months

QAPP Worksheet 19 (continued)

Matrix	Analytical Group	Analytical and Preparation Method	Containers (number, size, type)	Preservation Requirements (chemical, temperature, etc.)	Maximum Holding Time (preparation/analysis)
Soil	Mercury	U.S. EPA 7471A	6-inch stainless steel, brass, or acetate liner	Cool 4 ± 2 °C	20 days
Soil	Cyanide	U.S. EPA 9010B	6-inch stainless steel, brass, or acetate liner	Cool 4 ± 2 °C	14 days
Soil	Radium	U.S. EPA 901.1	6-inch stainless steel, brass, or acetate liner	Cool 4 ± 2 °C	6 months
Soil	Air permeability	API Recommended Practice 40	6-inch stainless steel, brass, or acetate liner	Cool 4 ± 2 °C	6 months
Soil	Density and moisture content	ASTM D2937 and D2216	6-inch stainless steel, brass, or acetate liner	Cool 4 ± 2 °C	6 months
Soil	Effective porosity	SWRCB	6-inch stainless steel, brass, or acetate liner	Cool 4 ± 2 °C	6 months
Soil	Grain-size distribution	ASTM C136-96 and D422-63	6-inch stainless steel, brass, or acetate liner	Cool 4 ± 2 °C	6 months
Soil	Liquid limits	ASTM D4318-00	6-inch stainless steel, brass, or acetate liner	Cool 4 ± 2 °C	6 months
Soil	Hydraulic conductivity	ASTM D5084-90	6-inch stainless steel, brass, or acetate liner	Cool 4 ± 2 °C	6 months
Soil	Total organic carbon	Walkley-Black	6-inch stainless steel, brass, or acetate liner	Cool 4 ± 2 °C	6 months

Matrix	Analytical Group	Analytical and Preparation Method	Containers (number, size, type)	Preservation Requirements (chemical, temperature, etc.)	Maximum Holding Time (preparation/analysis)
Water	VOCs	U.S. EPA 8260B	Three 40-mL glass vials with Teflon septa	HCl to pH < 2, cool 4 ± 2 °C, no headspace	14 days
Water	TPH-gasoline	U.S. EPA 8015-M	Three 40-mL glass vials with Teflon septa	HCl to pH < 2, cool 4 ± 2 °C, no headspace	14 days
Water	TPH-ff	U.S. EPA 8015B-M with silica gel cleanup	Two 1-liter amber glass bottles	Cool 4 ± 2 °C	14 days
Water	SVOCs, including 1,4-dioxane (non-PAHs)	U.S. EPA 8270C	Two 1-liter amber glass bottles	Cool 4 ± 2 °C	7 days until extraction; 40 days after extraction
Water	PAHs	U.S. EPA 8270C SIM	Two 1-liter amber glass bottles	Cool 4 ± 2 °C	7 days until extraction; 40 days after extraction
Water	TCL PCBs	U.S. EPA 8082	Two 1-liter amber glass bottles	Cool 4 ± 2 °C	7 days until extraction; 40 days after extraction
Water	TAL metals[a]	U.S. EPA 6010B/7000 Series	One 1-liter poly bottle	HNO_3 to pH < 2, Cool 4 ± 2 °C	6 months; 28 days until extraction for mercury
Water	Cyanide	U.S. EPA 9010B	One 250-mL poly bottle	NaOH, Cool 4 ± 2 °C	14 days
Water	Radium-226 and Radium-228	U.S. EPA Methods 903.1 and 904.0	Two 1-liter poly bottles	HNO_3 to pH < 2, ambient temperature (cooling not required)	6 months
Water	Hexavalent chromium	U.S. EPA 7196A	One 250-mL poly bottle	Cool 4 ± 2 °C	24 hours
Water	Mercury	U.S. EPA 1631	One 250-mL fluoropolymer bottle	Cool 4 ± 2 °C	28 days
Water	Common anions[b]	U.S. EPA 300 Series	One 500-mL poly bottle	Cool 4 ± 2 °C	28 days[c]
Water	Dissolved gases[d]	U.S. EPA RSK 175	Three 40-mL glass vials with Teflon septa	HCl to pH < 2, cool 4 ± 2 °C, no headspace	7 days
Water	Organic carbon, total	U.S. EPA 415.1	One 1-liter poly bottle	H_2SO_4 to pH <2, Cool 4 ± 2 °C	28 days
Water	Solids, total dissolved	U.S. EPA 160.1	One 500-mL poly bottle	Cool 4 ± 2 °C	7 days

QAPP Worksheet 19 (continued)

Matrix	Analytical Group	Analytical and Preparation Method	Containers (number, size, type)	Preservation Requirements (chemical, temperature, etc.)	Maximum Holding Time (preparation/analysis)
Water	Alkalinity, total (including bicarbonate and carbonate	U.S. EPA 310.1	One 250-mL poly bottle	Cool 4 ± 2 °C	14 days
Water	Sulfide	U.S. EPA 376.2	One 1500-mL poly bottle	NaOH + zinc acetate, Cool 4 ± 2 °C	7 days
Water	Iron, ferrous and ferric	Hach test kit	Glass	None required	Analyze immediately
Soil Gas	VOCs	U.S. EPA Method TO-15	One 1-liter Summa® canister	Ambient temperature	14 days

Notes:
[a] samples will be analyzed for dissolved metals
[b] common anions include chloride, nitrate (as nitrogen), nitrite (as nitrogen), and sulfate
[c] nitrate (as nitrogen) has a holding time of 48 hours
[d] dissolved gases include methane, ethane, and ethene

Acronyms/Abbreviations:
API – American Petroleum Institute
ASTM – American Society for Testing and Materials
°C – degrees Celsius
ff – fuel fingerprint
HCl – hydrochloric acid
HNO_3 – nitric acid
ICP – inductively coupled argon plasma
mL – milliliter
NaOH – sodium hydroxide
PAH – polynuclear aromatic hydrocarbon
PCB – polychlorinated biphenyl
poly – polyethylene
RSK – Robert S. Kerr Environmental Research Laboratory
SIM – selected ion monitoring
SVOC – semivolatile organic compound
SWRCB – (California) State Water Resources Control Board
TAL – target analyte list
TCL – target compound list
TDS – total dissolved solids
TPH – total petroleum hydrocarbons
U.S. EPA – United States Environmental Protection Agency
VOC – volatile organic compound

QAPP Worksheet 20
Field Quality Control Sample Summary

Matrix	Analytical Group	Analytical and Preparation SOP Reference[1]	Approximate Number of Primary Sampling Locations[2]	Approximate Number of Field Duplicates[3]	Approximate Number of MS/MSDs[4]	Approximate Number of Source Blanks[5]	Approximate Number of Equipment Rinsates[6]	Approximate Number of Trip Blanks	Approximate Total Number of Samples Submitted to the Laboratory
Soil	VOCs	SOP 4 and SAP Sections 2.1.2 and 2.2.1	517	0	26	1	25	One per cooler containing VOC samples	559 (plus trip blanks)
Soil	TPH	SOP 4 and SAP Sections 2.1.2 and 2.2.1	317	0	16	1	20	NA	344
Soil	SVOCs, including 1,4-dioxane (no PAHs)	SOP 4 and SAP Sections 2.1.2 and 2.2.1	332	0	17	1	20	NA	360
Soil	PAHs	SOP 4 and SAP Sections 2.1.2 and 2.2.1	79	0	4	1	10	NA	94
Soil	TCL PCBs	SOP 4 and SAP Sections 2.1.2 and 2.2.1	333	0	17	1	20	NA	359
Soil	TAL metals	SOP 4 and SAP Sections 2.1.2 and 2.2.1	416	0	21	1	25	NA	463
Soil	Hexavalent chromium	SOP 4 and SAP Sections 2.1.2 and 2.2.1	88	0	5	1	20	NA	114
Soil	Cyanide	SOP 4 and SAP Sections 2.1.2 and 2.2.1	88	0	5	1	20	NA	114
Soil	Radium	SOP 4 and SAP Sections 2.1.2 and 2.2.1	2	0	1	1	1	NA	5

QAPP Worksheet 20 (continued)

Matrix	Analytical Group	Analytical and Preparation SOP Reference[1]	Approximate Number of Primary Sampling Locations[2]	Approximate Number of Field Duplicates[3]	Approximate Number of MS/MSDs[4]	Approximate Number of Source Blanks[5]	Approximate Number of Equipment Rinsates[6]	Approximate Number of Trip Blanks	Approximate Total Number of Samples Submitted to the Laboratory
Water	VOCs	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2	127	13	7	1	30	One per cooler bearing VOC samples	177 (plus trip blanks)
Water	TPH	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2	79	8	4	1	25	NA	117
Water	SVOCs, including 1,4-dioxane (no PAHs)	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2	74	8	4	1	25	NA	112
Water	1,4-dioxane only	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2	43	5	3	1	20	NA	71
Water	PAHs	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2	38	4	2	1	10	NA	55
Water	TCL PCBs	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2	64	7	4	1	25	NA	101
Water	TAL metals	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2	113	12	6	1	30	NA	162
Water	Hexavalent chromium	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2	64	7	4	1	15	NA	91
Water	Mercury	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2	21	3	2	1	5	NA	32

Matrix	Analytical Group	Analytical and Preparation SOP Reference[1]	Approximate Number of Primary Sampling Locations[2]	Approximate Number of Field Duplicates[3]	Approximate Number of MS/MSDs[4]	Approximate Number of Source Blanks[5]	Approximate Number of Equipment Rinsates[6]	Approximate Number of Trip Blanks	Approximate Total Number of Samples Submitted to the Laboratory
Water	Cyanide	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2	64	7	4	1	15	NA	91
Water	Dissolved gases	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2	15	2	1	1	5	NA	24
Water	Radium	SOP 8 and SAP Sections 2.1.8 and 2.2.2	5	1	NA	1	2	NA	9
Water	Common anions and alkalinity	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2	20	2	1	1	5	NA	29
Water	Sulfide	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2	5	1	1	1	3	NA	11
Water	Total organic carbon	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2	20	2	1	1	5	NA	29
Water	Total dissolved solids	SOP 8 and SAP Sections 2.1.8, 2.1.9, and 2.2.2	33	4	2	1	10	NA	49
Soil gas	VOCs	SAP Sections 2.1.5 and 2.2.3	100	10	5	NA	NA	NA	115

Notes:

[1] SOP or SAP section that describes the sample collection procedures.

[2] For samples collected at different depths at the same location, each discrete sampling depth was counted as a separate sampling location. Numbers include step-out sampling points, if needed. Final total number of samples is based on field conditions.

[3] Field duplicates will be collected for groundwater and soil gas samples only and analyzed at a rate of one duplicate per 10 samples submitted to the laboratory for each type of analyte suite. Final total number of samples is based on field conditions.

[4] A matrix spike and a matrix spike duplicate will be submitted at a frequency of one set per 20 samples. Final total number of samples is based on field conditions.

[5] One blank from each source water location will be collected and analyzed for the same parameters as the related samples. Final total number of samples is based on field conditions.

[6] Equipment rinsate blanks will be collected at a minimum of one set (for all parameters of concern) per day. Final total number of samples is based on field conditions.

Acronyms/Abbreviations:

MS/MSD – matrix spike/matrix spike duplicate
NA – not applicable
PAH – polynuclear aromatic hydrocarbon
PCB – polychlorinated biphenyl
SAP – sampling and analysis plan
SOP – standard operating procedure
SVOC – semivolatile organic compound
TAL – target analyte list
TCL – target compound list
TPH – total petroleum hydrocarbons
VOC – volatile organic compound

QAPP Worksheet 22
Field Equipment Calibration, Maintenance, Testing, and Inspection

Field Equipment/ Instrument	Calibration Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]	Comments
Hydrogen ion concentration (pH) meter	Calibrate using standard pH buffer solutions before using meter.	At the start of each day before using meter.	Calibration is accepted if pH meter registers within plus or minus 0.5 pH units of the expected response for each buffer solution.	Perform necessary adjustments to instrument following manufacturer's instructions if acceptance criteria are not met.	Field personnel	SOP 6	
Specific electric conductance meter	Calibrate using known standard solution (usually potassium chloride) before using meter.	At the start of each day before using meter.	Calibration is accepted if specific electric conductance meter registers within 10 percent of the expected response for the known standard solution.	Perform necessary adjustments to instrument following manufacturer's instructions if acceptance criteria are not met.	Field personnel	SOP 6	

QAPP Worksheet 22 (continued)

Field Equipment/ Instrument	Calibration Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]	Comments
Turbidity meter	Calibrate using standard solution before using meter.	At the start of each day before using meter.	Calibration is accepted if turbidity meter registers within 10 percent of the expected response for the known standard solution.	Perform necessary adjustments to instrument following manufacturer's instructions if acceptance criteria are not met.	Field personnel	SOP 6	
FID (or equivalent)	Each day, zero and span with ambient air and methane standards. Calibrate with a low-range and mid-range standard, or calibrate at 10 parts per million on both scales. Adjust zero and span hourly or whenever zero appears to drift.	At the start of each day before work begins; calibrate as needed throughout the day whenever zero appears to drift.	Calibration is accepted if instrument registers within 5 percent of the expected response.	Perform necessary adjustments to instrument following manufacturer's instructions if acceptance criteria are not met.	SSHR	SAP Section 2.7 and SSHP Section 10	

QAPP Worksheet 22 (continued)

Field Equipment/ Instrument	Calibration Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]	Comments
Combustible gas indicator	Calibrate daily with methane or gas mixture (nominal 50 percent lower explosive limit).	At the start of each day before work begins.	Calibration is accepted if instrument registers within 5 percent of the expected response.	Perform necessary adjustments to instrument following manufacturer's instructions if acceptance criteria are not met.	SSHR	SAP Section 2.7 and SSHP Section 10	
Ear-insertable core temperature monitor	Check response daily before work begins, if monitor is required.	At the start of each day before work begins, if monitor is required.	Calibration is accepted if instrument registers within 5 percent of the expected response.	Perform necessary adjustments to instrument following manufacturer's instructions if acceptance criteria are not met.	SSHR	SAP Section 2.7 and SSHP Section 10	
Oxygen sensor	Each day, check with ambient air away from any sources of contamination. Adjust reading whenever "ambient air reading" appears to drift.	At the start of each day before work begins; calibrate as needed throughout the day whenever "ambient air reading" appears to drift.	Calibration is accepted if instrument registers within 5 percent of the expected response.	Perform necessary adjustments to instrument following manufacturer's instructions if acceptance criteria are not met.	SSHR	SAP Section 2.7 and SSHP Section 10	

QAPP Worksheet 22 (continued)

Field Equipment/ Instrument	Calibration Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]	Comments
Ludlum Model-2224 Scaler/ Rate Meter (or equivalent) Ludlum Model-2350-1 Datalogger (or equivalent) Ludlum Model-2929 Dual Channel Scaler	Calibrate according to manufacturer's suggested specifications	At the start of each day before using meter	Refer to manufacturer's suggested calibration criteria	Perform necessary adjustments to instrument following manufacturer's instructions if acceptance criteria are not met.	SSHR	SAP Section 2.7 and SSHP Section 10	
Ludlum Model-19 Micro R-meter (or equivalent)	Calibrate according to manufacturer's suggested specifications	At the start of each day before using meter	Refer to manufacturer's suggested calibration criteria	Perform necessary adjustments to instrument following manufacturer's instructions if acceptance criteria are not met.	SSHR	SAP Section 2.7 and SSHP Section 10	

Note:
[1] SOP or SAP section that describes the calibration/maintenance/testing/inspection procedures.

Acronyms/Abbreviations:
FID – flame ionization detector
NA – not applicable
SAP – sampling and analysis plan
SOP – standard operating procedure
SSHP – Site-Specific Safety and Health Plan Supplement
SSHR – Site Safety and Health Representative

QAPP Worksheet 29
Project Documents and Records

Document	Where Maintained
Field notes/logbooks	Project files
Underground utility survey and land survey reports	Project files
Boring and well logs	Project files
Photographs	Project files
Chain-of-custody forms	Project files
Investigation-derived waste inspection and container inventory logs	Project files
Field clearance and training records (initial 40-hour HAZWOPER safety and health training, first aid, cardiopulmonary resuscitation, 8-hour HAZWOPER refresher training, and annual medical clearance)	Project files
Material safety data sheets	Project files
Project surveillance reports	Project files
Field incident/accident reports	Project files
Laboratory raw data packages	Project files and Laboratory
Laboratory audit/assessment checklists/reports	Project files and Laboratory
Laboratory corrective action forms/reports	Project files and Laboratory
Laboratory equipment calibration logs	Laboratory
Sample preparation logs	Laboratory
Sample run logs	Laboratory
Sample disposal records	Laboratory
Validated analytical data packages	Project files and Third-Party Data Validator

Acronym/Abbreviation:
HAZWOPER – Hazardous Waste Operations and Emergency Response Standard

QAPP Worksheet 34
Verification Process

Verification Input	Description	Internal/ External	Responsible for Verification (Name and Organization)
Field notes/logbooks	Field notes/logbooks will be reviewed internally and placed in the project files.	I	Field team leader or designee (Bechtel)
Underground utility survey and land survey reports	All underground utility survey and land survey reports will be verified by the subcontractors performing the work for completeness and technical accuracy prior to submittal. The reports will be reviewed internally and placed in the project files.	I,E	Subcontractors Field team leader or designee (Bechtel)
Boring and well logs	Logs will be reviewed internally and placed in the project files. Copies of logs will be included in the report.	I	CTOL or designee (Bechtel)
Photographs	Photographs and descriptions of photographs in the field logbooks will be reviewed internally and placed in the project files. Copies of photographs will be included in the report.	I	CTOL or designee (Bechtel)
Chain-of-custody forms	Chain-of-custody forms will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The original and laboratory copies will be taped inside the coolers for shipment. A copy of the chain-of-custody forms will be placed in the project files and included in the report.	I	Field team leader or designee (Bechtel)
Investigation-derived waste inspection and container inventory logs	Waste inspection and container inventory logs will be reviewed internally and placed in the project files.	I	Field team leader or designee (Bechtel)
Field clearance and training records	Records will be reviewed internally and placed in the project files.	I	Field SSHR (Bechtel)
Material safety data sheets	Material safety data sheets will be reviewed internally and placed in the project files.	I	Field SSHR (Bechtel)
Field incident/accident reports	Field incident/accident reports will be reviewed internally and placed in the project files	I	SHM and Field SSHR (Bechtel)

QAPP Worksheet 34 (continued)

Verification Input	Description	Internal/ External	Responsible for Verification (Name and Organization)
Laboratory data packages and Validated analytical data packages	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal. All data packages will be verified externally by a third-party data validator according to the data validation procedures specified in Section 4 of the SAP[1]. All validated data packages will be reviewed internally and placed in project files	I,E	Laboratory and external data validator
Field surveillance/assessment checklists/reports and corrective action forms/reports	Upon report completion, a copy of all audit reports will be placed in the project files. If corrective actions are required, a copy of the documented corrective action taken will be attached to the appropriate surveillance report in the project files. Surveillance reports will be reviewed internally to ensure that all appropriate corrective actions have been taken and that corrective action reports are attached. If corrective actions have not been taken, the CTOL will be notified to ensure action is taken.	I	CTOL or designee (Bechtel)

Note:
[1] The SAP includes the Field Sampling Plan and Quality Assurance Project Plan

Acronym/Abbreviation:
CTOL – contract task order leader
SAP – Sampling and Analysis Plan
SHM – Safety and Health Manager
SSHR – Site Safety and Health Representative

APPENDIX A1

STUDY AREAS AT OU-2C

FOREWORD

Operable Unit (OU) 2C consists of Installation Restoration (IR) Program Sites 5, 10, and 12. The study areas for evaluation in OU-2C are the following:

- 6 evaluation areas requiring further field activities
  - Evaluation Area 1: OU-2C groundwater impacted by volatile organic compounds (VOCs), metals, and cyanide; and potentially impacted by radium-226 and radium-228 beneath Building 5 and by 1,4-dioxane
  - Evaluation Area 2: soil and groundwater in the vicinity of Building 2 (former dry cleaning operations, including Naval Air Station [NAS] generator accumulation point [GAP] 05)
  - Evaluation Area 3: soil beneath the southern portion of Building 5 (plating shop, foundry, etc.)
  - Evaluation Area 4: soil beneath the Aircraft Maintenance Line and adjoining shop area in the northern portion of Building 5
  - Evaluation Area 5: soil south of Building 5
  - Evaluation Area 6: soil east of Building 5
- 13 data gap areas
  - IR Site 5: Buildings 6, 34, 43, 44, 102, 282, 347, 405, 415, 500, and 505
  - IR Site 5: polynuclear aromatic hydrocarbon (PAH) data gap area and former materials storage area south and east of Building 44
  - IR Site 10: Building 400 hangar floor
- 22 solid waste management units (SWMUs)
  - 4 oil/water separators (OWSs) (OWS 005, OWS 006A, OWS 006B, and OWS 010)
  - 1 aboveground storage tank (AST) (AST 005G, removed)
  - 4 solvent distillation units (M-01, M-02, M-05, and M-08)
  - 1 coolant recovery system (M-09)
  - 9 Naval Aviation Depot (NADEP) GAPs (NADEP GAPs 02, 04, 17, 20, 25, 27, 31, 57, 70)
  - 1 NAS GAP (NAS GAP 01)
  - 1 Resource Conservation and Recovery Act [RCRA] area of concern (AOC) (AOC 005; also known as underground storage tanks [USTs] 5-2 and 5-3, both removed)
  - 1 RCRA UST (UST[R]-02, also known as USTs 6-1 and 6-2; both removed)

The locations of evaluation areas, data gap areas, and SWMUs are shown on Figure A1-1.

Detailed features of each study area are shown on Figures A1-2 through A1-16.

The study areas for OU-2C are discussed individually in area-specific sections in this appendix. The description for each area includes location, historical uses, sampling results from previous investigations, and the proposed supplemental RI sampling plan. To facilitate these discussions, this Foreword presents summaries of data sources and source documents, comparison criteria, the RI sampling approach, and analytical methods.

DATA SOURCES

Data from the following sources were evaluated as part of the draft Remedial Investigation Report for Operable Unit 2C, IR Sites 5, 10, and 12 (SulTech 2005a) and are summarized in this appendix, as applicable, for each OU-2C study area:

- soil and groundwater analytical results available in the OU-2C database prepared by SulTech from the investigations discussed in Section 3 of the Work Plan (excluding manhole sediment data collected as part of the storm sewer investigation and soil PAH data from the environmental baseline survey [EBS]; PAH data from the EBS were not used because analytical results had detection limits higher than current regulatory criteria)
- ongoing groundwater monitoring data from the basewide groundwater monitoring program (BGMP)

The above data sets for samples collected at each evaluation area, data gap area, and SWMU area are presented on a compact disk (CD) in Appendix A2 to the Sampling and Analysis Plan (SAP).

The OU-2C RI report to be prepared at the conclusion of the supplemental RI sampling activities will also include any additional data generated after 2004 that are available at the time the report is written. This will include data collected under the BGMP after 2004, data from groundwater monitoring conducted during and after the six-phase heating activity for the dense nonaqueous-phase liquid (DNAPL) source removal action (including monitoring for rebound effects), any ongoing total petroleum hydrocarbons (TPH) investigations, and any other sampling activities relevant to OU-2C.

SOURCE DOCUMENTS

The following environmental reports summarize the results of studies conducted within the boundaries of OU-2C:

- Data Summary Report, RI/FS Phases 2B and 3 (PRC and JMM 1992)
- Data Summary Report Background and Tidal Influence Study and Additional Work for IR Sites 4 and 5 (PRC and MW 1995)
- EBS/Community Environmental Response Facilitation Act Report (ERM-West 1994a)
- Parcel Evaluation Plans (ERM-West 1994b)
- Remedial Investigation/Feasibility Study Data Transmittal Memorandum, IR Sites 4, 5, 8, 10A, 12, and 14 – CTO 260 (PRC and MW 1996a)

- Remedial Investigation/Feasibility Study, Data Transmittal Memorandum, IR Sites 1, 2, 3, Runway Areas 6, 7A, 7B, 9, 10B, 11, 13, 15, 16, and 19 – CTO-280 (PRC and MW 1996b)
- Geochemical Profiling for Definition of Chlorinated Plumes, IR Sites 4 and 5, Alameda Naval Air Station (OGISO 1997)
- Data Transmittal Memorandum for IR Sites 4 and 5 Chlorinated Solvent Plume Definition and IR Site 14 Sump Investigations at Alameda Point (TtEMI and Einarson, Fowler, and Watson 1998)
- Data Summary Report, Quarterly Groundwater Monitoring, November 1997–August 1998 (TtEMI and Uribe & Associates 1998)
- IR Site 5 Electrokinetic Pilot-Scale Treatability Study Oversight Report, Alameda Point, Alameda, California, Draft (TtEMI 1999b)
- Fuel Pipeline Oversight and Sampling Report (TtEMI 2000a)
- EBS Data Evaluation Summary (IT 2001a)
- Draft Installation Restoration IR Sites 4 and 5 Cadmium Removal Action Engineering Evaluation and Cost Analysis, Alameda Point (TtEMI 2001a)
- Draft Installation Restoration IR Sites 4 and 5, DNAPL and Dissolved Source Removal Action, Engineering Evaluation and Cost Analysis, Alameda Point (TtEMI 2001b) and data transmittals (IT 2002b, 2002d, 2002e, 2002f)
- Summary of Background Concentrations in Soil and Groundwater, Alameda Point (TtEMI 2001d)
- Draft Radiological Closeout Survey Report for Buildings 5 and 400, Alameda Point (TtEMI 2001c)
- Internal Draft Addendum Confirmation Radiation Survey and Field Sampling Work Plan (TtEMI 2002a)
- Data Summary Report, Supplemental RI Data Gap Sampling for OU-1 and OU-2 (TtEMI 2002b)
- Draft IR Sites 5 and 14 Removal Action Closeout Report, Alameda Point (IT 2002a)
- Supplemental EBS (TtEMI 2002c)
- Underground Fuel Line Abandonment Report (IT 2002c)
- Underground Storage Tank Summary Report, Alameda (TtEMI 2003)
- Field Activity Report Assessment of PAH Contamination at Selected CERCLA Sites and EBS Parcels (BEI 2004)
- Petroleum ASTs Assessment and Closure Request, Alameda Point (SulTech 2004)
- Work Plan, Basewide Groundwater Monitoring Program (Shaw 2004a)
- SWMU Evaluation Report for Operable Unit 2C (SulTech 2005b)

- Spring 2005 Alameda Basewide Annual Groundwater Monitoring Report (ITSI 2005)
- Final Field Activities Report DNAPL Source Removal Action (Shaw 2006)

Pertinent data from these studies are discussed in area-specific summaries of previous investigations in this appendix. Data from these investigations are presented on CD in Appendix A2 to the SAP.

COMPARISON CRITERIA

Data from previous investigations at the study areas in OU-2C are compared to one or more of the following comparison criteria in order to identify chemicals of potential concern to be addressed by the supplemental RI sampling activities. During preparation of the OU-2C RI report following the supplemental RI sampling activities, these comparison criteria will be used as conservative tools to delineate the nature and extent of contamination, and will not be used to eliminate any chemicals from risk assessment calculations.

- Concentrations of VOCs, semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), metals (including hexavalent chromium), and cyanide in groundwater are compared to the lower of federal and California primary maximum contaminant levels (Tables A1-1 and A1-2).
- Concentrations of VOCs, SVOCs, pesticides, PCBs, metals(including hexavalent chromium), and cyanide in groundwater that may potentially discharge to surface water bodies (Seaplane Lagoon or Oakland Inner Harbor) are compared to California Toxics Rule criteria (Tables A1-1 and A1-2).
- Concentrations of VOCs, SVOCs (excluding PAHs), pesticides, PCBs, metals(including hexavalent chromium), and cyanide in soil are compared to their respective United States Environmental Protection Agency (U.S. EPA) Region 9 preliminary remediation goals (PRGs) for residential soil (Tables A1-1 and A1-2); California-modified PRGs are used where available (U.S. EPA 2004).
- Concentrations of TPH in soil and groundwater are compared to San Francisco Bay Regional Water Quality Control Board environmental screening levels (ESLs) as requested by the regulatory agencies (RWQCB 2005). Table A1-3 provides the comparison criteria.
- Concentrations of PAHs in soil are assessed by calculating benzo(a)pyrene equivalent concentrations and comparing these benzo(a)pyrene equivalents to the Alameda Point–specific residential soil screening value of 620 µg/kg for residential use and 2,100 µg/kg for industrial use (DON 2001).
- Concentrations of metals in soil that are above residential PRGs are compared to threshold background concentrations developed specifically for the central portion of Alameda Point (TtEMI 2001d, 2004) (Table A1-2). A metal concentration is considered an exceedance if it is greater than both the residential PRG and the background threshold concentration.

The Navy and regulatory agencies have initiated discussions to reconsider the background concentrations and data set established for Alameda Point at a meeting held on October 18, 2005 (DON 2005). It was agreed that the 95th percentile or quantile (Table A1-2) would be more appropriate for comparison as part of the assessment of contaminant nature and extent. The comparison criteria that will be used in the RI report for OU-2C will reflect any updated agreements reached by the time the RI report is prepared.

Exceedances of the comparison criteria listed above are summarized in Tables A1-4 through A1-17 and discussed in this appendix for contaminants reported in each OU-2C study area.

REMEDIAL INVESTIGATION SAMPLING APPROACH

Soil samples will generally be collected at two depth intervals (0 to 0.5 foot below ground surface [bgs] and 2 to 4 feet bgs) using the direct-push sampling method. At locations at which TPH is a chemical of interest, a third sample will be collected at the water table (soil/water interface) in the 4-to-6-foot depth interval; if groundwater is encountered at depths shallower than 4 feet bgs, a saturated soil sample will be collected in this depth interval. A fourth soil sample from the borings next to OWSs (OWS 005, OWS 006A, OWS 006B, and OWS 010) and former UST locations will be collected in the 10-to-12-foot depth interval, which is below the bottoms of the OWSs and USTs. At the locations in the PAH data gap area, soil samples will be collected at four depth intervals (0 to 0.5 foot bgs, 0.5 foot to 2 feet bgs, 2 to 4 feet bgs, and 4 to 8 feet bgs) in accordance with PAH assessment investigation sampling.

Discrete groundwater samples will be collected using the HydroPunch or equivalent sampling method. Groundwater will also be collected from newly installed monitoring wells and from existing monitoring wells that are not currently being sampled under the BGMP as needed to fill data gaps. Groundwater samples will be collected during the RI supplemental field activities from eight existing monitoring wells currently being sampled under the BGMP (M05-02, M05-05, M05-06, M05-09, D05-01, D05-03, D05-04, and D05-05); these samples will be analyzed for the analytes included in the BGMP sampling program. The discrete groundwater samples will be collected from the shallower first water-bearing zone (FWBZ) from approximately 5 to 10 feet below the groundwater table in each area; and in the deeper FWBZ at depths of approximately 20 to 25 feet below the water table. Groundwater flow directions developed from water levels collected during the BGMP will be used to aid in the placement of some borings.

As input for risk assessment calculations for the indoor air pathway, soil gas samples will be collected beneath the concrete slab at Building 5 (currently vacant) at a density of approximately one sample per 6,000 square feet. Samples will be analyzed for VOCs. The data from this investigation will be used to evaluate the potential risk from vapor intrusion from VOCs in groundwater to the hypothetical future occupants of the building. As part of the risk assessment, analytical results for soil gas samples will be compared to both soil ESLs and California human-health screening levels. The primary use of subslab soil gas data will be for risk assessment calculations (specifically as input to the Johnson

and Ettinger model). Subslab soil gas data will not be used to characterize the nature and extent of soil or groundwater contamination because soil and groundwater are being sampled and analyzed directly. Additionally, subslab soil gas data will not be used to characterize the nature of VOCs in soil or groundwater due to the potential for subslab soil vapor to include chemicals present in ambient air resulting from surface sources (e.g., vapor degreasers, dry cleaners, clarifiers, fuel tanks). However, subslab soil gas data for VOCs that are also reported in soil and groundwater may be used to evaluate the relative distribution of VOCs between each medium and to evaluate the areal distribution of potential risk associated with migration of VOCs from groundwater to indoor air.

Few samples for physical (geotechnical) analysis were collected during previous investigations. Therefore, to support risk assessment modeling, fate-and-transport assessment, and FS evaluations, soil samples will be collected for geotechnical analysis from locations throughout OU-2C for which there are no previous geotechnical results. These samples will be collected from the vadose zone in the 2-to-4-foot depth interval and from selected monitoring well borings in the 10-to-15-foot depth interval (shallower FWBZ) and the 20-to-30-foot depth interval (deeper FWBZ).

ANALYTICAL METHODS

Unless otherwise specified, one or more of the following analytical methods will be used for the samples from the proposed OU-2C sampling locations:

- U.S. EPA Methods 5035A and 8260B for VOCs in soil and groundwater
- U.S. EPA Method TO-15 for VOCs in soil gas
- U.S. EPA Method 8015B-M with silica gel cleanup for extractable-range TPH (fuel fingerprint)
- U.S. EPA Method 8015-M for purgeable-range TPH (as gasoline)
- U.S. EPA Method 8270C for SVOCs (non-PAHs, including 1,4-dioxane)
- U.S. EPA Method 8270C with selected ion monitoring for PAHs
- U.S. EPA Method 8082 for PCBs
- U.S. EPA Method 6010B/7000 series for metals
- U.S. EPA Method 1631 for mercury (low-level detection limits for groundwater samples in the event that any groundwater samples are collected within 500 feet of the shoreline)
- U.S. EPA Method 7196A for hexavalent chromium
- U.S. EPA Method 9010B for cyanide
- U.S. EPA Method 901.1 for radium in soil
- U.S. EPA Methods 903.1 and 904.0 for radium in groundwater

Because discrete groundwater samples are commonly turbid due to the presence of suspended solids, samples collected for metals will be filtered in the field prior to analysis.

For groundwater samples collected from monitoring wells, the following analytical methods also will be used.

- U.S. EPA Method 300.0 for common anions (chloride, fluoride, nitrate [as nitrogen], nitrite [as nitrogen], and sulfate)
- U.S. EPA Method 310.1 for alkalinity
- Robert S. Kerr Environmental Research Laboratory Method 175 for dissolved gases (methane, ethane, and ethene)
- U.S. EPA Method 415.1 for total organic carbon
- U.S. EPA Method 160.1 for total dissolved solids
- U.S. EPA Method 376.2 for sulfide
- Hach Test kit for iron (ferrous and ferric)

For soil samples collected for geotechnical analysis, the following methods will be used:

- American Petroleum Institute Recommended Practice 40 for air permeability (vadose zone samples only)
- American Society for Testing and Materials (ASTM) D2937 and D2216 for density and moisture content
- California State Water Resources Control Board method for effective porosity
- ASTM C136-96 and D422-63 for grain-size distribution
- ASTM D4318-00 for liquid limits
- ASTM D5084-90 for hydraulic conductivity
- Walkley-Black method for total organic carbon

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ACRONYMS/ABBREVIATIONS

AOC	area of concern
AST	aboveground storage tank
BEI	Bechtel Environmental, Inc.
BGMP	basewide groundwater monitoring program
bgs	below ground surface
BSU	Bay Sediment Unit
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAA	corrective action area
CD	compact disk
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	chemical of concern
COPC	chemical of potential concern
CPT	cone penetrometer test
CTO	contract task order
DCA	dichloroethane
DCE	dichloroethene
DNAPL	dense nonaqueous-phase liquid
DQO	data quality objective
DTSC	(California Environmental Protection Agency) Department of Toxic Substances Control
EBS	environmental baseline survey
FS	feasibility study
FWBZ	first water-bearing zone
GAP	generator accumulation point
HHRA	human-health risk assessment
IR	Installation Restoration (Program)
IWTP	industrial waste treatment plant
JP-5	jet propellant grade 5
µg/L	micrograms per liter
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
MTBE	methyl tert-butyl ether

NADEP	Naval Aviation Depot
NAS	Naval Air Station
NFA	no further action
OU	operable unit
OWS	oil/water separator
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PEP	parcel evaluation plan
ppb	parts per billion
PRG	preliminary remediation goal
PWC	(Navy) Public Works Center
RAPP	Removal Action Project Plan
RCRA	Resource Conservation and Recovery Act
RFA	RCRA facility assessment
RI	remedial investigation
RNS	ribbon nonaqueous-phase liquid sampler
SAP	sampling and analysis plan
SPH	six-phase heating
SVOC	semivolatile organic compound
SWBZ	second water-bearing zone
SWMU	solid waste management unit
TCA	trichloroethane
TCE	trichloroethene
TDS	total dissolved solids
TPH	total petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
U.S. EPA	United States Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound

Appendix A1
STUDY AREAS AT OU-2C

Investigation issues at Operable Unit (OU) 2C have been divided into three groups, based on similarities of sampling rationale and design:

- evaluation areas and data gap areas
- oil/water separators (OWSs) and one Resource Conservation and Recovery Act (RCRA) underground storage tank (UST[R]) unit
- solid waste management units (SWMUs) including area of concern (AOC), aboveground storage tank (AST), solvent distillation unit, Naval Aviation Depot (NADEP) generator accumulation point (GAP), and Naval Air Station (NAS) GAP units

Four sets of data quality objectives (DQOs) were developed as sitewide approaches for the investigation issues associated with these groups (Tables 1-6 through 1-9 in the Sampling and Analysis Plan [SAP]). The DQO sets apply to study areas at OU-2C as follows:

- **DQOs for groundwater** (Table 1-6 of the SAP) apply to the following:
  - Evaluation Area 1: OU-2C groundwater impacted by volatile organic compounds (VOCs), metals (including hexavalent chromium), and cyanide; and potentially impacted by radium-226 and radium-228 beneath Building 5 and by 1,4-dioxane
- **DQOs for soil evaluation areas** (Table 1-7 of the SAP) apply to the following:
  - Evaluation Area 2: Building 2 (former dry cleaning facility)
  - Evaluation Area 3: soil beneath Building 5 (former plating shop, foundry, etc.)
  - Evaluation Area 4: soil beneath Aircraft Maintenance Line and adjoining shop area
  - Evaluation Area 5: soil south of Building 5
  - Evaluation Area 6: soil east of Building 5
- **DQOs for OWSs and USTs** (Table 1-8 of the SAP) apply to the following:
  - OWS 005 (located in Evaluation Area 5)
  - OWS 006A
  - OWS 006B
  - OWS 010
  - UST(R)-02
- **DQOs for data gap areas and SWMUs** (Table 1-9 of the SAP) apply to the following:
  - data gaps related to Buildings 6, 34, 43, 44, 102, 282, 347, 400, 405, 415, 500, and 505
  - PAH data gap area and former materials storage area south and east of Building 44

- AOC 005 and NADEP GAP 20 (located in Evaluation Area 6)
- M-01, M-02, M-09, NADEP GAP 57, and NADEP GAP 70 (located in Evaluation Area 3)
- M-05, NADEP GAPs 02, 04, and 31 (located in Evaluation Area 4)
- AST 005G and NADEP GAP 25 (located in Evaluation Area 5)
- M-08, NADEP GAP 17, NADEP GAP 27, and NAS GAP 01 (identified as SWMUs outside the evaluation areas)

The purpose of this appendix is to describe each study area (including historical uses and previous investigations) and provide area-specific problem statements and optimized sampling designs (DQO Steps 1 and 7).

Evaluation areas, data gap areas, and SWMUs are shown on Figure A1-1. Summaries of proposed sampling and analyses for all areas are presented in Tables 1-2 through 1-5 of the SAP. OU-2C locations sampled during previous investigations for groundwater and soil are shown on Figures 3-1 and 3-2 of the SAP. Existing and proposed monitoring well sampling locations are shown on Figure A1-2. Distributions of chlorinated VOCs in groundwater beneath Evaluation Area 1 are shown on Figures A1-3 through A1-5. For Evaluation Areas 2 through 6, data gap areas, and SWMUs, previous soil sampling locations as well as proposed supplemental remedial investigation (RI) sampling locations are shown on Figures A1-6 through A1-16. Historical data were compared to criteria that are described in the Foreword to this appendix and listed in Tables A1-1 through A1-3. Samples with concentrations exceeding comparison criteria are summarized in Tables A1-4 through A1-17. Figures and tables follow the text of this appendix. Appendix A2 to the SAP presents previous data collected at OU-2C.

During meetings held on May 16 and June 15, 2006, the Navy and the regulatory agencies discussed data gaps identified by the regulatory agencies during their review of the draft RI Report (SulTech 2005). During these discussions, the Navy and BEI provided a response to the agencies' request for additional sampling within OU-2C. Agency concurrence with the Navy's proposed approach to address each data gap (by sampling or by demonstrating that adequate data were already available) was received during the June 15, 2006, discussion. A summary of the issues initially identified as data gaps and agency concerns is included in Table F-1 in Attachment F. This table provides the resolution for each issue (e.g., further sampling or no sampling due to adequate existing data). Additionally, issues related to specific media or chemicals that do not represent data gaps are explained in Sections A1.1.3 (Evaluation Area 1) and A1.7 (IR Site 5 Data Gaps Areas) of this appendix.

A1.1 EVALUATION AREA 1

Evaluation Area 1 consists of groundwater beneath OU-2C that has been impacted by chlorinated VOCs, hexavalent chromium, other metals, and cyanide. Groundwater may also have been impacted by 1,4-dioxane, which is a common component of degreasing solvents; however, no previous sampling has included analysis for this compound. Furthermore, groundwater may have been impacted by radium from radioluminescent painting operations in Building 5 that discharged paint containing radium-226 into the

storm sewer system leading from Building 5 into the Seaplane Lagoon at Outfall F from the 1940s and early 1960s.

Evaluation Area 1 encompasses approximately 36.8 acres located within Installation Restoration (IR) Site 5, west of Buildings 6 and 32 and IR Site 12, and includes the portion of IR Site 10 north of Building 400 (Figure A1-1). Evaluation Area 1 includes EBS Parcels 46, 47, 48, 49, 50A, 51A, 53A, 54, 55, 56, 57, 58, 59, and portions of 45A and 52. Although chlorinated VOCs and their related degradation products were found in groundwater at detectable concentrations in the first-water bearing zone (FWBZ) across OU-2C, the highest concentrations were present primarily in two general areas at Building 5: beneath the south-central portion of the building and at the eastern edge of the building (Figure A1-2). Within these two areas, four plumes of VOC concentrations exceeding 10,000 micrograms per liter (µg/L) were initially identified and targeted for dense nonaqueous-phase liquid (DNAPL) removal actions (Plumes 5-1 through 5-4). Subsequent plume characterization activities confirmed that only two areas (Plumes 5-1 and 5-3) had chlorinated VOC concentrations meeting criteria for DNAPL removal actions using a six-phase heating (SPH) technology (see Section A1.1.2.9).

The FWBZ represents saturated materials from 5 to approximately 40 feet below ground surface (bgs) and includes the shallower FWBZ in the fill material from 5 to 17 feet bgs and the deeper FWBZ in the sandy and silty portions of the underlying Bay Sediment Unit (BSU) from 17 to 40 feet bgs. The BSU is underlain by the Merritt Sand, which is the uppermost portion of the second-water bearing zone (SWBZ). Figures A1-3 and A1-4 show the distribution of chlorinated VOCs in the shallower and deeper FWBZ, respectively, as represented by the combined concentrations of the nine VOCs reported at concentrations exceeding comparison criteria. A 0.5-µg/L vinyl chloride contour line is used to approximate the extent of the VOC plume.

Trace concentrations of some chlorinated VOCs and their related degradation products were reported above detection limits in the SWBZ, particularly at the eastern edge of Building 5 at 60 to 70 feet bgs. Figure A1-5 shows the distribution of chlorinated VOCs in the SWBZ, as represented by the combined concentrations of the same nine VOCs that were reported at concentrations exceeding comparison criteria in groundwater samples collected in the FWBZ. The SWBZ is separated from the FWBZ by the BSU, which comprises both clayey materials that may act as an aquitard and sandy/silty materials. The presence of VOCs in the SWBZ may indicate a potential downward migration of solvents in groundwater at OU-2C.

Two investigations using direct-push technology to collect discrete groundwater samples have been conducted to characterize the nature and extent of VOCs in the FWBZ. An additional investigation was conducted to characterize the horizontal and vertical extent of chlorinated VOCs at concentrations exceeding 10,000 µg/L to a depth of up to 60 feet.

Between 1991 and 2004, more than 50 monitoring wells were installed and sampled for VOCs and other chemicals of potential concern (COPCs). Within Evaluation Area 1, seven FWBZ monitoring wells and seven SWBZ monitoring wells are currently being

sampled under the basewide groundwater monitoring program (BGMP) to monitor VOC concentrations:

- one FWBZ well in the plume – 2MW8S
- six FWBZ wells at the periphery of the plume – M05-01, M05-02, M05-05, M05-06, M05-08, and M05-08
- seven SWBZ wells at the periphery of the plume – wells D05-01 and D05-03 through D05-08

The FWBZ wells monitor the shallower portion of the FWBZ at depths of 5 to 15 feet bgs. Using maximum contaminant levels (MCLs) as the comparison criteria to characterize the nature and extent of contamination, 11 chlorinated VOCs have been found to exceed these criteria in multiple groundwater samples. For 11 VOCs reported at concentrations exceeding MCLs, Table A1-4 summarizes maximum concentrations in Evaluation Area 1 monitoring wells on a year-by-year basis.

Additional COPCs reported in groundwater across OU-2C include nonchlorinated VOCs, semivolatile organic compounds (SVOCs), pesticides, and metals. In addition, petroleum hydrocarbons have been reported in groundwater at OU-2C. Tables A1-4 through A1-11 list COPCs exceeding comparison criteria. Chlorinated solvents (VOCs), petroleum hydrocarbons, and metals are consistent with historical activities that occurred at OU-2C, including painting, paint stripping, degreasing, plating, jet engine testing, equipment cleaning and repair, and the use of petroleum hydrocarbons.

A1.1.1 Historical Use

The chlorinated VOC plume at OU-2C is generally located within IR Site 5, which is in the central portion of Alameda Point and contains Building 5, also known as the Aircraft Rework Facility (Figure A1-1). The area encompassing the plume is located approximately 1,200 feet north of Seaplane Lagoon (Figure A1-2). The following paragraphs describe historical activities at IR Site 5 that may have been sources of VOCs found in groundwater, including operations in and adjacent to Building 5, USTs, ASTs, OWSs, and the industrial wastewater sewer system.

Building 5 was erected in two stages: the southern portion (Building 5) was erected in the 1940s, followed several years later by the northern portion (Building 5A). For the purpose of this report, both portions are identified as Building 5. The building was closed in 1993 and is currently vacant; however, past uses included cleaning, reworking, and manufacturing of metal parts; plating, painting, and tool maintenance operations; and specialty operations (Canonie Environmental 1990). The building contained a main paint shop comprising two paint bays (Aircraft Paint East and Aircraft Paint West) and several smaller paint spray booths. In addition, there was a plating shop with operations involving solvent vapor degreasing; caustic and acid etching; metal stripping and cleaning; and chrome, nickel, silver, cadmium, and copper plating. A possible solvent tank was reportedly located outside the northeastern corner of Building 5 (TtEMI 1999a). The reported location of this tank is identical to the location of former UST 5-2. A

review of records at the fire department in August 2006 (Hallam, pers. com. 2006) did not reveal any additional information regarding this possible solvent tank.

Between 1940 and 1972, the wastewaters from all Navy operations at Alameda Point, including those in Building 5, were discharged directly to the nearest surface water bodies through the storm sewer system. In the early 1970s, the Navy installed a separate industrial wastewater sewer system to collect industrial wastewater for pretreatment prior to discharge to the East Bay Municipal Utility District. One pretreatment plant (Industrial Wastewater Treatment Plant [IWTP] 5) was located near the southwestern corner of the Building 5 (Figure A1-1). After 1972 and until 1991, the wastewater from the plating shops in Building 5 was split into two waste streams: one for alkaline (hexavalent chromium) tanks and one for cyanide tanks. The wastewater streams were kept separate until the cyanide stream was treated in a cyanide destruction unit. The two waste streams were then rerouted together to IWTP 5.

IR Site 5 also housed a hazardous waste storage area, which was closed in 1988 (DTSC 2001); drummed wastes formerly stored in the hazardous waste storage area included spent solvents, waste paints, and waste oils. This storage area, located outside Building 5 in the southeastern corner of the site, also stored drummed hydraulic fluid and lubricating oils. Building 5 contained numerous GAPs and other types of RCRA SWMUs, all of which were investigated and included in a SWMU evaluation report for OU-2C (SulTech 2005b). The areas described above are shown on Figure A1-1.

Lead-acid and nickel-cadmium batteries were serviced in the battery acid shop area. This area was in the northeastern portion of Building 5. The battery fluids were discharged to a sink in the storage area, and the sink reportedly discharged to the base industrial wastewater sewer system. Base personnel have indicated that the corrosive fluids deteriorated the piping in the sink and drain that led to the storm drain sewer system at Outfalls F and FF.

The physical features and activities listed below were evaluated in the draft SulTech RI Report (SulTech 2005a) as potential sources of contamination and identified as probable primary sources of groundwater contamination and/or soil contamination that might impact groundwater:

- Building 5
  - plating shop – VOCs, SVOCs, and metals
  - battery acid shop – metals and acid
  - hazardous waste storage area – VOCs, SVOCs, and metals
  - solvent tank – VOCs
  - shops in southern portion – zinc chromate, sulfuric acid, potassium hydroxide, heavy metals, methyl ethyl ketone, halogenated and nonhalogenated organics, corrosives, solvents, paints, waste oils, hydraulic fluids, antifreeze, beryllium, and mercury

  - shops in northern portion – lubricating oil, hydraulic fluid, methyl ethyl ketone, zinc chromate, paint, sulfuric acid, potassium hydroxide, petroleum products, halogenated organics, paint, corrosives, and heavy metals

- Building 348 corrosion control shop and solvent dip tanks – VOCs
- USTs and ASTs – total petroleum hydrocarbons (TPH)
- other buildings that historically used or stored chemicals that may have contributed to the VOCs in groundwater, including:
  - Building 2 – solvents from a dry cleaning facility
  - Building 261 – solvents
  - Building 347 – repair facility
  - Building 348 – methylene chloride
  - Building 405 – trichlorofluoroethane and solvents
  - Building 500 – oil, stains, paints, solvents, and glues

Buildings 34, 42, 62, 102, 194, 346, 614, 615, and former Buildings 51A, 53A, and 67 are not considered sources of VOC contamination because no usage or storage of chlorinated solvents in these buildings has been reported. Building 32, located east of Evaluation Area 1, was constructed in 1990 to house electroplating and metal finishing operations and formerly housed an IWTP (IWTP 32) that operated under the NAS Alameda RCRA Part B Permit for treatment of plating wastes. The IWTP was closed under RCRA and the sampling conducted in conjunction with closure found no releases to soil or groundwater (Shaw 2003b).

A1.1.2 Previous Investigations

Eleven investigations plus UST removal actions included the collection of groundwater samples within Evaluation Area 1 are as follows:

- Phase 2B and 3 Investigation (1991)
- Additional Work at IR Sites 4 and 5 (1992)
- Follow-on Investigation, Contract Task Order (CTO) 260 (1994)
- Follow-on Investigation, CTO-280 (1994)
- Environmental Baseline Survey (EBS) Phase 2B and Phase 2C
- Storm Sewer Investigations
- Geochemical Profiling to Define Chlorinated Solvent Plumes (1997 and 1998)
- Quarterly Groundwater Monitoring, CTO-108 (1997–1998)
- Chlorinated Solvent Treatability Testing (2000)
- Supplemental Remedial Investigation Data Gaps Sampling (2001)

- Chlorinated Solvent Plume Definition and DNAPL Treatability Studies (2001 and 2003)
- Basewide Groundwater Monitoring Program (2002–2005)
- TPH Investigations

A description of investigations taken directly from the draft SulTech RI Report is included in Section 3 of the Work Plan. The results of these investigations for samples collected in Evaluation Area 1 are summarized below. Locations sampled within the boundaries of Evaluation Area 1 are shown on Figure 3-2 of the SAP. Analytical results for groundwater samples collected within Evaluation Area 1 are included on compact disk (CD) in Appendix A2 to the SAP.

A1.1.2.1 PHASE 2B AND 3 INVESTIGATION, 1991 GROUNDWATER SAMPLING

Sampling for this investigation was performed as part of the NAS Alameda RI to determine if soil and groundwater were contaminated in areas identified as potential waste release sites (Canonie Environmental 1990). The investigation focused on the industrial, sanitary, and storm sewers, and included collecting soil and groundwater samples, installing groundwater monitoring wells, and performing groundwater monitoring (PRC and JMM 1992).

At IR Site 5, the investigation included installation of five monitoring wells (M05-01 through M05-05) (Figure A1-2). Groundwater samples collected from these wells were analyzed for VOCs, SVOCs, metals, cyanide, total organic carbon, pH, acidity, and general chemical characteristics (PRC and JMM 1992). COPCs reported included VOCs, SVOCs, metals, and cyanide. However, only VOCs and metals were reported at concentrations exceeding comparison criteria.

VOCs reported in groundwater at IR Site 5 included chlorinated VOCs (chloroethane, 1,2-dichloroethane [DCA]; 1,1-dichloroethene [DCE]; 1,2-DCE; 1,1,1-trichloroethane [TCA]; trichloroethene [TCE]; and vinyl chloride) and fuel constituents (ethylbenzene, toluene, and xylenes). The highest concentrations (36 to 760 µg/L) and the highest number of VOCs (1,1-DCA; 1,1-DCE; 1,2-DCE; 1,1,1-TCA; TCE; and vinyl chloride) were reported in well M05-04 located at the eastern margin of Building 5. No fuel constituents or SVOCs were reported in groundwater from well M05-04. Both chlorinated VOCs (chloroethane and 1,1-DCA at concentrations of 22 to 67 µg/L) and fuel-related VOCs (ethylbenzene, toluene, and xylenes at concentrations of 12 to 250 µg/L) were reported in groundwater samples from well M05-03, located south of Building 5. Seven SVOCs (1,2-dichlorobenzene; 1,3-dichlorobenzene; 1,4-dichlorobenzene; 2,4-dimethylphenol; bis[2-chloroethyl]ether; 2-methylnaphthalene; and naphthalene) and cyanide were also reported in groundwater from well M05-03. VOCs were reported in groundwater from well M05-02 located west of Building 5 (1,2-DCE; TCE; and vinyl chloride at concentrations of 8.8 to 95 µg/L) and well M05-05, located northeast of Building 5 (1,1-DCA; 1,2-DCE; and vinyl chloride at concentrations of 14 to 190 µg/L). One SVOC (bis[2-chloroethyl]ether) was reported from well M05-05, but no fuel constituent VOCs were reported in this well. The suite of chlorinated VOCs reported in groundwater at

IR Site 5 is typical of solvents used in paint stripping and metal parts cleaning, and of the products of solvent degradation (Table A1-4).

Metals reported in groundwater at IR Site 5 at concentrations exceeding comparison criteria were arsenic and nickel. Arsenic was reported in samples from all five wells, but was reported at concentrations exceeding 10 µg/L (the current federal MCL) only in samples from wells M05-03 (27.9 µg/L) and M05-05 (16.6 µg/L). Nickel was reported only from well M05-03 and at a concentration of 222 µg/L (the MCL is 100 µg/L).

At IR Site 10, the investigation included installation of three monitoring wells (M10-01 through M10-03) (Figure A1-2). Groundwater samples collected from these wells were analyzed for VOCs, SVOCs, metals, acidity, and general chemical characteristics (PRC and JMM 1992). COPCs reported included VOCs, SVOCs, and metals. However, no COPCs were reported at concentrations exceeding comparison criteria.

VOCs reported in groundwater at IR Site 10 included chlorinated VOCs 1,1-DCA; 1,2-DCE; 1,2-dichloropropane; and TCE at trace concentrations (1.4 to 3.4 µg/L) reported in groundwater from well M10-01 located north of Building 400 near Building 5. These VOCs are common industrial solvents or their degradation products. In addition, chloroform (2.5 to 52 µg/L) was reported in groundwater from wells M10-02 and M10-03, located south of Building 400. Chloroform is commonly associated with chlorinated drinking water. SVOCs (pyrene, bis[2-chloroisopropyl]ether, and bis[2-chloroethyl]ether) were reported in groundwater samples only from well M10-01.

At IR Site 12, the investigation included installation of four monitoring wells (M12-01 through M12-04). Groundwater samples collected from these wells were analyzed for VOCs, SVOCs, metals, pesticides, total recoverable petroleum hydrocarbons (TRPH), and general chemical characteristics (PRC and JMM 1992). COPCs detected included one VOC, SVOCs, and metals. However, no COPCs other than antimony were reported at concentrations exceeding comparison criteria.

The VOC 1,2-DCE (1.6 µg/L) was reported in groundwater collected from well M12-02. Low concentrations (1.2 to 5.9 µg/L) of polynuclear aromatic hydrocarbons (PAHs) (acenaphthene, fluoranthene, phenanthrene, and pyrene) and the SVOC bis(2-chloroethyl)ether were reported in groundwater from wells M12-02, M12-03, and M12-04. Antimony was reported at a concentration of 26.3 µg/L, which exceeds the MCL (6 µg/L), for a sample from well M12-01.

A1.1.2.2 ADDITIONAL WORK AT IR SITES 4 AND 5, 1992 GROUNDWATER SAMPLING

This follow-on work was based on the results of the sampling conducted around the perimeter of Building 5 during the Phase 2B and 3 investigation conducted in 1991 (PRC and JMM 1992). For this investigation, five areas in or around Building 5 were identified for further investigation and groundwater samples were collected from nine locations associated with four of these areas: the plating shop, the wastewater treatment area, the former hazardous waste storage area, and the battery storage area (PRC and MW 1995).

Plating Shop

This investigation included borings through the plating shop floor in the chromium processing area of Building 5 (Figure A1-1). One discrete groundwater sample was collected from each of five borings (B05PS-01 through B05PS-05) and analyzed for VOCs, metals, hexavalent chromium, and cyanide. COPCs reported included VOCs, metals, hexavalent chromium, and cyanide. A subsequent round of discrete groundwater sampling was conducted in 1993 at five additional borings (B05PS-06 through B05PS-10) and samples were analyzed for VOCs. Figure 3-2 of the SAP shows the locations of these discrete groundwater sampling points.

Groundwater beneath the plating shop contained the VOCs chloroethane; 1,1-DCA; 1,1-DCE; 1,1,1-TCA; and vinyl chloride at concentrations of 5.9 to 790,000 µg/L. These VOCs are common industrial solvents and their degradation products. VOCs reported in the discrete groundwater sampling at concentrations exceeding comparison criteria included 1,1-DCA; 1,1-DCE; 1,1,1-TCA; and vinyl chloride (Table A1-5). These VOCs were also reported in wells previously installed during the Phase 2B and 3 investigation around the perimeter of Building 5 (PRC and JMM 1992).

Metals reported at concentrations exceeding comparison criteria included aluminum, arsenic, barium, beryllium, cadmium, chromium, lead, and nickel (Table A1-10). In addition, hexavalent chromium (1,020 to 7,010 µg/L) and cyanide (342 to 4,550 µg/L) were reported in groundwater collected from beneath the plating shop (Tables A1-10 and A1-11). The presence of solvents, metals, and cyanide in groundwater beneath the plating shop was consistent with past plating activities (PRC and MW 1995).

Wastewater Treatment Plant

This investigation included the installation of two boreholes (B05WT-01 and B05WT-02) adjacent to the sumps used to store wastewater prior to pretreatment (see Figure A1-10). One discrete groundwater sample was collected from each boring and analyzed for VOCs, SVOCs, metals, hexavalent chromium, cyanide, and pH. COPCs reported included VOCs, metals, hexavalent chromium, and cyanide.

Groundwater at the wastewater treatment sump area contained common industrial solvents and their degradation products (chlorobenzene; chloroethane; 1,1-DCA; 1,2-DCE; methylene chloride; and vinyl chloride at concentrations of 12 to 210 µg/L) and fuel constituents (ethylbenzene, toluene, and xylenes at concentrations of 30 to 660 µg/L). Many of these VOCs were also reported in groundwater from nearby well M05-03 in the Phase 2B and 3 investigation. SVOCs (di-n-butylphthalate, 1,4-dichlorobenzene, 2,4-dimethylphenol, 4-methylphenol, and naphthalene at concentrations of 2.1 to 380 µg/L) were reported in groundwater from the wastewater treatment sump area (Table A1-8). In addition, cyanide (24.3 to 39.6 µg/L) and hexavalent chromium (2,830 to 9,350 µg/L) were reported in groundwater collected from this area (Table A1-10). Metals reported at elevated concentrations included chromium, cobalt, lead, nickel, vanadium, and zinc (Table A1-10). These compounds may be related to releases from wastewater treatment area sumps or to other sources (PRC and MW 1995).

Hazardous Waste Storage Area

This investigation included drilling two boreholes (B05HW-02 and M05HW-01) in the former hazardous waste storage area located at the southeast corner of Building 5 (Figure A1-1). A monitoring well (M05HW-01) was constructed in the boring located at the northern side of the area. The groundwater sample collected from the well was analyzed for VOCs, SVOCs, metals, hexavalent chromium, cyanide, and total dissolved solids (TDS).

Groundwater in the former hazardous waste storage area contained common industrial solvents and their degradation products (chlorobenzene, 1,1-DCA; 1,1-DCE; 1,2-DCE; tetrachloroethene [PCE]; TCE; and vinyl chloride at concentrations of 2.1 to 97 µg/L). SVOCs pyrene; bis[2-chloroisopropyl]ether; 1,2-dichlorobenzene; 1,3-dichlorobenzene; and 1,4-dichlorobenzene) were reported at relatively low levels (1.4 to 34 µg/L) (Table A1-8). No cyanide, hexavalent chromium, or other metals at elevated concentrations were reported in groundwater from the former hazardous waste storage area (PRC and MW 1995).

Battery Acid Shop Area

This investigation included two boreholes (B05BS-01 and B05BS-02) drilled outside the battery acid shop area at the northeast corner of Building 5 where the sink discharges to the industrial sewer, and one inside the battery storage area, immediately adjacent to where the piping from the sink enters the floor (Figure A1-9). One borehole was converted to a monitoring well (M05BS-01) and the sample was analyzed for VOCs, SVOCs, metals, hexavalent chromium, cyanide, and TDS.

Groundwater in the vicinity of the battery acid shop area contained common industrial solvents and their degradation products (1,1,-DCA; 1,1-DCE; 1,2-DCE; TCE; and vinyl chloride 1.2 to 98 µg/L) (Table A1-4) and the fuel constituent benzene (1.5 µg/L). The SVOC bis(2-chloroethyl)ether was reported at low levels (4.7 µg/L). No hexavalent chromium or cyanide was reported in groundwater samples from the battery acid shop. Metals were not reported at concentrations exceeding background levels. The solvents and SVOCs identified in groundwater have been reported in numerous wells at IR Site 5 and are probably not related to past practices in the battery storage area (PRC and MW 1995).

A1.1.2.3 FOLLOW-ON INVESTIGATION, CTO-260, 1994 GROUNDWATER SAMPLING

The objective of this investigation was to fill data gaps from previous investigations by collecting additional chemical, geological, and hydrogeologic information, and to use these data to assess the nature and extent of soil and groundwater contamination to prepare an RI and feasibility study (FS) (PRC and MW 1996a). Field activities included performing cone penetrometer testing (CPT); collecting direct-push groundwater samples and HydroPunch samples; installing wells, including SWBZ monitoring wells and a reference boring; and performing four quarters of groundwater monitoring.

The objective of the CPT and direct-push groundwater sampling program was to evaluate the lithology and hydrogeologic characteristics below a depth of 15 feet, to assess the thickness of the SWBZ, and to obtain a groundwater sample from the permeable zone within the SWBZ at each location.

During this follow-on investigation, soil samples were collected from seven CPT locations (CPT-S05-01 through CPT-S05-07) driven near monitoring wells where elevated levels of VOCs and SVOCs had been reported, adjacent to existing sewer lines, and spaced around Building 5. The additional CPT was conducted to further evaluate lithology and hydrogeologic characteristics in the vicinity of IR Site 5. HydroPunch samples (DHP-S05-01, HP-S05-02 through HP-S05-07) were located approximately 5 feet away from each CPT location and advanced to the top of the SWBZ, underlying the Holocene Bay Mud. Five FWBZ monitoring wells (M05-06 through M05-10) were installed at IR Site 5 to further characterize the VOC and metals concentrations in the FWBZ. An additional monitoring well within the IR Site 5 boundaries was installed in conjunction with activities at adjacent IR Site 8 (M08-7). A reference boring at IR Site 5 (REF-S05-01) was located at the northwestern corner of Building 5. The boring was drilled to a depth of 117 feet bgs and terminated after penetrating into approximately 5 feet of the Yerba Buena Mud. Three deep wells (D05-01 through D05-03) were installed at IR Site 5 to assess the lateral extent of VOCs in the SWBZ.

Groundwater samples were obtained from 10 shallow wells (M05-01 through M05-10) and 3 deep groundwater wells (D05-01 through D05-03) around the outside of Building 5. The FWBZ groundwater samples were analyzed for VOCs, SVOCs, metals, cyanide, and TDS. The primary VOCs reported from the wells in the FWBZ at IR Site 5 were chlorinated VOCs 1,1-DCA; 1,1,-DCE; 1,2-DCE; PCE; 1,1,1-TCA; TCE; and vinyl chloride and fuel constituent VOCs benzene, toluene, and xylenes. Of the five wells that were sampled as part of the earlier investigation, three wells showed similar VOC concentrations during this investigation. Well M05-03 showed an increase in VOC concentrations and well M05-01, in which no VOCs were previous reported, had low concentrations of several VOCs. The highest VOC concentrations were reported in newly installed well M05-07 located on the eastern side of Building 5. Table A1-4 provides a summary of VOC data for wells sampling during this investigation. Cyanide was reported in well M05-10 (Table A1-11) located inside Building 5 north of the plating shop, in well M05-03 south of Building 5, and in well M05HW-01 located at the southeastern corner of Building 5 (PRC and MW 1996a).

The primary chemicals reported from the SWBZ groundwater wells consisted of carbon disulfide and chloroform; however, samples from SWBZ well D05-02 had reported concentrations of TCE (42 µg/L) and vinyl chloride (1 µg/L). No cyanide was reported in any of the SWBZ wells (PRC and MW 1996a).

Low levels of VOCs were reported in the HydroPunch samples. The VOCs reported were 1,1-DCA; 1,1-DCE; 1,2-DCE; benzene; carbon disulfide; TCE; and vinyl chloride. Low levels of SVOCs (N-nitrosodiphenylamine) were also reported in the HydroPunch samples (PRC and MW 1996a).

The primary compounds reported in the HydroPunch samples at IR Site 5 were VOCs, SVOCs, TPH, and metals (PRC and MW 1996a). VOCs reported in the HydroPunch samples consisted of 1,1,1-TCA; 1,1-DCA; 1,1-DCE; 1,2-DCE; chloroethane; ethylbenzene; PCE; toluene; TCE; vinyl chloride; and xylenes. SVOCs reported at the site included 2-methylnapthalene, acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, carbazole, chrysene, dibenzofuran, fluorene, fluoranthene, indeno(1,2,3-cd)pyrene, N-nitrosodiphenylamine, pyrene, and phenanthrene. Metals reported in the HydroPunch samples included cadmium, chromium, copper, lead, mercury, and silver. In addition, TPH was also reported at the site (PRC and MW 1996a).

A1.1.2.4 FOLLOW-ON INVESTIGATION, CTO-280, 1994 GROUNDWATER SAMPLING

During the 1994 follow-on investigation under CTO-280, additional field work was conducted at IR Sites 5 and 10 to further assess the nature and extent of chemicals in soil and groundwater reported during winter and spring 1994 (PRC and MW 1996b). The fieldwork included performing CPT borings, collecting HydroPunch samples and shallow soil samples, installing shallow monitoring wells, collecting quarterly groundwater samples, and installing piezometers.

Additional fieldwork conducted at IR Site 5 included four additional CPT sampling locations (CPT-S05-08, CPT-S05-09, CPT-S05-11, and CPT-S05-12). The CPT was used to evaluate lithology and hydrogeologic characteristics below a depth of 15 feet and to identify the SWBZ. HydroPunch groundwater samples were obtained from each of the CPT locations (DHP-S05-08, DHP-05-09, DHP-S05-11, DHP-S05-12) along with two samples from the SWBZ (SHP-S05-11 and SHP-S05-12). Figure 3-2 of the SAP shows the locations of these discrete groundwater sampling points. Three piezometers (PEZ S05-08 through PEZ S05-10) were installed around the plating shop to ascertain groundwater flow direction in the FWBZ. In addition, two shallow groundwater monitoring wells (M05-11 and M05-12) were installed adjacent to the overspray trenches northwest and northeast of the building (Figure A1-2).

The groundwater samples were analyzed for VOCs, SVOCs, metals, cyanide, TPH, general chemistry, and total organic carbon. The analytes reported in the FWBZ wells consisted of TPH as diesel; 1,1-DCA; 1,2-DCE; carbon disulfide; and vinyl chloride. In the SWBZ, the analytes reported were diesel and carbon disulfide (PRC and MW 1996b).

A1.1.2.5 ENVIRONMENTAL BASELINE SURVEY, 1995 GROUNDWATER SAMPLING

Evaluation Area 1, located within IR Site 5, consists of all or portions of EBS Parcels 45A, 46, 47, 48, 49, 50A, 51A, 53A, 54, 55, 56, 57, 58, and 59. As a part of the EBS, these parcels were investigated under the Phase 2A and 2B investigations and a storm sewer investigation. Figure 3-2 of the SAP shows the locations of these discrete groundwater sampling points.

Based on data gaps identified at the site, soil and groundwater were sampled during the EBS. During Phase 2A, no groundwater samples were collected at EBS parcels within Evaluation Area 1; however, during Phase 2B, groundwater samples were collected at EBS Parcels 45A, 57, and 59 (IT 2001a).

EBS Parcel 45A

The details of groundwater sampling at EBS Parcel 45A are discussed under Section A1.2, Evaluation Area 2.

EBS Parcel 57

The Phase 2A report identified VOCs and chromium in subsurface soils at EBS Parcel 57. Phase 2B collected groundwater samples for analysis at three locations (057-006-014, 057-006-015, and 057-006-016). Figure 3-2 of the SAP shows the locations of these discrete groundwater sampling points.

Phase 2B groundwater samples were collected for analysis from within or south of the footprint of Building 348. This metal building with a concrete floor was constructed in approximately 1960 and covered about 5,100 square feet. Historically, Building 348 was used as a corrosion control shop. The parcel evaluation plan (PEP) noted that activities conducted included steam cleaning of aircraft outer surfaces and parts using methylene chloride. Abandoned dip tanks were observed along the east and west sides of the building interior. The EBS Phase 1 site inspection noted that the concrete floor was pitted and eroded over approximately 80 percent of the floor area. The floor of the wash bays in the building were sloped to allow drainage of wastewater from steam cleaning and part stripping to a gutter and industrial wastewater drain. The berm for this area had a hole in it, allowing liquids to flow into and out of the wash bay.

Phase 2B groundwater samples contained several VOCs at concentrations exceeding comparison criteria, including carbon tetrachloride (130 µg/L); 1,1-DCA (80 to 1,300 µg/L); 1,2-DCA (2 to 780 µg/L); 1,1-DCE (19 to 290 µg/L); 1,1,1-TCA (4,700 µg/L); TCE (3 to 10 µg/L), and vinyl chloride (1 to 580 µg/L) (Table A1-5). Additional VOCs were reported at concentrations below comparison criteria, including 1,2-dichloropropane (1 to 2 µ/gL); 2-butanone (39 J µg/L); benzene (0.6 J to 1 J µg/L); chlorobenzene (19 µg/L); chloroethane (2 to 13 µg/L); chloroform (28 to 85 µg/L); chloromethane (4 J µg/L); ethylbenzene (31 µg/L); methylene chloride (2 to 5 µg/L); PCE (2 µg/L); toluene (12 to 69 µg/L); and total xylenes (270 to 790 µg/L). Phase 2B groundwater samples contained metals at concentrations exceeding EBS comparison criteria, including aluminum (147,000 to 213,000 µg/L), arsenic (64.6 to 85.8 µg/L), beryllium (7.7 µg/L), chromium (980 to 1130 µg/L), lead (69.4 to 184 µg/L), manganese (4,610 to 5,610 µg/L), mercury (0.39 and 1.2 µg/L), nickel (645 to 1170 µg/L), and vanadium (653 to 1,330µg/L) (Table A1-10).

EBS Parcel 59

Two groundwater samples (059-SS-003 and 059-SS-004) were collected and analyzed from the storm sewer corridor during the Phase 2B investigations. Figure 3-2 of the SAP shows the locations of these discrete groundwater sampling points. These samples were

analyzed for pesticides and polychlorinated biphenyls (PCBs). No pesticides or PCBs were reported in these groundwater samples (IT 2001a).

A1.1.2.6 STORM SEWER INVESTIGATIONS, 1995–1997 GROUNDWATER SAMPLING

Investigations of storm sewer sediments and storm sewer corridors were proceeding in 1995 at the same time as the Phases 2A and 2B sampling activities. See Section A1.1.2.4 for groundwater samples collected and analyzed from along sewer corridors for EBS Parcel 59 (IT 2001a).

A storm sewer sediment removal action was completed by the Navy between 1995 and 1997 (IT 1997, TtEMI 1997c). No groundwater samples were collected during this removal action.

In 2000, the Navy conducted a storm sewer study. The primary objective of this investigation was to identify storm sewer sections that were damaged, located below the water table (submerged), and subject to infiltration of contaminated groundwater (TtEMI 2000b). No groundwater samples were collected.

Approximately 1,380 feet of line in the vicinity of IR Site 5 was identified as undamaged, nonpriority storm sewer line. These lines were part of systems that discharged to Outfalls F and G. In addition, approximately 1,785 feet of outfall system F in the vicinity of IR Sites 5, 10, and 12 was identified as within indicator chemical plumes but subject to the radiological program and beyond the scope of this Work Plan for supplemental RI sampling at OU-2C. According to a Navy Remedial Project Manager (Richardson, pers. com. 2006), the radiological program will include remediation of the drains and associated piping inside Building 5 leading out to the storm drains.

A1.1.2.7 GEOCHEMICAL PROFILING TO DEFINE CHLORINATED SOLVENT PLUMES, 1997 AND 1998 GROUNDWATER SAMPLING

Past investigations identified the presence of chlorinated solvents in subsurface soil and groundwater at several locations around Building 5. Quarterly groundwater monitoring around the site had identified elevated levels of 1,1,1-TCA; 1,1-DCE; 1,1-DCA; 1,2-DCE; chloroethane; and TCE. The objective of geochemical profiling investigations was to define the vertical and lateral extent of chlorinated solvents under and around Building 5. During 1997, discrete groundwater samples were collected and analyzed from 26 sampling locations (S05-1B-A, S05-1B/2B-A, S05-2A-A, S05-2A-B, S05-2A-C, S05-2B-A, S05-2B-B, S05-2B-C, S05-3A-A, S05-3A-B, S05-3A-C, S05-3A-D, S05-3A-E, S05-3B-A, S05-3B-B, S05-3B-C, S05-3B-D, S05-4A-A, S05-4B-A, S05-4B-B, S05-4B-C, S05-4B-D, S05-5B-A, S05-5B-B, S05-SB-1, and S05-SB-2) along nine transect lines across the eastern one-third of the building and the area east of the building. Groundwater samples were collected and analyzed from various depths down to 20 feet bgs (OGISO Environmental 1997). During late 1997 and early 1998, discrete groundwater samples were collected at 29 locations (S05-2-1 through S05-2-4, S05-3-1 through S05-3-5, S05-4-1 through S05-4-6, S05-5-1 through S05-5-5, S05-6-1 through S05-6-5, and S05-7-1 through S05-7-4) along six transect lines across the central and

eastern portion of Building 5, including sampling east of Building 5 and south of Building 5; and at two locations (S05-1-2 and S05-2-3), located outside of OU-2C, in a transect that crossed Building 12 and EBS Parcel 53 (located east of IR Site 10 and south of IR Site 5). These groundwater samples were collected and analyzed from various depths down to 30 feet bgs (TtEMI and Einarson, Fowler, and Watson 1998). The discrete groundwater samples were analyzed for VOCs. Figure 3-2 of the SAP shows the locations of these discrete groundwater sampling points.

The screening-level data evaluated for the 1997 investigation reported benzene, toluene, ethylbenzene, and xylenes (BTEX) and 12 additional chlorinated VOCs (Table A1-5). Chlorinated VOCs with the highest concentrations were the following:

- 1,1,1-TCA up to 100,000 µg/L, 1,1-DCE up to 65,000 µg/L, and carbon tetrachloride up to 4,600 µg/L (S05-4B-C at 10 feet bgs, east of Building 5, adjacent to the foundry)
- 1,1-DCA up to 29,000 µg/L and 1,2-DCE up to 4,600 µg/L (S05-2A-A at 13.5 feet bgs, east of Building 5, adjacent to the southern portion of the Aircraft Maintenance Line area)
- chloroethane up to 43,000 µg/L (S05-2B-B at 14 feet bgs, east of Building 5 and south of Building 62)
- vinyl chloride up to 5,500 µg/L (S05-2B-A at 15 feet bgs, northwestern portion of Building 5 in Aircraft Maintenance Line area)
- TCE up to 320 µg/L (S05-3B-C at 10 feet bgs, east of Building 5)

The report characterized VOCs in groundwater extending from 4.5 feet to 14 feet bgs and concluded that these solvents appear to be "ponded" on the top of the BSU (approximately 15 feet bgs), with minimal downward migration, as few VOCs were reported in samples collected at 20 feet bgs. A large solvent plume was delimited at the eastern side of Building 5, south of Building 62 and north of Building 500. A possible second plume was identified along the south side of Building 5 and a possible third plume was identified within Building 5 and was thought to be migrating away from the former plating shop location near the center of the building. The report concluded that solvents were dispersed throughout IR Site 5, but confined by the BSU (OGISO Environmental 1997).

The screening-level data evaluated for the 1998 investigation reported BTEX and 16 additional chlorinated VOCs. Chlorinated VOCs with the highest concentrations were the following:

- 1,1-DCA up to 40,000 µg/L and 1,1-DCE up to 2,000 µg/L (S05-4-5 at 11.5 feet bgs, northwest of the former plating shop inside Building 5)
- 1,2-DCE up to 1,100 µg/L (S05-5-3 at 11.5 feet bgs, in the eastern central portion of Building 5)
- chloroethane up to 1,100 µg/L (S05-3-4 at 11.5 feet bgs, south of Building 5)
- vinyl chloride up to 490 µg/L (S05-3-2 at 11.5 feet bgs, south of Building 5)

The report characterized the presence of VOCs in groundwater extending from 4.5 feet to 15.5 feet bgs and also concluded that the assorted solvents appear to be ponded on the top of the BSU (at approximately 15 feet bgs), with minimal downward migration, because few VOCs were reported in samples collected at and below 20 feet bgs (TtEMI and Einarson, Fowler, and Watson 1998).

For samples collected to the southeast of OU-2C (S05-1-2 and S05-1-3), no chlorinated VOCs were reported at concentrations above detection limits (TtEMI and Einarson, Fowler, and Watson 1998). For discrete groundwater samples collected from two EBS sampling locations (053-0035 and 053-0037) in this area southeast of OU-2C, only low levels of two chlorinated VOCs were reported in one sample (chloroform at 11 µg/L and TCE at 3 µg/L). Results for discrete groundwater samples collected southeast of OU-2C indicate that the extent of the VOC plume is confined to OU-2C (Figure A1-3).

A1.1.2.8 QUARTERLY GROUNDWATER MONITORING, CTO-108, 1997–1998

Four quarters of groundwater monitoring were conducted in 1997 through 1998. The groundwater samples were analyzed for VOCs, TPH, SVOCs, metals, cyanide, general chemistry, and total organic carbon. The analytes reported in the FWBZ wells consisted of diesel; 1,1-DCA; 1,2-DCE; carbon disulfide; and vinyl chloride (Table A1-4). In the SWBZ, the analytes reported were BTEX compounds (0.6 to 2 µg/L), chloroform (1 to 10 µg/L), and vinyl chloride (0.5 µg/L).

A1.1.2.9 CHLORINATED SOLVENT TREATABILITY STUDIES, 2000 GROUNDWATER SAMPLING

In 2000, two treatability studies were conducted to address two areas with elevated concentrations of chlorinated VOCs.

The Navy conducted a surfactant-enhanced subsurface remediation treatability study at the northeastern corner of Building 5 (Plume 5-1) (Figure A1-2). The purpose of the study was to demonstrate enhanced removal of VOC concentrations exceeding 10,000 µg/L. A site investigation was conducted to finalize the location of the treatability study cell test area and to determine the pre-test volume of VOCs exceeding 10,000 µg/L using soil coring and the Pre-Partitioning Interwell Tracer Test. Soil core samples were collected throughout the study area and a VOC volume was estimated using the measured core properties as the basis of the calculation. Following the site investigation, the Navy conducted surfactant-enhanced subsurface remediation for VOC removal. After the surfactant injection, a site investigation was conducted to determine the post-test VOC volume using post-test soil coring and the Post-Partitioning Interwell Tracer Test. The post-test soil cores were drilled within 2 feet of the selected pre-study soil sampling locations at depth intervals identical to the pre-coring locations. The Post-Partitioning Interwell Tracer Test was conducted using the same protocol as the Pre-Partitioning Interwell Tracer Test to determine the post-test VOC mass. The soil coring and Post-Partitioning Interwell Tracer Test results showed excellent mass reduction (over 97 percent). The results exceeded the project goal of 95 percent VOC removal (Surbec-Art Environmental 2000).

A steam-enhanced extraction remediation treatability study was conducted at the eastern margin of Building 5 (Plume 5-4). Steam was injected via wells. Injections and extractions occurred cyclically (Berkeley Environmental Restoration Center 2000).

A1.1.2.10 SUPPLEMENTAL REMEDIAL INVESTIGATION DATA GAP SAMPLING, 2001 GROUNDWATER SAMPLING

This investigation included direct-push groundwater sampling and analysis to address dissolved-phase chlorinated VOCs in groundwater, the potential for DNAPL in the saturated zone, VOCs in soil gas overlying groundwater, and hexavalent chromium and cyanide in groundwater in the vicinity of the former plating shop in Building 5. A round of groundwater sampling from existing wells was also conducted during this investigation.

Dissolved-Phase VOC Sampling

The overall objectives of data gap sampling at IR Site 5 were to investigate chlorinated VOCs in groundwater at Building 5. To verify the vertical extent of VOC contamination in the FWBZ, groundwater samples were collected by a direct-push method from the top of the FWBZ and at the base of the fill soil at 31 locations (S05-DGS-DP01, S05-DGS-DP06 through S05-DGS-DP08, S05-DGS-DP10 through S05-DGS-DP12, S05-DGS-14 through S05-DGS-16, S05-DGS-DP21 through S05-DGS-DP25, and S05-DGS-DP34 through S05-DGS-DP49). On the basis of initial analytical results, step-out sampling was conducted at shallow groundwater sampling locations to characterize the extent of the chlorinated VOC plume. The interval targeted for sampling was the top of the FWBZ. Figure 3-2 of the SAP shows the locations of these discrete groundwater sampling points.

The delineation of VOC plumes addressed the chlorinated VOCs underlying Building 5, east of Building 5, and extending south of Building 5 to beneath Building 400 in IR Site 10. The lateral extent of the VOC plumes was defined to MCLs, except for the northwestern corner of IR Site 5. VOCs reported at concentrations exceeding MCLs in the northwestern area at depths of 0 to 20 feet bgs included benzene, cis-1,2-DCE, and vinyl chloride. VOCs reported at concentrations exceeding MCLs in the northwestern area at depths of 15 to 20 feet bgs included benzene, cis-1,2-DCE, and vinyl chloride (Table A1-5). Vertical extent was characterized with below-detection-limit VOC concentrations reported in samples collected below 20 feet bgs. At 16 feet bgs, only benzene (up to 5.8 µg/L) and vinyl chloride (up to 2 µg/L) were reported at concentrations that exceeded MCLs.

TPH plumes were characterized as commingled with chlorinated VOCs; therefore, TPH contamination would be managed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program. Step-out sampling was recommended to define lateral extent of TPH plume west of M05-03 and east of CA05-05, located between IR Sites 5 and 10 (TtEMI 2002b). Table A1-6 provides a summary of TPH data from monitoring wells.

Dense Nonaqueous-Phase Liquid Sampling

An investigation was conducted to detect and define the limits of VOC contamination at concentrations exceeding 10,000 µg/L at IR Site 5. Ribbon nonaqueous-phase

liquid samplers (RNSs) were installed at potential source locations (S05-DGS-DP01, S05-DGS-DP05 through S05-DGS-DP16) where VOC concentrations exceeding 10,000 µg/L were suspected but no monitoring wells were located. Figure 3-2 of the SAP shows the locations of these discrete groundwater sampling points. In addition, groundwater samples were collected and analyzed from each soil boring after removal of RNSs.

In locations where VOC concentrations exceeding 10,000 µg/L were suspected and monitoring wells (M05-04 and M05-07) were already in place, multi-level, passive diffusion bag samplers were used to collect depth-discrete samples from the screened interval of the wells. An evaluation of RNS and passive diffusion bag sample data and phase separation shake tests did not indicate the presence of DNAPL at IR Site 5. However, the results of confirmation groundwater samples collected from RNS borings indicated VOC concentrations exceeding 10,000 µg/L (Table A1-5).

Soil Gas Sampling

Soil gas samples were collected from groundwater contaminant plume areas at depths below the ground surface and above the groundwater table. Soil gas samples were collected using a direct-push, soil vapor probe and a slow-purge, vacuum-monitored induction system. Soil gas samples were collected from eight locations (S05-DGS-SG03, S05-DGS-SG06, S05-DGS-SG09, S05-DGS-SG12, S05-DGS-SG15, S05-DGS-SG18, and S05-DGS-SG21) and analyzed for chlorinated VOC, BTEX, and TRPH to support vapor intrusion modeling in the baseline human-health risk assessment (HHRA) for IR Site 5. Measurable concentrations of VOCs were reported in soil gas above the contaminant plume in groundwater (TtEMI 2002b).

Hexavalent Chromium and Cyanide Sampling

Objectives for the investigation in groundwater of inorganic chemical contamination related to the plating shop at Building 5 included determining whether hexavalent chromium and cyanide were present and documenting cadmium and chromium concentrations. Groundwater samples were collected at IR Site 5 using a direct-push drill rig. Groundwater samples were collected from five locations within the former plating shop (S05-DGS-DP14, S05-DGS-DP17 through S05-DGS-DP20), two locations south of Building 5 adjacent to the plating wastewater holding tanks (S05-DGS-DP26 and S05-DGS-DP27), and five locations around the periphery of the former plating shop (S05-DGS-DP61 through S05-DGS-DP66) (see Figure 3-2 of the SAP). Samples were submitted to a fixed laboratory for analysis of cadmium, total chromium, hexavalent chromium, and cyanide, and measurement of pH. A metals soil removal action was conducted during data gap sampling.

In groundwater samples collected from within the boundaries of the former plating shop prior to the soil removal action, cadmium concentrations were 7.8 to 189 µg/L, total chromium concentrations were 12.6 to 138 µg/L, hexavalent chromium concentrations were below the detection limit (10 µg/L), and cyanide concentrations ranged from below the detection limit to 480 µg/L (Tables A1-10 and A1-11). However, for groundwater

samples collected outside the plating shop area, cadmium concentrations were below the detection limit and total chromium concentrations ranged from below the detection limit to 17 µg/L. Cyanide concentrations for samples within the plating shop boundaries ranged from below the detection limit to 480 µg/L and from below the detection limit to 1,090 µg/L for samples outside the plating shop (TtEMI 2002b) (Table A1-11). Figure 3-2 of the SAP shows the locations of these discrete groundwater sampling points.

Monitoring Well Sampling

A round of water level measurements and groundwater sampling and analysis was conducted for all existing wells at IR Sites 5, 10, and 12 to determine current conditions (M05-01 through M05, M05BS-01, M05HW-01, D10A-01, M10-01 through M10-03, and M12-01 through M12-04). The groundwater samples were analyzed for VOCs and TPH using a mobile laboratory. Tables A1-4 and A1-6 provide summaries of VOC and TPH data, respectively, from monitoring wells.

A1.1.2.11 CHLORINATED SOLVENT PLUME DEFINITION AND DENSE NONAQUEOUS-PHASE LIQUID TREATABILITY STUDIES, 2001–2003 GROUNDWATER SAMPLING

From September 2001 through January 2002, an investigation was conducted to determine the vertical and lateral extent of potential plumes with VOC concentrations exceeding 10,000 µg/L prior to preparation of final project plans to conduct a VOC source removal action at IR Site 5. Four plumes (5-1, 5-2, 5-3, and 5-4) were identified in the engineering evaluation and cost analysis (TtEMI 2001b). Samples were analyzed specifically for ten VOCs: 1,1-DCA; 1,2-DCA; 1,1-DCE; cis-1,2-DCE; trans-1,2-DCE; 1,1,1-TCA; 1,1-2-TCA; PCE; TCE; and vinyl chloride. VOC concentrations were summed for each sample and compared to a screening criterion of 10,000 µg/L as an indication of the possible presence of DNAPL.

For Plume 5-1 (east of Building 5 and south of Building 62), 33 borings (5-1-ADD2 through 5-1-ADD10, 5-1-ADD12 through 5-1-ADD17, 5-1-ADD19 through 5-1-ADD21, 5-1-ADD23, 5-1-ADD24, and 5-1-ADD26 through 5-1-ADD38) were installed and groundwater samples were collected at 5-foot intervals to depths of up to 60 feet bgs. Figure 3-2 of the SAP shows the locations of these discrete groundwater sampling points. Screening analyte concentrations (i.e., the combined sum of concentrations for the ten VOCs) exceeding 10,000 µg/L were encountered at 12 locations and at depths up to 60 feet bgs (IT 2002b). A DNAPL removal action using SPH was planned, and in 2004 the removal action was implemented and completed.

Prior to implementation of the SPH removal action, the discovery of mobile DNAPL within the Plume 5-1 triggered the implementation of a physical DNAPL removal. A series of temporary wells (MRW1 through MRW4) were installed in a triangular grid and DNAPL was removed periodically from those wells.

For Plume 5-2 (east of Building 5), six borings (5-2-ADD2, 5-2-ADD5, 5-2-ADD6, 5-2-ADD8, 5-2-ADD10, and 5-2-ADD13) were installed and groundwater samples were collected and analyzed at 5-foot intervals to depths of up to 25 feet bgs. Screening

analyte concentrations (i.e., the combined sum of concentrations for the ten VOCs) did not exceed 10,000 µg/L. No further action for DNAPL removal was recommended (IT 2002d).

For Plume 5-3 (within the central portion of Building 5), 84 borings (5-3-ADD1 through 5-3-ADD9, 5-3-ADD11 through 5-3-ADD24, 5-3-ADD26 through 5-3-ADD51, 5-3-ADD53, 5-3-ADD55 through 5-3-ADD59, 5-3-ADD63, 5-3-ADD71 through 5-3-ADD72, 5-3-ADD74 through 5-3-ADD76, 5-3-ADD80 through 5-3-ADD83, 5-3-ADD85 through 5-3-ADD87, 5-3-ADD89, 5-3-ADD91, 5-3-ADD93 through 5-3-ADD95, 5-3-ADD98, 5-3-ADD101 through 5-3-ADD103, 5-3-ADD107 through 5-3-ADD107, and 5-3-ADD109 through 5-3-ADD110) were installed and groundwater samples were collected and analyzed at 5-foot intervals to depths of up to 35 feet bgs. Screening analyte concentrations (i.e., the combined sum of concentrations for the ten VOCs) exceeding 10,000 µg/L were encountered at approximately 40 locations and at depths up to 35 feet bgs (IT 2002e). A DNAPL removal action using SPH was implemented in 2006.

For Plume 5-4 (east of Building 5), 14 borings (5-4-ADD1 through 5-4-ADD9, 5-4-ADD10 through 5-4-ADD12, and 5-4-ADD20 through 5-4-ADD21) were installed and groundwater samples were collected and analyzed at 5-foot intervals to depths of up to 25 feet bgs. Screening analyte concentrations (i.e., the combined sum of concentrations for the 10 VOCs) did not exceed 10,000 µg/L. No further action for DNAPL removal was recommended (IT 2002f).

Individual VOC concentrations exceeding MCLs are listed in Table A1-5.

A1.1.2.12 IR SITE 5 DNAPL SOURCE REMOVAL ACTIONS, 2004–2006

A full-scale mass removal action using SPH with vapor extraction was completed for DNAPL source removal at Plume 5-1 between July 8, 2004, and November 5, 2004 and set up was begun for the Plume 5-3 removal action in April 2006 (Shaw 2006). The objective of the removal actions was to remove sufficient contaminant mass to permanently reduce the total concentrations of chemicals of concern (COCs) to below 10,000 parts per billion (ppb) within the horizontal extent of Plume 5-1, to a maximum depth of 20 feet bgs. The removal action was conducted in accordance with the final Removal Action Project Plans (RAPP) for IR Sites 4 and 5 DNAPL and Dissolved Source Removal Action (IT 2002a), the Amendment to the RAPP for installation of well points for DNAPL extraction (IT 2002b), and the RAPP Addendum (Shaw 2003b).

The application of SPH was successful in treating the targeted Plume 5-1, an area of approximately one-third acre. The COCs (predominantly 1,1,1-TCA and TCE, and the degradation products from these compounds) were mobilized into the vadose zone as a vapor by heating the soil and groundwater via SPH, and then removed by vapor extraction. More than 3,000 pounds of VOCs were recovered over the 15-week SPH treatment. Groundwater concentrations in the treatment zone above 20 feet bgs were reduced from an average initial total COCs concentration (sum of concentrations of ten chlorinated VOCs: 1,1-DCA; 1,2-DCA; 1,1-DCE; cis-1,2-DCE; trans-1,2-DCE; PCE;

1,1,1-TCA; 1,1,2-TCA; TCE; and vinyl chloride) of approximately 49,000 µg/L to less than 120 µg/L.

Prior to the full-scale SPH application, the total COC concentrations in seven treatment zone monitoring wells (1MW6S, 1MW7S, P-5-1-MWS1, P-5-1-MWS2, p-5-1-MWS3, P-5-1-MWS4, and P-5-1-MWS5) ranged from an average of 300 µg/L to 240,000 µg/L. The highest concentrations were for 1,1,1-TCA (205,000 µg/L in well P-5-1-MWS3). Four months after completion of the SPH operation, the highest COC concentration in treatment zone monitoring wells was 1,414 µg/L in well 1MW6S, while concentrations in all other wells were either below the detection limit of 1 µg/L or less than 20 µg/L. Results for all monitoring wells sampled during the SPH application showed total COC concentration reductions to values well below the removal action goal of 10,000 ppb and therefore meeting the removal action objective (Shaw 2006).

A1.1.2.13 BASEWIDE GROUNDWATER MONITORING PROGRAM, 2002–2005 GROUNDWATER SAMPLING

Within Evaluation Area 1, seven FWBZ monitoring wells and seven SWBZ monitoring wells are currently being sampled under the BGMP to monitor VOC concentrations:

- one FWBZ well in the plume – 2MW8S
- six FWBZ wells at the periphery of the plume – M05-01, M05-02, M05-05, M05-06, M05-08, and M05-09
- seven SWBZ wells at the periphery of the plume – wells D05-01 and D05-03 through D05-08

Groundwater samples from wells included in the BGMP area were analyzed for VOCs, TPH, metals, anions, sulfide, alkalinity, and dissolved gases.

Twenty-two monitoring wells within the boundaries of Evaluation Area 1 have been sampled quarterly or semiannually (FWBZ wells 2MW8S, M05-01 through M05-12, M05BS-01, M05HW-01, and M10-01; and SWBZ wells D05-01 through D05-07). An additional nine wells in IR Sites 5, 10, and 12 outside of Evaluation Area 1 have been sampled quarterly or semiannually (FWBZ wells M10-02, M10-03, M117-E, M12-01 through M12-04, M08-7; and SWBZ wells D10A-01 and D12-01) (Shaw 2003a, 2004b, 2004c; PRC 1996; TtEMI 1997b, 1998). Additional wells that have been sampled on a less routine basis or as part of VOC removal activities include 1MW6S, 1MW7S, MLS-1, MLS-7, P-5-1-MWD1 through P-5-1-MWD5, P-5-1-MWI1 through P-5-1-MWI5, P-5-1-MWS1 through P-5-1-MWS5, and MRW1 through MRW4.

Tables A1-4, A1-6, and A1-9 summarize all monitoring well samples collected between 1991 and 2004 on an area-by-area basis for VOCs, TPH, and metals, respectively. Maximum concentrations for each year are presented for the ten VOCs that were reported at concentrations exceeding MCLs in more than one sample (Table A1-4); for all reported TPH (Table A1-6); and for metals exceeding MCLs (Table A1-9).

A1.1.2.14 TOTAL PETROLEUM HYDROCARBON INVESTIGATIONS, 1994–2000 GROUNDWATER SAMPLING

This subsection summarizes the results of groundwater sampling and analysis conducted as part of TPH investigations for USTs within the boundaries of Evaluation Area 1.

UST 5-1 was a 250-gallon tank used to store waste oil, and was located west of Building 5 near Building 347 (TtEMI 2003, PWC 1996a). The tank was installed in 1940 and removed on October 25, 1994; TPH-contaminated soil was excavated. One monitoring well (MW05-02) was installed near the tank, and groundwater contained VOCs and TPH at concentrations up to 230 µg/L.

UST 5-2 was a 4,000-gallon steel tank used to store jet fuel, and was located east of Building 5 (TtEMI 1997a, 2003). The tank was removed on June 24, 1997. Soil samples and a groundwater sample were collected following the UST removal (TtEMI 1997a). The groundwater sample (NAS05-01-S-07-W) contained benzene at a concentration of 7 µg/L and TPH as diesel at 864,000 µg/L (Tables A1-5 and A1-7). As part of the TPH Data Gap Investigation in 2000, two groundwater samples were collected near the former location of this UST (CA05-01 and CA05-02). Samples were analyzed for VOCs and TPH. Chlorinated VOCs and TPH were reported at concentrations exceeding comparison criteria (Tables A1-5 and A1-7, respectively).

Two monitoring wells (FWBZ well M05-07 and SWBZ well D05-02) near the former location of UST 5-2 were sampled for TPH in 2001. Groundwater samples collected from M05-07 contained TPH as diesel and TPH as gasoline, and samples from D05-02 contained TPH as motor oil (Table A1-6). The closure report indicated that a jet fuel release to the soil and groundwater had occurred, and corrective action is ongoing (TtEMI 2003). The former location of UST 5-2, along with UST 5-3, is designated as AOC 005 and is located within the Alameda Point TPH Program's Corrective Action Area (CAA)-5A.

UST 5-3 was a 320-gallon steel tank used to store waste oil and solvents, and was located east of Building 5 (TtEMI 1999c, 2003). The tank was removed on December 8, 1998. Contaminated soil was removed. The product line was reported to have a 3-inch hole (TtEMI 1999a). Soil samples collected after the UST removal (locations 030-MOD1-283, 284, and 285) contained chlorinated VOCs and TPH (Tables A1-12 and A1-13). No groundwater samples were collected at the time of UST removal. As part of the TPH Data Gap Investigation in 2000, one groundwater sample (CA05-03) was collected near the former location of this UST. Samples were analyzed for VOCs and TPH. Chlorinated VOCs and TPH as motor oil were reported at concentrations exceeding comparison criteria (Tables A1-5 and A1-7). A groundwater sample collected from nearby well M05-04 in 2001 was analyzed for TPH and contained TPH as gasoline at a concentration of 220 µg/L. As described above, the former location of UST 5-3 is part of AOC 005 and is located within CAA-5A.

UST 62-1 was a 2,000-gallon fiberglass tank used to store diesel, and was located east of Building 5 near Building 62 (TtEMI 1999e, 2003). The tank was removed on November 20, 1998. Contaminated soil was removed.

USTs 261-1 and 261-2 were both 800-gallon steel tanks used to store kerosene, and were located south of Building 5 near Building 261 (TtEMI 2003, PWC 1996c). Both tanks were installed in 1943 and removed on December 8, 1994. Soil was not removed and samples were not collected because tanks were housed in a concrete vault. The vault was filled with concrete during the demolition of Building 261 (PWC 1996b).

UST 261-3 was a 1,500-gallon steel tank used to store the solvent PD-680 (solvent naphtha), and was located south of Building 5 near Building 261 (TtEMI 2003, PWC 1996c). The tank was installed in 1943 and removed on December 8, 1994. One groundwater sample was collected from the excavation (261-3L) and analyzed for BTEX and TPH. Analytes reported at concentrations exceeding detection limits included TPH as diesel, gasoline, and jet fuel. Concentrations (2,500 to 15,000 µg/L) exceeded comparison criteria (Table A1-7). Additionally, in 1999, groundwater samples were collected from three geoprobe sampling locations (057-001, 057-002, and 057-008) and analyzed for VOCs and TPH. COPCs reported included the VOCs 1,1-DCA; 1,1-DCE; ethylbenzene; TCE; vinyl chloride; and xylenes; and TPH as diesel, gasoline, and jet fuel (TtEMI 2003). Analytical results exceeding comparison criteria are listed in Tables A1-5 and A1-7. As part of the TPH Data Gap Investigation in 2000, one groundwater sample (CA05-04) was collected near the former location of this UST. Samples were analyzed for VOCs and TPH. Fuel constituent 1,2,4-trimethylbenzene and TPH as gasoline were reported at concentrations exceeding comparison criteria (Tables A1-5 and A1-7).

UST 400-1 was a 250-gallon steel tank used to store diesel fuel near Building 400 (TtEMI 2003; PWC 1997b). The tank was installed in the mid-1940s and was removed on January 26, 1995, in good condition; TPH-contaminated soil was excavated. Soil samples collected after the UST removal contained TPH concentrations up to 14,000 milligrams per kilogram (mg/kg). The former location of UST 400-1 has been designated UST(R)-12 and is being addressed under CAA-5C. Discrete groundwater samples collected in 1997 (400-1-MOJ, 400-2-MOJ, 400-3-MOJ, 400-16-MOJ, and 400-17-MOJ) contained TPH concentrations up to 48,000 µg/L (Table A1-7). Three monitoring wells (400MJ-MW1, 400MJ-MW2, 400MJ-MW3) were installed in 1997, and sampled in 1997, 1998, and 1998 (TtEMI 2003). Groundwater samples from these wells contained TPH concentrations up to 1,600 µg/L (Table A1-6). A discrete groundwater sample (400-001) was collected as part of the UST methyl tert-butyl ether (MTBE) investigation in 1999 and contained several chlorinated VOCs and MTBE. Only 1,1-DCA was reported at a concentration exceeding the screening criterion (Table A1-7). As part of the TPH Data Gap Investigation in 2000, one groundwater sample (CA05-05) was collected near the former location of this UST. Samples were analyzed for VOC, TPH, and SVOCs. Chlorinated VOC 1,1-DCA at a concentration below comparison criteria, and TPH as diesel and as motor oil were reported at concentrations exceeding comparison criteria (Table A1-7). Corrective action is ongoing under the TPH Program (TtEMI 2003).

UST 614-1, located near Building 614 on the west side of Building 5, was a steel tank with a capacity of 20,000 gallons. This tank was designed for use as an emergency

overflow tank in the event that chemical offloading in Building 614 resulted in a spill. No spill occurred in Building 614, and the UST did not contain hazardous materials.

Four USTs (615-1 through 615-4) were associated with Building 615, located south of Building 5. USTs 615-1 and 615-2 were steel tanks with capacities of 10,000 gallons and 5,000 gallons, respectively. These tanks were designed for use as emergency overflow tanks in the event that chemical offloading in Building 615 resulted in a spill. No spills occurred and the USTs did not contain hazardous materials. These tanks remain in place and are exempt from regulatory closure (TtEMI 2003).

UST 615-3 was a 50-gallon steel tank used to store oil and water, and is also known as OWS 615 (TtEMI 2003, PWC 1997a). The tank was removed on December 20, 1994. A discrete groundwater sample (615-001) was collected and analyzed as part of the UST MTBE investigation in 1999 and contained several chlorinated VOCs and MTBE. Only one VOC (4-methyl-2-pentanone) was reported at a concentration of 1,300 µg/L. Corrective action will be determined under the RCRA program (TtEMI 2003).

UST 615-4 was an 80-gallon capacity steel tank used to store waste oil, and located near Building 615 (TtEMI 1999d, 2003). The tank was removed on December 9, 1998. No groundwater sampling was conducted.

A1.1.3 Proposed Sampling Rationale and Design

The sampling plan for Evaluation Area 1 addresses data gaps associated with the nature of contaminants in groundwater, contaminant levels within source areas, and the potential discharge of contaminants in groundwater at OU-2C to surface water. The following discussion presents the problem statement and optimized sampling design proposed for Evaluation Area 1 (DQO Steps 1 and 7). Sitewide DQOs that apply to Evaluation Area 1 are presented in Table 1-6 of the SAP. Proposed sampling locations are shown on Figure A1-2.

Chlorinated VOCs in groundwater at OU-2C were initially identified in 1991 when five shallow monitoring wells were installed around Building 5. One or more VOCs were reported in FWBZ wells located at the southeastern side of Building 5 (M05-04 located east of the foundry and heat treatment area), south of Building 5 (M05-03 near the plating shop wastewater pre-treatment area), at the northeastern corner of Building 5 (M05-05), and at the western side of Building 5 (M05-02). No chlorinated VOCs were reported in groundwater from well M05-01 at the northwestern corner of Building 5. Groundwater flow direction in the FWBZ has been characterized as toward the north and west across Building 5, which places wells M05-01, M05-02, and M05-05 at downgradient locations from potential source areas within and east of Building 5. In 1991, cyanide was also reported in well M05-03 at a concentration below the MCL.

Subsequent investigations in 1992 and the installation and sampling of additional FWBZ wells in 1994 and 1995 identified potential VOC source areas at the location of the former plating shop within Building 5 (well M05-10) and east of Building 5 at the location of a possible former solvent tank (well M05-07), and south of Building 5 (wells M05-03 and M05HW-01). In 1992, cyanide and hexavalent chromium were also

identified at concentrations exceeding MCLs in discrete groundwater samples collected from the plating shop area.

Chlorinated solvents and their breakdown products (1,1-DCA; 1,2-DCA; 1,1-DCE; 1,2-DCE; PCE; 1,1,1-TCA; TCE; and vinyl chloride) were reported in groundwater across OU-2C. Benzene has also been reported in groundwater and is likely related to leaking USTs formerly present at OU-2C that were used to store petroleum products. VOCs present at concentrations exceeding 10,000 µg/L were reported in three areas:

- Plume 5-1: source may be a possible former solvent tank at the east margin of Building 5
- Plume 5-3: source is likely the former degreasing operations in the former plating shop area
- Plumes 5-2 and 5-4: source may be the former foundry and heat treatment area at the southeastern margin of Building 5

DNAPL source removal actions for Plume 5-1 (completed in 2004) and Plume 5-3 (initiated in 2006) have greatly reduced or will reduce the levels of VOCs in groundwater in these two plume areas (see Section A1.1.2.12). For this reason, further groundwater sampling for VOCs in groundwater within the two areas encompassed by the 10,000 µg/L VOC concentration contours (Figure A1-2) is not proposed as part of the Supplemental RI field activities.

The area south of Building 5 may also be a source area; this area was formerly occupied by plating shop wastewater pretreatment units (near well M05-03), an industrial wastewater treatment facility (IWTP 5), a former hazardous waste storage area (near well M05HW-01), and various activities that may have used VOCs.

During meetings held on May 16 and June 15, 2006, the Navy and the regulatory agencies discussed data gaps as identified by the regulatory agencies during their review of the draft RI Report (SulTech 2005a). During these discussions, the Navy and BEI provided a response to the agencies' request for additional sampling within OU-2C. Agency concurrence with the Navy's proposed approach to address each data gap (by sampling or by demonstrating that adequate data were already available) was received during the June 15, 2006, discussion. For Evaluation Area 1, no additional groundwater sampling to delineate the extent of VOCs or metals is proposed except as described below. Delineation of VOCs at concentrations exceeding 10,000 µg/L (as an indication of the presence of DNAPL) is complete, DNAPL removal actions are under way or completed (see Sections A1.1.2.11 and A1.1.2.12), and no additional characterization of DNAPL in groundwater is proposed. Any data gaps associated with Water Board criteria for fuel site closure will be addressed by review of TPH data against ESLs.

The nature of groundwater contamination by chlorinated VOCs has been characterized (i.e., chlorinated solvents and their breakdown products); however, data gap issues remain concerning other chemicals, including any presence of 1,4-dioxane; the extent of hexavalent chromium and cyanide at concentrations exceeding MCLs; and radium-226 and radium-228 in the shallower portion of the FWBZ beneath Building 5. The

horizontal extent of the chlorinated VOC plume in the shallower FWBZ (Figure A1-3) and deeper FWBZ (Figure A1-4) and the vertical extent of chlorinated VOCs to depths of 40 feet bgs have been characterized, except for data gaps related to the following:

- the limits of VOCs at concentrations exceeding MCLs at the western margin of the plume
- the direction of groundwater flow at the western, downgradient margin of OU-2C
- the direction of plume migration off-site, if any, at the western, downgradient margin of OU-2C
- concentrations of VOCs immediately downgradient of the source area for Plume 5-1 beneath the interior of Building 5
- concentrations of VOCs in groundwater in the shallower FWBZ at the upgradient margin of the VOC plume (southeast of Building 5)
- concentrations of VOCs in groundwater in the shallower FWBZ in the vicinity of former Building 348, located south of Building 5
- concentrations of VOCs in the deeper FWBZ near the northeastern corner of Building 5

SWBZ wells installed in 1994 were located near the northwestern corner of Building 5 (well D05-01), east of Building 5 in the Plume 5-1 area (well D05-02), and west of Building 5 (well D05-03). In 1994, only groundwater from well D05-02 contained VOCs (1,2-DCE; TCE; and vinyl chloride); and following initial sampling, VOCs were reported below detection limits with the exception of occasional reports of benzene and vinyl chloride at concentrations below MCLs. Well D05-02 was abandoned as part of the SPH DNAPL removal activity for Plume 5-1 and replaced with wells D05-05 and D05-06 in 2004. SWBZ wells were also installed in 2004 west and east of the Plume 5-1 area (wells D05-04 and D05-07, respectively) and east of the Plume 5-2/5-4 area (well D05-08). No VOCs have been reported in any of the newly installed SWBZ wells. However, in 2001 and 2002, vinyl chloride was reported in SWBZ well D05-03 at the western margin of OU-2C at concentrations exceeding the MCL (0.5 µg/L).

Metals reported in groundwater at OU-2C at concentrations exceeding MCL comparison criteria included aluminum, antimony, arsenic, barium, cadmium, chromium, lead, mercury, nickel, and thallium. Arsenic is naturally occurring and its presence is attributed to background conditions at OU-2C. Arsenic tends to mobilize under reducing groundwater conditions, which are present at OU-2C. In addition, most of the metals were reported fewer than ten times at concentrations exceeding MCL comparison criteria, and they were not considered risk drivers in OU-2C groundwater. The OU-2C RI report will address all metals reported in groundwater (including arsenic) and will identify which metals may represent a release. The OU-2C RI report will include a statistical comparison of metals concentrations in groundwater from OU-2C to the Alameda Point background data set. The RI report will also address all metals concentrations for individual samples that exceed the Alameda Point background 95th percentile to assess

whether there has been a release regardless of whether the OU-2C data set for a given metal is comparable to background.

Although the extent of chlorinated VOCs in the FWBZ has been characterized in Evaluation Area 1, the westernmost and presumably furthest downgradient wells (M05-02 and M05-06) have been reported with several VOCs at concentrations that occasionally exceed MCLs. These wells monitor the shallower FWBZ (screened at 10 to 15 feet bgs). No groundwater samples have been collected from the deeper FWBZ in this area. Additionally, SWBZ well D05-03 at the downgradient margin of the Evaluation Area 1 has also had reported concentrations of vinyl chloride. Available water level data suggest that groundwater flow is to the west toward a groundwater sink or trough at or near well M05-06. This sink or trough may represent a preferential groundwater flow pathway and may represent a direct connection with the bay (water level elevations at well M05-06 are comparable to mean sea level). However, a data gap exists as to whether groundwater flows toward the north (to Oakland Inner Harbor) or south (to Seaplane Lagoon) and whether it is in hydraulic connection with the bay. To determine the possible discharge point of groundwater from Evaluation Area 1, this plan proposes additional aquifer testing activities. To address the possible presence of VOCs in the deeper FWBZ and the SWBZ and confirm the extent of VOCs in groundwater at the western margin of the plume, this plan proposes the installation of at least one additional SWBZ well and several additional shallower and deeper FWBZ wells.

Data gaps also exist for the VOC concentrations in the upgradient margin of the VOC plume and in the vicinity of former Building 348. To address these data gaps, this plan proposes the installation of two monitoring wells in the shallower FWBZ (screened at 10 to 15 feet bgs). One well (M05-19) will be installed southeast of Building 5 to monitor groundwater quality at the upgradient margin of the OU-2C VOC plume. Another well (M05-20) will be installed to monitor groundwater quality at the former location of Building 348, an area with historical presence of VOCs located south of Building 5. Operations at former Building 348 may have been the source of VOCs previously reported in groundwater.

Although the nature of chlorinated VOCs in Evaluation Area 1 has been characterized, the presence of VOC concentrations exceeding 10,000 μg/L suggests that 1,4-dioxane may be present in groundwater at OU-2C. The compound 1,4-dioxane is a common additive to chlorinated solvents used in degreasing activities like those conducted at the former plating shop in Building 5. Additionally, the extent of cyanide and hexavalent chromium has not been adequately characterized. To address these issues, this plan proposes to sample existing monitoring wells, to install and sample new monitoring wells, to sample discrete groundwater, and to analyze for VOCs, 1,4-dioxane, cyanide, and hexavalent chromium as well as for a full analyte list for new wells, as described in DQO Table 1-6 of the SAP. In addition, to address the possible release of radium associated with previous operations in Building 5 to groundwater in the shallower portion of the FWBZ, discrete groundwater samples will be collected from five selected locations (SND57SB01, SM09SB01, NADEP GAP 70, EA3SB12, and EA3SB29) beneath this building (Table 1-4 of the SAP). Data collected during these investigation activities will

be used in conjunction with existing data to complete characterization of the nature and extent of COPCs for this area, to conduct a risk assessment, and to support an FS.

Between 1940 and 1972, wastewaters from all Navy operations at Alameda Point were discharged directly into the nearest surface waters through the storm sewer system. From the beginning of that time period through the early 1960s, radioluminescent painting operations on the second floor of Building 5 discharged paint containing radium-226 into the storm sewer system leading from the building into the Seaplane Lagoon at Outfall F. To address the possible release of radium associated with previous operations in Building 5 to groundwater in the shallower portion of the FWBZ, this plan proposes to collect discrete groundwater samples from selected locations for radium-226 and radium-228 analyses.

A1.1.3.1 AQUIFER TESTING

Coordinated monitoring of tidal influence in both FWBZ and SWBZ wells is needed to address the potential discharge of VOCs in groundwater to surface water. Proposed activities include the following:

- Conduct a tidal influence study using existing OU-2C-specific wells and newly installed piezometers.
- Measure water levels at low tide and prepare potentiometric map. See Work Plan Figure 2-7 for the potentiometric map prepared under the BGMP using data collected in spring 2006 (ITSI 2006).
- Install piezometer pairs at up to eight locations (a total of 16 piezometers) between OU-2C and Seaplane Lagoon and along the western border of OU-2C. The piezometers will be installed to monitor water levels in the shallower FWBZ (10 to 15 feet bgs) and in the deeper FWBZ (25 to 30 feet bgs).

Aquifer testing may be conducted to characterize tidal influence, groundwater flow direction in the FWBZ at the western margin of OU-2C, and possible point of discharge to surface water for Evaluation Area 1. A 25-hour groundwater elevation study will be performed using newly installed temporary piezometers and selected new monitoring wells (well pair M05-13 and L05-01, well pair M05-14 and L05-03, and L05-02 next to M05-02) and existing monitoring wells (M05-01, M05-02, M05-06, 26SW03, M117-E, and, if accessible, MBG-04). This study will be conducted to assess the direction of groundwater flow and the extent of tidal influence on groundwater beneath OU-2C. Slug tests will be conducted on all newly installed monitoring wells (M05-13 through M05-19, L05-01 through L0-07, and D05-09) to determine the hydrologic characteristics of the saturated zone at the site. Water chemistry parameters measured during groundwater monitoring will be used to define the freshwater/saline water interface and to adjust potentiometric heads for water density.

As part of BGMP activities in spring 2006, an informal tidal study was conducted to evaluate the extent of tidal influence on groundwater in selected nearshore FWBZ wells at Alameda Point. Pressure transducers were placed in 23 wells located throughout Alameda Point, including two wells within OU-2C (M10-02 and M117-E), to investigate

areas where groundwater was considered to be potentially tidally affected. Each transducer logged hourly groundwater-level measurements over the course of a 25-hour period. The transducers were then removed from their respective wells and the information collected was downloaded for evaluation (ITSI 2006). The transducer data for wells M10-02 and M117-E will be incorporated in the OU-2C RI report.

A1.1.3.2 MONITORING WELL INSTALLATION

Up to 15 new permanent groundwater monitoring wells will be installed in Evaluation Area 1 to address data gaps associated with OU-2C. The wells will be located to supplement the existing network of FWBZ and SWBZ wells on order to monitor groundwater quality and to determine the groundwater flow direction and aquifer properties. Thirteen well locations in the shallower FWBZ (wells M05-13 through M05-16), deeper FWBZ (L05-01 through L05-06), and the SWBZ (well D05-09) have been selected based on the existing data (Figure A1-2). Two additional shallower FWBZ wells (wells M05-17 and M05-18) will be installed in Evaluation Area 2 if discrete groundwater results indicate VOCs at concentrations exceeding comparison criteria. Wells are planned for the following areas as shown on Figure A1-2:

- west of Building 5 – two shallower and deeper FWBZ well pairs outside the northwestern and southwestern corners of the building to monitor the western extent and direction of migration of VOCs (M05-13/L05-01 and M05-14/L05-03)
- west of Building 5 – one deeper FWBZ well and one SWBZ well adjacent to existing well M05-02 to monitor the deeper FWBZ and the SWBZ at the western margin of the VOC plume (L05-02/D05-09)
- within Building 5 – one shallower FWBZ well and one deeper FWBZ well northeast of the former plating shop area and downgradient from the SPH removal action area (M05-15/L05-04)
- east of Building 5 – one shallower FWBZ well and one deeper FWBZ well within the source area east of the foundry (M05-16/L05-05)
- northeast of Building – one deeper FWBZ well adjacent to existing well M05-05 at the northeastern margin of the VOC plume (L05-06)
- upgradient margin of the VOC plume – one FWBZ well southeast of Building 5 and upgradient of the VOC plume (M05-19)
- south of Building 5 – one FWBZ well within former Building 348 (M05-20)
- Evaluation Area 2 – two FWBZ wells located north and south of Building 2, depending on the results of discrete groundwater sampling (see Section A1.2) (M05-17 and M05-18)
- up to three additional wells, as needed, depending on the results of VOC source evaluation from discrete groundwater sampling results in Evaluation Areas 3, 5, and 6

In addition, one soil sample will be collected from the borings of six new permanent monitoring wells and submitted for geotechnical analysis. The depths, locations, and

rationale for the geotechnical soil samples are presented in Table 1-2 of the SAP. The specific geotechnical parameters are listed in DQO Table 1-6 of the SAP.

Depending on the results of VOC source evaluation from discrete groundwater sampling in Evaluation Areas 3, 5, and 6, and discrete groundwater sampling results from data gap areas or SWMUs, additional wells not already depicted on Figure A1-2 may be needed. The decision to install additional monitoring wells will be made based on the results of the discrete groundwater sampling and with a decision logic as illustrated on Figure A1-17 and described in Table A1-18.

A1.1.3.3 MONITORING WELL SAMPLING

Groundwater in new and existing FWBZ (shallower and deeper) and SWBZ wells will be sampled for VOCs, 1,4-dioxane, metals including total and hexavalent chromium, and cyanide during RI supplemental field activities. Groundwater from newly installed wells will be sampled and analyzed for the full analyte suite, as described in the DQO Table 1-6 of the SAP. Groundwater samples will be collected during the RI supplemental field activities from eight existing monitoring wells currently being sampled under the BGMP (M05-02, M05-05, M05-06, M05-09, D05-01, D05-03, D05-04, and D05-05); these samples will be analyzed for the analytes included in the BGMP sampling program.

In addition to organic and inorganic analytes that may represent contamination, the full analyte suite includes physical, geochemical, and biochemical parameters for use in FS evaluations (e.g., dissolved gases, common anions, alkalinity, total dissolved solids, ferrous and ferric iron, and total organic carbon). Additional physical and geochemical parameters will be measured and recorded in the field during monitoring well sampling including pH, conductivity, oxidation-reduction potential, turbidity, dissolved oxygen, and temperature.

A1.1.3.4 DISCRETE GROUNDWATER SAMPLING FOR RADIUM

To address the possible release of radium associated with previous operations in Building 5 to groundwater in the shallower portion of the FWBZ, discrete groundwater samples will be collected from five selected locations (SND57SB01, SM09SB01, NADEP GAP 70, EA3SB12, and EA3SB29) beneath this building. Note that these locations are located in Evaluation Area 3 (discussed below); however, Evaluation Area 1 consists of groundwater beneath OU-2C as stated in Section A1.1. Discrete groundwater samples will be analyzed for radium-226 and radium-228 using United States Environmental Protection Agency (U.S. EPA) Methods 903.1 and 904.0, respectively.

A1.1.3.5 SUBSLAB SOIL GAS SAMPLING

Soil gas samples will be collected from under the concrete slab at Building 5 at a density of approximately one sample per 6,000 square feet. Samples will be collected in Summa canisters in accordance with subslab soil sampling procedures and will be analyzed for VOCs using U.S. EPA Method TO-15. The data from this investigation will be used to

evaluate the potential risk to the hypothetical future occupants of the building from vapor intrusion of VOCs in groundwater. Note that Building 5 is currently vacant.

The primary use of subslab soil gas data will be for risk assessment calculations. Subslab soil gas data will not be used to characterize the nature and extent of soil or groundwater contamination because soil and groundwater are being sampled and analyzed directly. Additionally, subslab soil gas data for VOCs that are also reported in soil and groundwater may be used to evaluate the relative distribution of VOCs among the environmental media.

The structure currently identified as Building 5 was erected in two stages, with the southern portion built in 1942, followed some years later by the northern portion (5A). The foundations and footers of the two portions of the building may differ, which may influence the distribution of subslab soil gas. To provide for evaluation of subslab soil gas data as impacted by possible subsurface infrastructure differences between the northern and southern portions of Building 5, sampling is planned as follows:

- For the southern portion of the building (approximately 315,000 square feet), 55 subslab soil gas sampling locations are planned, to be numbered EA1SG001 through EA1SG055.
- For the northern portion of the building (approximately 300,000 square feet), 45 subslab soil gas sampling locations are planned, to be numbered EA1SG056 through EA1SG100.

The ongoing six-phase heating source removal action may impact the quality of subslab soil gas data in the vicinity of Plume 5-3 (Figure A1-2). Ten of the 100 planned subslab soil gas sampling locations are within the boundaries of area currently undergoing six-phase heating activities, including sampling locations EA1SG017, EA1SG018, EA1SG027, and EA1SG028 within the Phase I area (activities completed in January 2007), and sampling locations EA1SG038 through EA1SG040, and EA1SG049 through EA1SG051, within the Phases II and III area. SAP Figure 2-3 shows the portions of the Plume 5-3 addressed by each phase and the larger fenced areas that encompass the removal activities. Note that heating electrodes are all located inside the area delineated by the 10,000 µg/L contour. Elevated groundwater temperatures, collection and removal of soil vapors, and reduction of VOC concentrations in groundwater may impact subslab soil gas data quality; specifically, subslab soil gas concentrations will not be at steady state within the area of the six-phase heating removal action.

Six-phase heating source removal activities began in August 2006 for Plume 5-3, which is located beneath the former plating shop area in the central area of the southern portion of Building 5 and encompasses an area of approximately 40,000 square feet (Shaw 2007). The removal action is being conducted in three phases (each phase addresses groundwater beneath a surface area of approximately 13,000 square feet) and raises groundwater temperatures in the center of the plume at 12 feet bgs to approximately 90°C. Vapor extraction wells installed to 5 feet bgs collect and remove steam with entrained contaminant vapors from the plume area. Phase I was to be completed in January 2007, with Phases II and III to follow. Monitoring of groundwater temperatures

during Phase I of the Plume 5-3 removal action (Shaw 2007) and during the Plume 5-1 removal action completed in 2004 (Shaw 2006) demonstrated that groundwater temperatures are not elevated above ambient (approximately 22 °C) beyond 30 to 40 feet from each heating electrode. Additionally, data from the six-phase heating source removal action for Plume 5-1 (located to the east of the northern portion of the building, as shown on Figure A1-2 and SAP Figure 2-3) indicated that groundwater temperatures at the center of the heated area returned to ambient levels after approximately 1.5 years (Shaw 2006).

Within the area of Plume 5-3, six-phase heating activities will have impacted soil gas concentrations that were likely at near-steady conditions for the past 10 to 15 years (plating shop activities that were the probable source of VOCs in groundwater were discontinued by 1991), as suggested by calculations presented in the article "Assessing the Significance of Subsurface Contaminant Vapor Migration to Enclosed Spaces" (Johnson et al. 1999). However, subslab soil gas concentrations (i.e., concentrations in the proposed sampling zone at 5 inches below the base of the slab) are likely not significantly affected where groundwater temperatures remain at ambient levels outside the six-phase heating area. The collection and removal of steam with entrained contaminant vapors from above the heated plume area may reduce the impact of the heating activities on soil gas concentrations outside the plume area; specifically, captured vapors cannot migrate beyond the removal area. Reduction of VOCs in groundwater from concentrations greater than 10,000 µg/L to concentrations less than 1,000 µg/L will have a long-term impact on subslab soil vapor concentrations. Regardless of when planned subslab soil gas sampling within the six-phase heating removal action area is conducted (before, during, or after heating), concentrations measured will only be representative of the time of sampling.

Both the ongoing six-phase heating activities and the subsequent reduction of VOC concentrations in groundwater result in a level of uncertainty as to whether measured soil gas concentrations represent steady-state conditions. As a result, there is a level of uncertainty regarding the representativeness (i.e., quality) of subslab soil gas in the vicinity of Plume 5-3. Therefore, subslab soil gas data from this area will be evaluated prior to use in characterizing risks for the indoor air pathway. However, it is likely that soil gas concentrations will not be greatly impacted outside the area of heated groundwater (i.e., at distance greater than 40 feet from the heating electrodes). To assess the representativeness of subslab soil gas data collected outside the expected radius of influence of the six-phase heating activities, the distribution of VOC concentrations in subslab soil gas in relation to distance from the six-phase heating source removal activities will be examined. In addition, the impact of collection and removal of steam with entrained contaminant vapors from above the heated plume and the reduction of VOC concentrations in groundwater as a result of the removal action will be taken into consideration.

To provide for collection of subslab soil gas in conjunction with six-phase heating activities and for evaluation of quality of soil gas data, as impacted by this source removal action in the southern portion of Building 5, sampling is planned as follows.

- Prior to installation of the subslab soil gas sampling probe at all sampling locations within the six-phase heating source removal action area and at selected locations outside the six-phase heating area, temperature measurements will be collected from beneath the slab.
- For the ten subslab soil gas sampling locations that are within the Plume 5-3 area, samples will be collected prior to implementation of heating activities (six-phase heating Phases II and III), if possible, or 2 to 4 weeks after groundwater temperatures have returned to ambient levels. This includes sampling locations EA1SG017, EA1SG018, EA1SG027, and EA1SG028 within the Phase I area, and sampling locations EA1SG038 through EA1SG040, and EA1SG049 through EA1SG051, within the Phases II and III area.
- For the remaining subslab soil sampling locations, which are all more than 40 feet from the six-phase heating electrodes and unlikely to be significantly impacted by the removal action, samples will be collected without restrictions related to the six-phase heating area.

A1.2 EVALUATION AREA 2

AOC 2 is an approximate 0.9-acre area within the boundaries of EBS Parcel 45A in the northeastern corner of IR Site 5 (Figure A1-6). The eastern portion of Building 2, which contained a dry cleaning facility, is in the central portion of Evaluation Area 2. NAS GAP 05 is located in Evaluation Area 2. Between 1996 and 2000, an open space in the eastern portion of Building 2 (west of the dry cleaning facility and NAS GAP 05) became the Alameda Power and Telecommunication Satellite Dish Yard. Due to the satellite dishes and associated equipment, there is no access to this area for any proposed drilling activities.

Evaluation Area 2 addresses the following data gaps:

- a possible release of dry-cleaning solvents (i.e., VOCs) to soil and groundwater
- a possible source of solvents in soil that may represent an ongoing release to groundwater
- the nature and extent of VOCs previous reported in groundwater

A1.2.1 Historical Use

Building 2 was constructed in 1947 and was used as an enlisted personnel barrack. Building 2 contained a dry cleaning facility located in Wing 2 (wings numbered from east to west). The dry cleaning facility included a PCE recovery unit. NAS GAP 05 was located within Wing 2 and was used to collect chlorinated solvents related wastes generated from the dry cleaning facility.

A1.2.2 Previous Investigations

Two investigations included the collection of soil or groundwater samples at Evaluation Area 2:

- EBS Phase 2A and Phase 2B
- 2003 PAH Study

These investigations are described in Section 3 of the Supplemental RI Work Plan. The results of these investigations for samples collected in Evaluation Area 2 are summarized below. Locations sampled in and around Evaluation Area 2 are shown on Figure A1-6. Analytical results for soil and groundwater samples collected within Evaluation Area 2 are included on CD in Appendix A2 to the SAP.

A1.2.2.1 ENVIRONMENTAL BASELINE SURVEY, 2001 SOIL AND GROUNDWATER SAMPLING

During Phase 2A sampling, two surface (1 to 1.5 feet bgs) and four subsurface (3 to 5 feet bgs) soil samples were collected at locations 045-002-003, 045-002-004, 045-002-005, 045-002-006, and 045-002-007 (Figure A1-6); this was to address possible contamination related to improper disposal of degreasers and chlorinated solvents used in the dry cleaning operations, and the area under the air compressor. Sample locations 045-002-005 and 045-002-007 were located adjacent to NAS GAP 05. VOC analytical results reported concentrations of PCE (0.076 and 0.15 mg/kg) below the 1996 EPA Region 9 preliminary remediation goal (PRG) (1.5 mg/kg). The TPH analytical results reported low concentrations of TPH as motor oil. During Phase 2B sampling, four HydroPunch groundwater samples (10 to 12 feet bgs) were collected around Building 2 at locations 045-003-008, 045-003-009, 045-003-010, and 045-003-011 (Figure A1-6). Samples were analyzed for VOCs. Concentrations exceeding MCLs were reported for 1,2-DCE (240 to 320 µg/L) and vinyl chloride (4 to 79 µg/L) in two of the groundwater samples. In addition, one groundwater sample reported concentrations of PCE (2 µg/L) and chloroethane (13 µg/L). These compounds were commonly associated with dry cleaning operations (IT 2001a).

A1.2.2.2 2003 POLYNUCLEAR AROMATIC HYDROCARBON STUDY

Four soil borings (C3S005B006, C3S005B007, C3S005B010, and C3S005B011) were advanced in Evaluation Area 2 during the 2003 PAH study (BEI 2004). Samples were collected from four depth intervals between 0 and 8 feet bgs and analyzed for PAHs. All PAH concentrations were below the screening criterion.

A1.2.2.3 SOLID WASTE MANAGEMENT UNIT REPORT

One SWMU site (NAS GAP 05) was included in the 2005 SWMU Report (SulTech 2005b). The location of NAS GAP 05 is listed in the SWMU Report as inside Wing 2 of Building 2, adjacent to the former dry cleaning facility. In a letter dated November 4, 1999, the California Environmental Protection Agency Department of Toxic Substances Control (DTSC) recommended no further action (NFA) for this SWMU.

A1.2.3 Proposed Sampling Rationale and Design

The sampling plan for Evaluation Area 2 addresses potential impacts to soil and groundwater from a possible release of chlorinated solvents used in dry cleaning operations that were conducted in Building 2, Wing 2, and will assess groundwater quality downgradient of the former dry cleaning facility. The following discussion presents the problem statement and optimized sampling design proposed for Evaluation Area 2 (DQO Steps 1 and 7). Sitewide DQOs that apply to Evaluation 2 are presented in Table 1-7 of the SAP. Proposed sampling locations are shown on Figure A1-6.

Reported concentrations of 1,2-DCE and vinyl chloride in groundwater are above the comparison criteria. Due to uncertainty concerning direction of groundwater flow in the vicinity of Evaluation Area 2, samples will be collected and analyzed from locations surrounding the sampling locations where VOCs were originally found in groundwater. Additional soil and discrete groundwater samples will be collected to assess the distribution of VOCs in groundwater from previous site activities and confirm that previously reported concentrations do not represent a groundwater plume at this location. These data will be used to characterize the nature and extent of contamination, conduct risk assessments for this area, and support an FS.

Soil samples will be collected from five borings at Evaluation Area 2, representing approximately one boring per 1,000 square feet; two soil samples will be collected from each boring (0 to 0.5 foot and 2 to 4 feet bgs). Discrete groundwater samples will be collected and analyzed from each boring at two depth intervals within the FWBZ (10 to 15 feet bgs and 25 to 30 feet bgs). In addition, discrete groundwater samples will be collected and analyzed from two borings located west of the Alameda Power and Telecommunications Satellite Dish Yard and outside Evaluation Area 2. These samples will be collected at two depth intervals within the FWBZ (10 to 15 feet bgs and 25 to 30 feet bgs). The proposed soil and discrete groundwater sampling locations are shown on Figure A1-6. Data collected during these investigation activities will be used in conjunction with existing data to complete characterization of the nature and extent of COPCs for this area, to conduct a risk assessment, and to support an FS.

In the event that discrete groundwater sampling analytical results indicate the presence of a VOC plume in groundwater at Evaluation Area 2, up to two monitoring wells will be installed and sampled ("to be determined" wells M05-17 and M05-18 shown on Figure A1-2). These wells will be located to augment the existing network of FWBZ monitoring wells in OU-2C in order to monitor groundwater quality and to determine the groundwater flow direction and aquifer properties. Well locations will be selected based on evaluation of existing data combined with the new results from the supplemental RI discrete groundwater sampling.

Discrete groundwater samples will be collected using the HydroPunch or an equivalent sampling method. Groundwater will also be collected from newly installed monitoring wells, if any. The discrete groundwater samples will be collected from the FWBZ from approximately 5 to 10 feet below the groundwater table in each area.

Soil and groundwater samples will be analyzed for VOCs and 1,4-dioxane. Groundwater samples will also be analyzed for TDS, if sufficient volume can be obtained. Although TPH (as motor oil) concentrations were reported in EBS soil samples, concentrations were below comparison criteria and no further investigation of TPH will be conducted as part of the Evaluation Area 2 study.

A1.3 EVALUATION AREA 3

Evaluation Area 3 includes the southern portion of Building 5 (7.6 acres). Building 5 contained the former plating shops, and various parts-painting, degreasing, heat treatment, and foundry operations, and is located in EBS Parcel 54 (Figure A1-7). Building 5 was closed in 1993 and is currently vacant. Former SWMUs located in the southern portion of Building 5 included M-01, M-02, M-09, NADEP GAPs 10, 12, 13, 16, 18, 22, 23, 24, 27A, 29, 30, 57, and 70. Five of the SWMUs (M-01, M-02, M-09, NADEP GAPs 57 and 70) have been identified for further sampling. Evaluation Area 3 includes the former location of AST-005H in the southwestern corner of Building 5.

Evaluation Area 3 addresses the following data gaps:

- a possible source of VOCs, 1,4-dioxane, metals (including hexavalent chromium), and cyanide in soil that may represent an ongoing release to groundwater, including, but not limited to, the areas adjacent to Plumes 5-2, 5-3, and 5-4
- a possible release of metals in soil in the vicinity of the heat-treatment and foundry shops
- confirmation of removal of soil with elevated concentrations of chromium and lead at the limits of the cadmium excavation area
- a possible release of VOCs, TPH, SVOCs, PCBs, or metals in soil and groundwater at the former locations of five SWMUs (M-01, M-02, M-09, and NADEP GAPs 57 and 70)

A1.3.1 Historical Use

The southern portion of Building 5 housed various shops for activities including cleaning, reworking, and manufacturing of metal parts, such as the foundry and heat treatment shop; plating, painting, and tool maintenance operations; and specialty operations such as the application of radioluminescent paint to aircraft dial faces and rubber manufacturing (Canonie Environmental 1990). The metal plating shop operations included solvent vapor degreasing; caustic and acid (hydrochloric, nitric, and sulfuric) etching; metal stripping and cleaning; and chrome, nickel, silver, cadmium, and copper plating. Figure A1-1 includes an inset that shows a schematic of the plating shop. Between 1940 through 1972, the wastewaters from all Navy operations at Alameda Point, including those in Building 5, were discharged directly to the nearest surface waters through the storm sewer system. After 1972, an industrial wastewater collection and treatment system was installed and operated until 1991, when plating operations were discontinued in Building 5. A system of industrial wastewater lines were installed that collected plating

wastewaters and routed them to a cyanide destruction and plating wastewater pretreatment area prior to treatment at IWTP 5 (shown on Figures A1-7 and A1-8). The wastewater from the plating shops was split into two waste streams: one for alkaline tanks and one for cyanide tanks. The wastewater streams were kept separate until the cyanide stream was treated in a cyanide destruction unit. The two waste streams were then rerouted together to a pretreatment plant IWTP 5) located near the southwestern corner of Building 5 (Figure A1-7) prior to discharge to the basewide NAS Alameda industrial wastewater system.

A1.3.2 Previous Investigations

Six investigations and UST removal actions included the collection of soil samples in Evaluation Area 3:

- Additional Work at IR Sites 4 and 5, 1992–1993
- Follow-on Investigation, CT0-280, 1994
- EBS Phase 2B and Phase 2C, 1994–1995
- Electrokinetic Pilot-Scale Treatability Study, 1998
- Supplemental RI Data Gaps Sampling, 2001
- Cadmium Removal Action, 2001–2002

These investigations are described in Section 3 of the Work Plan. The results of these investigations for samples collected in Evaluation Area 3 are summarized below. Soil sampling locations within the boundaries of Evaluation Area 3 are shown on Figures A1-7 and A1-8. Analytical results for soil samples collected in Evaluation Area 3 are included on CD in Appendix A2 to the SAP.

A1.3.2.1 ADDITIONAL WORK AT IR SITES 4 AND 5, 1992–1993 SOIL SAMPLING

This follow-on work was based on the results of the sampling conducted at the perimeter of Building 5 during the Phases 2B and 3 investigation conducted in 1991 (PRC and JMM 1992). For this investigation, five areas in or around Building 5 were identified for further investigation. One of these areas was the plating shop, where soil samples were collected in 1992 and 1993, and a second was the selective plating shop (PRC and MW 1995).

Plating Shop

This investigation included five soil borings (B05PS-01 through B05PS-05) installed through the floor of the chromium processing area of the plating shop in 1992 and five additional borings (B05PS-06 through B05PB-10) installed through the floor of the cyanide processing area in 1993 (Figure A1-8). Soil samples were collected from two or three depths from each boring and analyzed for VOCs, metals, hexavalent chromium, cyanide, and total organic carbon. COPCs reported included VOCs, metals, hexavalent chromium, and cyanide. Most samples were collected from the vadose zone (0 to 6 feet bgs). Three samples were collected from the saturated zone (17.5 to 22 feet bgs).

VOCs were reported in 17 soil samples collected at depths between 0 and 22 feet bgs and included acetone; 2-butanone; chloroethane; 1,1-DCA; methylene chloride; 1,1,1-TCA; and TCE. Maximum concentrations (2.2 and 4.3 mg/kg) were reported for samples collected in the saturated zone at a depth of 22 feet bgs. Only one sample contained a VOC at a concentration exceeding the screening criterion: the sample collected at 22 feet bgs from boring B05PS-08 contained 1,1-DCA at 4.3 mg/kg (Table A1-12).

Soil beneath the plating shop contained cadmium, chromium, and iron concentrations exceeding comparison criteria (Table A1-17). Ten samples had cadmium concentrations between 38.6 and 570 mg/kg (compared to the PRG of 37 mg/kg). Eight samples with elevated cadmium concentrations were collected at depths of less than 3 feet bgs, one at 4.5 bgs, and one at 18 feet bgs. Two samples had chromium concentrations of 244 and 850 mg/kg (compared to the PRG of 210 mg/kg). The samples with elevated chromium concentrations were collected at 2 feet bgs and 18 feet bgs. Four samples had iron concentrations between 23,800 and 35,400 mg/kg (compared to the PRG of 23,000 mg/kg). Arsenic concentrations also exceeding the PRG value (0.39 mg/kg), but were comparable to Alameda Point background concentrations; the maximum arsenic concentration was 4.7 mg/kg.

In addition, hexavalent chromium (0.059 to 3.55 mg/kg) and cyanide (0.202 to 23.7 mg/kg) were reported in soil samples from beneath the plating shop.

Selective Plating Shop

One subsurface soil sample was collected from a location adjacent to a floor drain in the selective plating shop. The soil sample was collected at 6 inches below the concrete floor and analyzed for VOCs, metals, hexavalent chromium, cyanide, and TOC. No VOCs or cyanide were reported.

Soil beneath the selective plating shop contained cadmium at 113 mg/kg, which exceeds the PRG (37 mg/kg) (Table A1-17). Hexavalent chromium concentration was 2.17 mg/kg. The arsenic concentration also exceeded the screening criterion, but was comparable to Alameda Point background concentrations.

A1.3.2.2 FOLLOW-ON INVESTIGATION, CTO-280, 1994 SOIL SAMPLING

During the 1994 follow-on investigation under CTO-280, additional field work was conducted at IR Sites 5 and 10 to further assess the nature and extent of chemicals in soil and groundwater reported during winter and spring 1994 (PRC and MW 1996b). The fieldwork included performing CPT borings, collecting HydroPunch samples and shallow soil samples, installing shallow monitoring wells, collecting quarterly groundwater samples, and installing piezometers.

Additional fieldwork conducted in Evaluation Area 3 included installation of a soil boring (05GB003) and two CPT sampling locations (CPT-S05-08 and CPT-S05-09) east and west of the plating shop in Building 5. The CPT sampling location was installed to evaluate lithology and hydrogeologic characteristics below a depth of 15 feet and to identify the SWBZ. Soil samples were collected at three depths from boring 05GB003 and analyzed for VOCs, TPH, SVOCs, and metals. COPCs reported included SVOCs

and metals. Only arsenic and iron exceeded comparison criteria; arsenic concentrations were comparable to background concentrations.

A1.3.2.3 ENVIRONMENTAL BASELINE SURVEY, 2001 SOIL SAMPLING

Evaluation Area 3 is located entirely within EBS Parcel 54, and includes three of the targeted sampling areas within EBS Parcel 54. Sampling within each of these three target areas is summarized below.

Target Area 2

Target Area 2 at EBS Parcel 54 consisted of the area that included heat treatment, pattern, metal manufacturing, foundry, rubber manufacturing, shot peen, and welding shops located in the southeast corner of Building 5; these shop areas may have been impacted by use of chemicals containing VOCs, SVOCs, metals, and TPH. Surface and subsurface soil samples were collected from nine locations (054-002-008 through 054-002-016) (Figure A1-7). Surface soil samples were analyzed for SVOCs, metals, and TPH. Subsurface soil samples were analyzed for these constituents as well as for VOCs. COPCs reported included SVOCs and metals. Low levels of TPH as motor oil were also reported in this area.

Two soil samples from the foundry and heat treatment shop had metals concentrations exceeding comparison criteria. One surface soil sample (0 to 0.5 foot bgs) from location 054-002-011 contained lead at a concentration (547 mg/kg) that exceeded the PRG (150 mg/kg). One surface soil sample (0 to 0.5 foot bgs) from location 054-002-012 had iron (37,100 mg/kg), thallium (5.9 mg/kg), and vanadium (95.3 mg/kg) at concentrations exceeding comparison criteria (PRGs of 23,000, 5.2, and 78 mg/kg, respectively). The concentration ranges for these four metals in all soil samples collected in Target Area 2 were iron (6,760 to 37,100 mg/kg), lead (0.4 to 547 mg/kg), thallium (1.6 to 5.9 mg/kg), and vanadium (13.9 to 37,100 mg/kg). On the basis of data for sampling locations 054-002-011 and 054-002-012, it appeared that EBS Parcel 54, Target Area 2, may have been affected by operations in Building 5. No additional EBS sampling was recommended, as the IR Program would be used to define the extent of the compounds (IT 2001a).

Target Area 3

Target Area 3 at Parcel 54 included the rigging, electrical work, overhaul, and metal rework and finishing shops located in the northeastern portion of the southern half of Building 5; these shop areas were potentially impacted by use of chemicals containing VOCs, SVOCs, metals, and TPH compounds. Surface soil and subsurface soil samples were collected from seven locations (054-003-017 through 054-003-023) (Figure A1-7). Surface soil samples were analyzed for TPH, SVOCs, and metals, while the subsurface samples were analyzed for these constituents as well as for VOCs. COPCs reported included SVOCs and metals.

Only arsenic and iron were reported at concentrations exceeding comparison criteria, and arsenic concentrations were comparable to background levels. No additional EBS sampling of these compounds was recommended at this target area (IT 2001a).

Target Area 4

At Parcel 54, Target Area 4 consisted of the small parts painting, in-flight refueling, landing gear, and cryogenics shops located in the north-central area of the southern portion of Building 5. The analytes that potentially impacted the site included VOCs, SVOCs, metals, and TPH. Surface and subsurface soil samples were collected from six locations (054-004-024 through 054-004-029) in this area (Figure A1-7). All samples were analyzed for TPH, SVOCs, and metals. Subsurface samples were also analyzed for VOCs. COPCs reported included VOCs, SVOCs, and metals.

Only arsenic and iron were reported at concentrations exceeding comparison criteria, and arsenic concentrations were comparable to background levels. No additional EBS sampling was recommended at this target area (IT 2001a).

A1.3.2.4 ELECTROKINETIC PILOT-SCALE TREATABILITY STUDY, 1998 SOIL SAMPLING

The specific objective of the electrokinetic pilot-scale treatability study was to treat chromium-contaminated soil and groundwater at IR Site 5 (TtEMI 1999b). The technology was applied from December 1997 to June 1998 on chromium-contaminated soil located beneath Building 5 at the former aircraft rework facility plating shop. Previous investigations indicated that salts containing chromium (III) and hexavalent chromium (chromium VI)—such as chromic acid, dichromate, and chromate anions—were deposited into the soil under the plating shop during chromium plating operations that occurred at the site from 1942 to 1990.

Soil samples were collected from 12 borings at depths of 1.5, 4.5, and 8.5 feet bgs and analyzed for metals, hexavalent chromium, and general chemistry parameters. Metals reported at concentrations exceeding comparison criteria included arsenic, cadmium, chromium, iron, and hexavalent chromium. However, arsenic concentrations were comparable to background concentrations.

A1.3.2.5 SUPPLEMENTAL REMEDIAL INVESTIGATION DATA GAP SAMPLING, 2001 SOIL SAMPLING

The objectives of data gap sampling at IR Site 5 were to 1) delineate chlorinated VOC plumes in groundwater, 2) characterize inorganic analytes in the vicinity of the plating shop in Building 5, 3) investigate storm sewer pathways, and 4) collect soil gas and soil samples to support vapor intrusion modeling in the baseline HHRA (TtEMI 2001d, 2002b).

In Evaluation Area 3, soil samples were collected to determine the extent of cadmium-contaminated soil in the plating shops area. These data were collected to support potential removal actions and to determine whether cadmium was present at concentrations of concern in soil at the plating shops. Subsurface soil samples were collected at the plating shop using a direct-push drill rig at depths from 0 to 8.5 feet bgs. Soil samples were collected from 19 locations (S05-DGS-DP14, S05-DGS-DP17 through S05-DGS-DP20, S05-DGS-DP31 through S05-DGS-DP33, and S05-DGS-DP50 through S05-DGS-DP60) (Figure A1-8). Samples were submitted to a fixed laboratory for analysis of cadmium. A metals removal

action was conducted during data gap sampling (see Section A1.3.2.6). Locations S05-DGS-DP50 through S05-DGS-DP60 represent confirmation samples collected during the removal action to verify that concentrations in remaining soil were below action levels.

Cadmium concentrations in samples collected prior to the excavation ranged from below the detection limit to 266 mg/kg, compared to the PRG of 37 mg/kg. Cadmium concentrations for samples collected following excavation were below the comparison criteria with the exception of one sample collected at 8 feet bgs from location S05-DGS-DP55 (Table A1-17).

A1.3.2.6 CADMIUM REMOVAL ACTION, 2001–2002 SOIL SAMPLING

The Navy conducted a metals removal action at the former plating shop in Building 5 between December 2001 and February 2002 (IT 2002a). The concrete floor was removed and soil was extracted during an initial excavation and two subsequent step-out excavations. Confirmation samples were collected during the removal action to verify that concentrations in remaining soil were below action levels.

For the initial excavation, 20 confirmation samples were collected at the perimeter of the excavation at depths of 3.5 or 7 feet bgs (S05-EXC-SWE1, SWE2, SWN1, SWN2, SWS1, SWS2, SWW1, and SWW2) and beneath the excavation at a depth of 7 feet bgs (S05-EXC-X1Y1, X1Y2, X1Y3, X2Y1, X2Y2, X2Y3, X3Y1, X3Y2, X3Y3, X4Y1, X4Y2, AND X4Y3). Note that confirmation samples were collected after clean fill soil was placed in the excavation. Borings for collection of confirmation samples were advanced through the clean fill material to a depth of 7 feet. Confirmation samples were analyzed for cadmium, chromium, lead, and hexavalent chromium. All cadmium, lead, and hexavalent chromium concentrations were below comparison criteria. Two samples from beneath the excavation (S05-EXC-X2Y2 and X4Y2) had chromium concentrations exceeding the screening criterion. Sample S05-EXC-X4Y2 also had a cadmium concentration of 31.2 mg/kg, approaching the PRG of 37 mg/kg; therefore, a step-out excavation to the south was conducted.

Upon completion of the first step-out excavation, seven confirmation samples were collected (S05-EXC-SWE3, SWW3, SWS1-1, SWS2-1, X5Y1, X5Y2, and X5Y3) and analyzed for cadmium only. Cadmium concentrations exceeded the comparison criteria in three samples (Table A1-17) and a third step-out and hot spot excavation round was conducted.

For the third round of excavation, nine confirmation samples were collected (S05-EXC-SWB1 and SWB2 west of the excavated area; S05-EXC-SWS1-2, X4Y2-1, X5Y2-1, X5Y3-1, X5Y4, X6Y2, and X6Y3) and analyzed for cadmium. Elevated concentrations were reported in samples S05-EXC-SWB1 and S05-EXC-X4Y2-1. Following additional hot spot excavation, three confirmation samples were collected (S05-EXC-SWB1-1, SWB2-1, and X4Y2-2). All cadmium concentrations for these final three samples were below comparison criteria.

The removal action report recommended that no further removal action was warranted (IT 2002a). As part of the removal action soil to depths of 7 feet bgs was removed at locations of previous sampling points 05GB003, B05PS-01 through B05PS-05;

C1 through C12; S05-DGS-DP14, S05-DGS-DP18, S05-DGS-DP20, S05-DGS-DP55, and S05-DGS-DP57. The excavation was also intended to remove soil at the locations of previous sampling points B05PS-06 through B05PS-10, but due to an error in the reported locations of these sampling points, the excavation did not extend far enough south to include these locations. Figure A1-8 shows the correct locations of sampling points B05PS-01 through B05PS-10.

A1.3.2.7 SOLID WASTE MANAGEMENT UNIT REPORT

Sixteen SWMU sites (M-01, M-02, M-09, NADEP GAPs 10, 12, 13, 16, 18, 22, 23, 24, 27A, 29, 30, 57, and 70) and AST 005H were included in the 2005 SWMU Report (SulTech 2005b). The approximate locations of the SWMUs listed in the SWMU Report are shown on Figure A1-7. Two of these units were mobile distillation units (M-01 and M-01); M-09 was a larger distillation unit within a concrete berm and is still present. According the RCRA facility assessment (RFA), no further action was recommended for these distillation units since they were located within a building and on a concrete floor (DTSC 1992). The NADEP GAP units were part of the RCRA GAP hazardous waste management system initiated in 1987 and operated until base closure and building cleanup in 1997. Actual startup dates are unknown.

A1.3.3 Proposed Sampling Rationale and Design

The problem statement and optimized sampling design (DQO Steps 1 and 7) proposed for Evaluation Area 3 are presented in this subsection. Sitewide DQOs that apply to Evaluation Area 3 are presented in Table 1-7 of the SAP. DQOs for SWMUs within Evaluation Area 3 are presented in Table 1-9 of the SAP. Proposed sampling locations are shown on Figure A1-7.

The presence of VOCs in groundwater beneath Evaluation Area 3 suggests the possible presence of VOCs in soil that could be a continuing source of VOCs released to groundwater. Therefore, soil sampling will be conducted throughout Evaluation Area 3 to assess the possible presence of VOCs in vadose zone soil. Evaluation Area 3 (325 by 900 feet) will be divided into 100-by-100-foot grids and one boring will be located within each grid (borings EA3SB01 through EA3SB27). Data collected during these investigation activities will be used in conjunction with existing data to complete characterization of the nature and extent of COPCs for this area, to conduct a risk assessment, and to support an FS.

Soil sampling during the EBS in the eastern portion of Building 5 (in the foundry and heat treatment shop) area identified lead, thallium, and vanadium at concentrations above comparison criteria. Therefore, soil samples will be collected to assess the distribution of metals in soil in the eastern portion of Evaluation Area 3. Using the grid system designed for VOC characterization, boring locations within each grid in the eastern portion of Evaluation Area 3 (EA3SB17 through EA3SB27) will be optimized to distribute current and historical sampling points such that each historical sampling location with elevated lead, thallium, or vanadium concentrations is surrounded by two borings within 50 feet. The OU-2C RI report will address all metals reported in soil (in addition to lead,

thallium, and vanadium) and will identify which metals may represent a release. The RI report will include a statistical comparison of metals concentrations for OU-2C to the Alameda Point background data set. The RI report will also address all metals concentrations for individual samples that exceed the Alameda Point background 95th percentile to assess whether there has been a release regardless of whether the OU-2C data set for a given metal is comparable to background.

To address concerns regarding potential releases from industrial wastewater sewer lines in Evaluation Area 3, twelve borings (EA3SB28 through EA3SB35, and EA3SB40 through EA3SB43) will be placed at locations along the drain lines within, adjacent to, and downstream from the plating shop. Soil samples will be analyzed for VOCs, 1,4-dioxane, metals, hexavalent chromium, and cyanide. At three of these locations (EA3SB29, EA3SB40, and EA3SB41), discrete groundwater samples will also be collected and analyzed for VOCs, 1,4-dioxane, metals, hexavalent chromium, and cyanide in the FWBZ along the industrial wastewater lines. Discrete groundwater samples will be collected at two depth intervals (10 to 15 feet bgs and 25 to 30 feet bgs). Sampling locations EA3SB42 and EA3SB43 will address the former location of the cyanide eductor sump (EA3SB42) and the chromium eductor sump (EA3SB43). For location EA3SB42 (south of the excavated area), two soil samples (0 to 0.5 and 2 to 4 feet bgs) and one discrete groundwater sample will be collected. For location EA3SB43 (within the excavated area), one discrete groundwater sample will be collected. The discrete groundwater samples will be collected at the soil/water interface (approximately 4 to 6 feet bgs).

Five of the boring locations (EA3SB28, EA3SB34, EA3SB40, EA3SB41, and EA3SB42) along the industrial wastewater lines are adjacent to the southern limit of the cadmium excavation area. These sampling points will provide metals data to confirm the removal of soil containing elevated concentrations of chromium and lead.

A soil sample for geotechnical analysis will be collected at boring location EA3SB12 in the 2-to-4-foot depth interval.

In the event that analytical results for soil samples from Evaluation Area 3 borings indicate the presence of constituents for which no previous groundwater sampling has been conducted, discrete groundwater sampling may be required. The decision to conduct discrete groundwater sampling will be made with a decision logic as illustrated on Figure A1-18 and described in Table A1-18. In the event that analytical results for discrete groundwater samples are above comparison criteria, additional monitoring wells may be needed. The decision logic for additional monitoring well installation is illustrated on Figure A1-17 and described in Table A1-18.

Five SWMU locations within Evaluation Area 3 will be sampled, including M-01, M-02, M-09, and NADEP GAPs 57 and 70. Additionally, areas identified during the April 18, 2006 site walk will be sampled according to SWMU protocols. The following discussion presents the problem statement and optimized sampling design proposed for these SWMUs and additional areas of interest (DQO Steps 1 and 7).

- Investigation of SWMU-specific issues will follow DQOs presented in Table 1-9 of the SAP.
- Soil and discrete groundwater samples will be collected from one boring at each SWMU. The borings will be adjacent to and on the assumed downgradient side, where possible, of each SWMU or at the location of cracks or joints in concrete. Soil samples will be collected at three depths from each boring (0 to 0.5, 2 to 4, and 4 to 6 feet bgs); the third sampling depth will be at the water table (soil/water interface).
- Soil and groundwater samples will be analyzed for VOCs, TPH, SVOCs, 1,4-dioxane, PCBs, metals, hexavalent chromium, and cyanide. Groundwater samples will also be analyzed for TDS, if sufficient volume can be obtained.

Several features of the eastern portion of Building 5 were identified during the April 18, 2006 site walk as possible sources or pathways for release of chemicals to the subsurface. Therefore, soil samples will be collected to assess the possible release of chemicals at the location of each of these features. These include two locations in this area associated with former foundry operations (near two floor drains located in the foundry and in the reddish-colored dirt near the eastern wall of the foundry, EA3SB36 and EA3SB37) and two locations in the rubber room (the location of former chemical tanks and former chemical mixing operations, EA3SB38 and EA3SB39).

The following discussion presents the problem statement and optimized sampling design proposed for the locations of these features (DQO Steps 1 and 7).

- Investigation of these features will follow SWMU-specific DQOs presented in Table 1-9 of the SAP.
- Soil samples will be collected from one boring at an area representative of each feature. The borings will be as close to the feature of interest as possible, or at an obvious low point or crack/joint, and on the assumed downgradient side, where possible, of each feature.
- Soil samples will be analyzed for VOCs, SVOCs, 1,4-dioxane, PCBs, metals, hexavalent chromium, and cyanide.

The former location of AST 005H was identified during the April 18, 2006, site walk as a possible source for a release of chemicals to the subsurface. Therefore, soil and groundwater samples will be collected to assess the possible release of chemicals at the former location of AST 005H. The boring location (EA3SB12) within the grid containing the former AST location will follow the SWMU-specific DQOs presented in Table 1-9 of the SAP.

- Soil and groundwater samples will be collected from one boring. The borings will be adjacent to and on the assumed downgradient side, where possible, of the former AST.
- Soil and groundwater samples will be analyzed for VOCs, TPH, SVOCs, 1,4-dioxane, PCBs, metals, hexavalent chromium, and cyanide.

To address the possible release of radium associated with previous operations in Building 5 to groundwater in the shallower portion of the FWBZ, the discrete groundwater sample collected at 10 to 15 feet bgs from selected locations EA3SB12, and EA3SB29 will be analyzed for radium-226 and radium-228 using U.S. EPA Methods 903.1 and 904.0, respectively.

In the event that analytical results for soil samples from one or more of the five SWMU locations in Evaluation Area 3 are above comparison criteria, step-out soil sampling may be required. The decision logic for additional soil sampling is illustrated on Figure A1-19 and described in Table A1-18. Additionally, although sampling for Evaluation Area 3 is within the area of known groundwater contamination, step-out discrete groundwater sampling will be considered if results of planned discrete groundwater sampling are above comparison criteria and are not consistent with known nature and extent of contamination. The decision logic for additional SWMU discrete groundwater sampling is illustrated on Figure A1-20 and described in Table A1-18. In the event that analytical results for discrete groundwater samples from one or more of the five SWMU locations or the former location of AST 005H are above comparison criteria, additional monitoring wells may be needed. The decision logic for additional monitoring well installation is illustrated on Figure A1-17 and described in Table A1-18.

A1.4 EVALUATION AREA 4

Evaluation Area 4 (Aircraft Maintenance Line and adjoining shop area) is a 5.6-acre area in the north and northeastern portion of Building 5 in EBS Parcel 54 and includes the eastern four-fifths of the aircraft maintenance line and the former battery acid shop and paint mixing area (Figure A1-9). Building 5 was closed in 1993 and is currently vacant. Former SWMUs located within Evaluation Area 4 included M-04, M-05, NADEP GAPs 02, 03, 04, 05, 08, 14, 21, and 31, and SWMU 005. Four of the SWMUs (M-05, NADEP GAP 02, 04, and 31) have been identified for further sampling.

The data gaps that Evaluation Area 4 is designed to address include the following:

- possible release of metals in soil in the Aircraft Maintenance Line area
- possible release of metals in soil in the vicinity of battery acid shop and paint mixing areas, including the location of former NADEP GAP 04
- possible release of VOCs, TPH, SVOCs, PCBs, and metals in soil and groundwater at the former locations of four SWMUs (M-05 and NADEP GAPs 02, 04, and 31)
- possible release of VOCs, TPH, SVOCs, PCBs, and metals at the locations of utility vaults and aircraft tie-down structures

A1.4.1 Historical Use

The northern portion of Building 5 housed the Aircraft Maintenance Line, which included aircraft electrical, structural, and mechanical maintenance; aircraft painting,

ground support equipment repair and maintenance; material storage; and hazardous waste recycling.

A1.4.2 Previous Investigations

Three investigations included the collection of soil samples within Evaluation Area 4 (Aircraft Maintenance Line and adjoining shop area):

- Additional Work for IR Sites 4 and 5, 1992
- Follow-On Investigation, CTO-280, 1994
- EBS Phase 2B and Phase 2C, 1994–1995

These investigations are described in Section 3 of the Work Plan. The results of these investigations for samples collected within Evaluation Area 4 are summarized below. Locations sampled in and around Evaluation Area 4 are shown on Figure A1-9. Analytical results for soil samples collected within Evaluation Area 4 are included on CD in Appendix A2 to the SAP.

A1.4.2.1 ADDITIONAL WORK AT IR SITES 4 AND 5, 1992 SOIL SAMPLING

Follow-on work at Building 5 was based on the results of the sampling conducted at the perimeter of Building 5 during the Phase 2B and 3 investigation conducted in 1991 (PRC and JMM 1992). Of the five areas in or around Building 5 identified for further investigation, only the battery acid shop area was within Evaluation Area 4 (PRC and MW 1995).

Two boreholes (B05BS-01 and B05BS-02) were drilled at the following locations:

- outside the battery acid shop area at the northeast corner of Building 5 where the sink discharged to the storm drain sewer
- inside the battery acid shop area, immediately adjacent to where the piping from the sink entered the floor (Figure A1-9)

Soil samples were collected at the ground surface from both borings and from 2, 5, and 15 feet bgs from the boring outside the building. All soil samples were analyzed for VOCs, SVOCs, metals, hexavalent chromium, cyanide, and pH. One soil sample was analyzed for TOC. The borehole outside the building was converted to a monitoring well (M05BS-01). See Section A1.1.2.3 for groundwater results. COPCs reported included acetone, one PAH, metals, and hexavalent chromium.

No analytes exceeded comparison criteria, with the exception of arsenic at concentrations comparable to background. One lead concentration (94.8 mg/kg) exceeded the background level (37.66 mg/kg) in a sample from the boring outside Building 5. No other analytes were reported at concentrations exceeding background levels from the location within Building 5 (PRC and MW 1995).

A1.4.2.2 FOLLOW-ON INVESTIGATION, CTO-280, 1994 SOIL SAMPLING

During the 1994 follow-on investigation under CTO-280, additional fieldwork was conducted at IR Sites 5 and 10 to further assess the nature and extent of the chemicals in soil and groundwater reported during winter and spring 1994 (PRC and MW 1996b). The fieldwork included performing CPT borings, collecting HydroPunch samples and shallow soil samples, installing shallow monitoring wells, collecting quarterly groundwater samples, and installing piezometers.

Additional fieldwork conducted within Evaluation Area 4 included installing a CPT sampling location (CPT-S05-12) adjacent to the overspray trench in the northeastern bay of Building 5 (Figure A1-9). In addition, a shallow groundwater monitoring well (M05-12) was installed at this location (Figure A1-2). The CPT sampling location was installed to evaluate lithology and hydrogeologic characteristics below 15 feet bgs and to identify the SWBZ. Soil samples were collected at three depths from the CPT boring and at four depths from the monitoring well boring.

The soil samples were analyzed for VOCs, SVOCs, metals, TPH, and pH. Lead was the only analyte reported at concentrations exceeding soil comparison criteria (Table A1-17). Lead concentrations (161 to 190 mg/kg) in five samples collected between 0 and 5.5 feet bgs from borings CPT-S05-12 and M05-12 exceeded the residential soil PRG (150 mg/kg) (PRC and MW 1996b).

A1.4.2.3 ENVIRONMENTAL BASELINE SURVEY, 2001 SOIL SAMPLING

During Phase 2A at Parcel 54, sampling of Target Area 1 (Aircraft Maintenance Line in the middle of Building 5A) included the collection of four surface (1 foot to 1.5 feet bgs) and three subsurface (3 to 5 feet bgs) soil samples (locations 054-001-001 through 054-001-007) (Figure A1-9). Five of these sampling locations were within Evaluation Area 4. Surface samples were analyzed for TPH, SVOCs, and metals, while subsurface samples were analyzed for these constituents as well as for VOCs. Analytical results revealed elevated concentrations of lead, arsenic, and thallium that exceeded the comparison criteria (Table A1-17). Lead concentrations (251 to 1,770 mg/kg) were elevated at three sampling locations (054-001-003, 054-001-005, and 054-001-006) in the central part of the target area. Arsenic and thallium were reported at elevated concentrations (329 mg/kg and 335 mg/kg, respectively) at one location (054-001-007). Concentrations ranges for these three metals for all soil samples collected in Target Area 1 were arsenic (1.7 to 329 mg/kg), lead (2.2 to 1,770 mg/kg), and thallium (1.3 to 335 mg/kg). Low levels of TPH as motor oil were also reported. These data indicated that EBS Parcel 54 Target Area 1 may be impacted by lead, arsenic, and thallium, possibly associated with operations previously located in this area. These detections warranted further investigation (IT 2001a).

A1.4.2.4 SOLID WASTE MANAGEMENT UNIT REPORT

Eleven SWMU sites (M-04, M-05, NADEP GAPs 02, 03, 04, 05, 08, 14, 21, 31, and SWMU 005) were included in the 2005 SWMU Report (SulTech 2005b). The approximate locations of the SWMUs listed in the SWMU Report are shown on

Figure A1-9. Two of these units were mobile distillation units (M-04 and M-05). According to the RFA, no further action was recommended for these mobile distillation units since they were located within a building and on a concrete floor (DTSC 1992). The NADEP GAP units and SWMU 005 were part of the RCRA GAP hazardous waste management system initiated in 1987 and operated until base closure and building cleanup in 1997. Actual startup dates are unknown.

A1.4.3 Proposed Sampling Rationale and Design

The problem statement and optimized sampling design (DQO Steps 1 and 7) proposed for Evaluation Area 4 (Aircraft Maintenance Line and adjoining shop area) are presented in this subsection. Sitewide DQOs that apply to Evaluation Area 4 are presented in Table 1-7 of the SAP. DQOs for SWMUs within Evaluation Area 4 are presented in Table 1-9 of the SAP. Proposed sampling locations are shown on Figure A1-9. Data collected during these investigation activities will be used in conjunction with existing data to complete characterization of the nature and extent of COPCs for this area, to conduct a risk assessment, and to support an FS.

Soil sampling in the central and eastern portion of the Aircraft Maintenance Line area (Evaluation Area 4) during the EBS identified arsenic, lead, and thallium at concentrations above screening criteria. Therefore, soil samples will be collected to assess the distribution of metals in soil in Evaluation Area 4. Evaluation Area 4 (400 by 600 feet) will be divided into 100-by-100-foot grids and one boring will be located within each grid (borings EA4SB01 through EA4SB20 and boring EA4SB29), for an approximate total of 25 borings. For previous sampling locations 054-001-003, 054-001-005, 054-001-006, and 054-001-007 where metals results exceeded PRGs, boring locations within each grid will be optimized and one or two additional borings (EA4SB23 through EA4SB28) will be located so that each historical sampling location with elevated arsenic, lead, or thallium concentrations is surrounded by three borings within 25 feet. Four grid locations will be replaced with borings for SWMUs (M-05, NADEP GAPs 02, 04, and 31) and will be sampled in accordance with SWMU-specific DQOs (see below). Two locations (e.g., EA4SB07 or EA4SB10) will be co-located with structural features in the aircraft maintenance line floor (utility vaults and aircraft tie-downs) and will also be sampled in accordance with SWMU-specific DQOs. The remaining 18 locations will be sampled in accordance with Evaluation Area 4 DQOs.

The OU-2C RI report will address all metals reported in soil (in addition to arsenic, lead, and thallium) and will identify which metals may represent a release. The OU-2C RI report will include a statistical comparison of metals concentrations for OU-2C to the Alameda Point background data set. The RI report will also address all metals concentrations for individual samples that exceed the Alameda Point background 95th percentile to assess whether there has been a release, regardless of whether the OU-2C data set for a given metal is comparable to background.

A soil sample for geotechnical analysis will be collected at boring location SM05SB02 in the 2-to-4-foot depth interval.

In the event that analytical results for soil samples from Evaluation Area 4 (Aircraft Maintenance Line and adjoining shop area) borings indicate the presence of constituents for which no previous groundwater sampling has been conducted, discrete groundwater sampling may be required. The decision logic for additional discrete groundwater sampling is illustrated on Figure A1-18 and described in Table A1-18. In the event that analytical results for discrete groundwater samples are above comparison criteria, additional monitoring wells may be needed. The decision logic for additional monitoring well installation is illustrated on Figure A1-17 and described in Table A1-18.

The following discussion presents the problem statement and optimized sampling design proposed for these SWMUs and the battery acid shop (DQO Steps 1 and 7).

- Evaluation Area 4–specific issues will follow DQOs presented in Table 1-7 of the SAP. Soil samples will be collected from one boring within each 100-by-100-foot grid. Soil samples will be collected at two depths from each boring (0 to 0.5 and 2 to 4 feet bgs). Soil samples will be analyzed for metals.
- For each of the four previous sampling locations for which metals concentrations exceeded PRGs, one or two additional borings will be added to provide three sampling locations at a distance of 25 feet from each of the original sampling locations (Figure A1-9). Soil samples will be collected at two depths from each boring (0 to 0.5 foot bgs and 2 to 4 feet bgs). Soil samples will be analyzed for metals.
- Due to the historical detection of elevated levels of VOCs in groundwater underlying Evaluation Area 4, soil samples will also be analyzed for VOCs.

Four SWMUs within Evaluation Area 4 (M-05, and NADEP GAPs 02, 04 (paint-mixing area), and 31) and the battery acid shop were identified for further sampling. Therefore, soil and groundwater samples will be collected to assess the possible release of chemicals at these locations. The following discussion presents the problem statement and optimized sampling design (DQO Steps 1 and 7) proposed for these SWMUs and the battery acid shop and paint mixing area.

- SWMU-specific issues will follow DQOs presented in Table 1-9 of the SAP. Soil and discrete groundwater samples will be collected from one boring at NADEP GAP 02. The boring will be adjacent to and on the assumed downgradient side, where possible, of the SWMU or at the location of cracks or joints in concrete. Soil samples will be collected at three depths from each boring (0 to 0.5, 2 to 4, and 4 to 6 feet bgs); the third sampling depth will be at the water table (soil/water interface). Soil and groundwater samples will be analyzed for VOCs, TPH, SVOCs, 1,4-dioxane, PCBs, metals, hexavalent chromium, and cyanide. Groundwater samples will also be analyzed for TDS, if sufficient volume can be obtained.
- Soil samples and one discrete groundwater sample will be collected from two borings at each of the following locations: SWMU M-05, NADEP GAP 31, within the paint-mixing area that includes NADEP GAP 04, and within the battery acid shop. The borings will be at the locations of cracks or joints in concrete or other features identified during the April 18, 2006 site walk. For the three SWMU sampling locations, soil samples will be collected at three depths

from each boring (0 to 0.5, 2 to 4, and 4 to 6 feet bgs); the third sampling depth will be at the water table (soil/water interface). Soil and groundwater samples will be analyzed for VOCs, TPH, SVOCs, 1,4-dioxane, PCBs, metals, hexavalent chromium, and cyanide. For the battery acid shop sampling locations, soil samples will be collected at two depths from each boring (0 to 0.5 foot bgs and 2 to 4 feet bgs) and soil and groundwater samples will be analyzed for VOCs, metals, hexavalent chromium, and cyanide. Groundwater samples will also be analyzed for TDS, if sufficient volume can be obtained.

In the event that analytical results for soil samples from one or more of the four SWMU locations in Evaluation Area 4 are above comparison criteria, step-out soil sampling may be required. The decision logic for additional soil sampling is illustrated on Figure A1-19 and described in Table A1-18. Additionally, although sampling for Evaluation Area 4 is within the area of known groundwater contamination, step-out discrete groundwater sampling will be considered if results of planned discrete groundwater sampling are above comparison criteria and are not consistent with known nature and extent of contamination. The decision logic for additional SWMU discrete groundwater sampling is illustrated on Figure A1-20 and described in Table A1-18. In the event that analytical results for discrete groundwater samples from one or more of the four SWMU locations or the former battery acid shop are above comparison criteria, additional monitoring wells may be needed. The decision logic for additional monitoring well installation is illustrated on Figure A1-17 and described in Table A1-18.

Two structural features of the aircraft maintenance line floor (aircraft tie-down structure and utility vault) were identified during the April 18, 2006 site walk as possible pathways for release of chemicals to the subsurface. Therefore, soil samples will be collected to assess the possible release of chemicals at a minimum of one example of each of these features. The following discussion presents the problem statement and optimized sampling design proposed for these locations (DQO Steps 1 and 7).

- Investigation of these features will follow SWMU-specific DQOs presented in Table 1-9 of the SAP. Soil samples will be collected from one boring at a representative of each feature. The borings will be adjacent to and on the assumed downgradient side, where possible, of each feature. Soil samples will be collected at three depths from each boring (0 to 0.5, 2 to 4, and 4 to 6 feet bgs); the third sampling depth will be at the water table (soil/water interface). Soil samples will be analyzed for VOCs, TPH, SVOCs, 1,4-dioxane, PCBs, and metals.

A1.5 EVALUATION AREA 5

Evaluation Area 5 is a 4-acre area south of Building 5 including EBS Parcels 53A, 55, 57 and portions of 51A, 52, and 54 (Figure A1-10). Evaluation Area 5 comprises the area containing former chromium and cyanide wastewater pretreatment units, former IWTP 5, the former locations of Buildings 261, 348, and 415, and existing Building 615. Evaluation Area 5 also contains CAA-5B, which has been transferred to CERCLA for closure due to the presence of chlorinated VOCs in underlying groundwater, and a portion of CAA-5C, which is being addressed under the TPH Program. Most of

Evaluation Area 5 is paved open space. IWTP 5 was closed under RCRA in 1993 (DTSC 1999a). Former SWMUs located within Evaluation Area 5 included AOC 261, NADEP GAPs 25 and 26, OWS 005, OWS 615, SWMU 615, and UST(R)-19. Two of the SWMUs (NADEP GAP 25 and OWS 005) have been identified for further sampling. On Figure A1-10, a circle with a 50-foot radius has been drawn around each of the SWMUs identified for sampling and labeled "area of interest." A former fenced hazardous waste storage area encompassing former Building 415 and several other structures was located at the eastern margin of Evaluation Area 5. This former hazardous waste storage area predates establishment of RCRA SWMUs and does not have a SWMU designation.

Evaluation Area 5 addresses the following data gaps:

- possible presence of VOCs, 1,4-dioxane, metals (including hexavalent chromium), and cyanide in soil that may represent an ongoing release to groundwater
- a possible release of VOCs, TPH, SVOCs, PCBs, or metals in soil associated with former Building 415
- a possible release of VOCs, TPH, SVOCs, PCBs, and metals in soil and groundwater at the former locations of two SWMUs (NADEP GAP 25 and OWS 005)
- closure of CAA-5B under CERCLA due to commingled TPH and chlorinated VOCs in groundwater

A1.5.1 Historical Use

The area south of Building 5 was used for a number of activities related to equipment cleaning and waste management and is completely paved. The western half of Evaluation Area 5 contains for the former location of IWTP 5 and the area containing the pretreatment units for hexavalent chromium and cyanide wastewaters from plating operations in Building 5, anodizing wastewater, and paint booth wastewater. The eastern half of Evaluation Area 5 contains CAA-5B, which encompasses the former locations of Buildings 261, 348, and 415, former UST locations designated AOC 261, existing Building 615 and associated USTs and OWS designated SWMU 615, UST(R)-19, and OWS 615, respectively, and a former hazardous waste storage area. Former Building 261 was constructed in 1943 and was used as a NADEP storage area for chromium, cyanide, kerosene, and PD-680 solvent. Former Building 348, constructed in 1960, was a corrosion control shop used for steam cleaning of aircraft outer surfaces and parts; this facility used methlyene chloride as a solvent. Former Building 415 was constructed in 1956 and consisted of a storage shed and a hazardous waste accumulation area for waste petroleum products, resins, solvents, oils, and lubricants. Building 615 was constructed in 1982 and designed for use as hazardous material delivery spill control facility with associated USTs and OWS 615. However, this building was never used for its designated purpose, but rather was used as an electrical equipment and parts storage facility.

The areas described above are shown on Figure A1-10.

A1.5.2 Previous Investigations

Five investigations and plus UST removal actions included the collection of soil samples within Evaluation Area 5:

- Phase 2B and 3 Investigation, 1991
- Additional Work at IR Sites 4 and 5, 1992
- EBS Phase 2B and Phase 2C
- 2003 PAH Study
- TPH Investigations

These investigations are described in Section 3 of the Work Plan. The results of these investigations for samples collected in Evaluation Area 5 are summarized below. Locations sampled within the boundaries of Evaluation Area 5 are shown on Figure A1-10. Analytical results for soil and groundwater samples collected within Evaluation Area 5 are included on CD in Appendix A2 to the SAP.

A1.5.2.1 PHASE 2B AND 3 INVESTIGATION, 1991 SOIL SAMPLING

Sampling for this investigation was performed as part of the NAS Alameda RI to determine whether soil and groundwater were contaminated in areas identified as potential waste release sites (Canonie Environmental 1990). The investigation focused on the industrial, sanitary, and storm sewers, and included collecting soil and groundwater samples, installing groundwater monitoring wells, and performing groundwater monitoring (PRC and JMM1992).

Within Evaluation Area 5, the investigation included installation of three borings (B05-07 through B05-09) at locations east of IWTP 5, west of former Building 348, and west of the former hazardous waste storage area (Figure A1-10). Soil samples collected from these borings were analyzed for VOCs, SVOCs, metals, and cyanide (PRC and JMM 1992). Samples were collected at five depths (1, 2, 6.5, 8, and 14 feet bgs). The shallowest sample was not analyzed for VOCs and the three deepest samples were likely within the saturated zone. COPCs reported included VOCs, SVOCs, and metals.

VOCs reported in soil samples included chloroethane, 1,1-DCA, toluene, and total xylenes. No VOCs exceeded comparison criteria. The only SVOCs reported at concentrations exceeding detection limits were PAHs. Metals concentrations were below comparison criteria or, in the case of arsenic, comparable to Alameda Point background levels.

A1.5.2.2 ADDITIONAL WORK AT IR SITES 4 AND 5, 1992

This follow-on work was based on the results of the sampling conducted at the perimeter of Building 5 during the Phase 2B and 3 investigation conducted in 1991 (PRC and JMM 1992). For this investigation, five areas in or around Building 5 were identified for further investigation. Two of these areas were the cyanide and chromium wastewater pretreatment area and the former hazardous waste storage area (PRC and MW 1995).

Wastewater Treatment Area

This investigation included two soil borings (B05WT-01 and B05WT-02) installed north of the pretreatment units (Figure A1-10). Soil samples were collected from a depth of 10 feet bgs from each boring and analyzed for VOCs, SVOCs, metals, hexavalent chromium, cyanide, and total organic carbon. COPCs reported included SVOCs, metals, and hexavalent chromium. No analytes were reported at concentrations exceeding comparison criteria. These samples were within the saturated zone.

Former Hazardous Waste Storage Area

This investigation included two soil borings (M05HW-01 and B05HW-02) installed at the north and south of the former hazardous waste storage area (Figure A1-10). Soil samples were collected from depths of 0, 5, 10, and 15 feet bgs from each boring and analyzed for VOCs, SVOCs, metals, hexavalent chromium, cyanide, and total organic carbon. COPCs reported included VOCs, SVOCs, metals, and hexavalent chromium. Only arsenic and PAHs were reported at concentrations exceeding screening criteria, and arsenic was comparable to background concentrations.

A1.5.2.3 ENVIRONMENTAL BASELINE SURVEY, 2001 SOIL SAMPLING

Evaluation Area 5 includes EBS Parcels 55 and 57 and portions of EBS Parcels 51A, 52, 53A, and 54. Sampling locations in these EBS parcels in Evaluation Area 5 are summarized below. No sampling locations in EBS Parcel 51A were included in Evaluation Area 5.

EBS Parcels 52 and 53A

In EBS Parcels 52 and 53A, one storm sewer line sampling location (052-SS-001) and one industrial wastewater sewer line sampling location (053-IW-001) were located along the drain corridor at the southern border of Evaluation Area 5. Soil samples were collected at depths of 7 to 8 feet bgs and 11 feet bgs (likely in the saturated zone) and analyzed for VOCs, SVOCs, PCBs, organic lead, reactivity, oil and grease, TPH, and metals. COPCs reported in these samples included TPH, SVOCs, and metals. Only arsenic was reported at concentrations exceeding comparison criteria, and arsenic concentrations were comparable to background levels.

EBS Parcel 54

EBS Parcel 54 sampling areas in Evaluation Area 5 included Target Area 5 and sanitary sewer and industrial wastewater lines.

Target Area 5 at EBS Parcel 54 was a stained area in the vicinity of IWTP 5. Industrial wastewater treatment processes involving VOCs, SVOCs metals-contaminated water, and cyanide may have potentially impacted this area. Subsurface soil samples were collected at two locations (054-005-0030 and 054-005-0031) and analyzed for VOCs, TPH, SVOCs, metals, and cyanide (Figure A1-10). Analytical results revealed detectable concentrations of one SVOC and several metals. No other analytes were reported at the site. Only arsenic was reported at concentrations exceeding comparison criteria, and

arsenic concentrations were comparable to background levels. These data appeared to indicate that Target Area 5 had not been affected by constituents associated with IR Site 5. No additional EBS sampling was recommended at this target area (IT 2001a).

One sanitary sewer line sampling location (054-SN-005) and three industrial wastewater sewer line sampling locations (054-IW-002 through 054-IW-004) were located along the drain corridor through Evaluation Area 5. Soil samples were collected at depths of 5 to 10 feet bgs (likely in the saturated zone) and analyzed for VOCs, TPH, SVOCs, metals, and cyanide. Samples along industrial wastewater lines were also analyzed for pesticides, PCBs, organic lead, and oil and grease. COPCs reported in these samples included VOCs, TPH, SVOCs, and metals. Only arsenic was reported at concentrations exceeding comparison criteria, and arsenic concentrations were comparable to background levels.

EBS Parcel 55

Soil sampling at EBS Parcel 55 consisted of one target area (Target Area 1) that included the bermed area of Building 261 and encompassed approximately 100 square feet. Target compounds at Target Area 1 consisted of petroleum-based fuels. Surface and subsurface soil samples were collected at two locations (055-001-001 and 055-001-002) (Figure A1-10). Subsurface soil samples were collected from depths ranging from 4 to 4.5 feet bgs. Surface samples were analyzed for TPH and the subsurface samples were analyzed for VOCs. Low levels of PCE and TPH as motor oil were reported. On the basis of these data, no additional EBS sampling was recommended at this target area (IT 2001a).

EBS Parcel 57, Phase 2A

Phase 2A sampling at EBS Parcel 57 included five target areas and one zone-specific area.

Target Area 1. Target Area 1 included Building 348 and covered approximately 5,100 square feet. Target compounds included VOCs, TPH, and metals. Surface soil and subsurface samples were collected at three locations (057-001-001 through 057-001-003) (Figure A1-10). Subsurface sample depths ranged from 4 to 4.5 feet bgs. Surface samples were analyzed for metals and TPH. Subsurface samples were analyzed for VOCs. COPCs reported included VOCs, TPH, and metals. Concentrations of VOCs, ethylbenzene, PCE, and TCE, TPH as diesel, and the metals arsenic and chromium exceeded comparison criteria. However, arsenic concentrations were comparable to Alameda Point background levels. Chromium was reported at elevated concentrations (408 J and 876 J mg/kg) in two samples (locations 057-001-001 and 057-001-003) compared to the PRG of 210 mg/kg. Concentrations for chromium in all samples collected in Target Area 1 ranged from 158 to 876 mg/kg, which exceed the Alameda Point background 95th percentile concentration of 54.84 mg/kg. Based on the parcel-specific sampling results, the Navy recommended additional sampling (IT 2001a).

Target Area 2. Target Area 2 at EBS Parcel 57 consisted of the soil beneath the stains in the former hazardous waste storage area containing Building 415. Potential contaminants included VOCs, TPH, and metals. Surface soil and subsurface samples were collected at three locations (057-002-004 through 057-002-006). The surface soil samples were

analyzed for metals and TPH. The subsurface soil samples were collected from depths ranging from 4 to 4.5 feet bgs and analyzed for VOCs. COPCs included VOCs, TPH as motor oil, and metals. However, only arsenic and iron concentrations exceeded comparison criteria and arsenic concentrations were comparable to Alameda Point background concentrations. On the basis of these data, no additional sampling was recommended at Target Area 2 (IT 2001a).

Target Area 3. Target Area 3 at EBS Parcel 57 included the stained soil surrounding a dip tank located between Buildings 5 and 348. Surface and subsurface soil samples were collected at two locations (057-004-007 and 057-003-008) (Figure A1-10). Surface soil samples were analyzed for TPH, metals, and cyanide. Subsurface soil samples were collected from depths ranging from 4 to 4.5 feet bgs and analyzed for VOCs. COPCs reported included VOCs, TPH as motor oil, and metals. Only arsenic was reported at concentrations exceeding comparison criteria, and arsenic concentrations were comparable to background levels. On the basis of these data, no additional sampling was warranted at Target Area 3 (IT 2001a).

Target Area 4. Target Area 4 at EBS Parcel 57 included the area south of Building 615 where stored chemicals included flammable materials and other petroleum products. Surface and subsurface soil samples were collected at two locations (057-004-009 and 057-004-010). Surface soil samples were analyzed for TPH, and the subsurface soil samples were analyzed for VOCs (Figure A1-10). Low levels of methylene chloride were reported at the site. On the basis of these data, no additional sampling was warranted at Target Area 4 (IT 2001a).

Target Area 5. Target Area 5 at EBS Parcel 57 consisted of the area surrounding the "grease interceptor" located on the north side of Avenue F, near the southeast corner of the parcel. The targeted sampling area corresponds to the former location of UST 615-4, which was part of the spill control system for Building 615. Subsurface soil samples were collected from two locations (057-005-011 and 057-005-012) at a depth of from 4 to 6 feet bgs (corresponding to the bottom of the grease interceptor) (Figure A1-10). Samples were analyzed for VOCs, TPH, and metals. COPCs reported included VOCs, TPH, and metals. None of the VOC concentrations were above comparison criteria. TPH as diesel and as gasoline were reported at concentrations above the TPH comparison criteria (Table A1-13). Only arsenic was reported at concentrations exceeding the screening criterion, and arsenic concentrations were comparable to background levels. On the basis of these data, no additional sampling was warranted at Target Area 5 (IT 2001a).

Zone-Specific Target Area. The zone-specific target area at EBS Parcel 57 included current and former railroad track areas within or adjacent to Building 5. These areas may have been impacted by historical releases of TPH, PCBs, SVOCs, and lead from railroad operations. One surface soil sample was collected at location 057-Z10-013 just south of Building 615 (Figure A1-10). The sample was analyzed for metals, pesticides and PCBs, lead, and TPH. COPCs reported included SVOCs, Aroclor 1260, and lead. None of the COPCs were reported at concentrations above comparison criteria. Based on these results, the EBS concluded that no additional zonewide samples were warranted at the site (IT 2001a).

EBS Parcel 57, Phase 2B

The intent of this additional sampling was to determine if the elevated chromium and VOC concentrations reported in samples from Target Area 1 (Building 348) resulted from activities at EBS Parcel 57, or if these chemicals migrated onto the parcel from off-site sources (IT 2001a). Phase 2B collected one surface soil sample and three additional subsurface soil samples at three locations (057-006-014 through 057-006-016) (Figure A1-10). The subsurface soil samples were analyzed for VOCs and metals. The surface soil sample was analyzed for metals only. Chromium concentrations were generally lower in the soil samples than previously reported in the Phase 2A samples. Combined Phase 2A and 2B data indicated a need for additional characterization and potential remediation to be addressed under the IR Program (IT 2001a).

EBS Parcel 57, Phase 2C

The primary goal of Phase 2C EBS investigation at EBS Parcel 57 was to investigate the impact on subsurface soil and groundwater related to former USTs 261-1, 261-2, and 261-3. EBS Phase 2C samples were located across EBS Parcel 57 and near former locations of USTs and fuel lines. Ten subsurface soil samples (057-0033, 057-0035, 057-0037, 057-0039, 057-0041, 057-0043, 057-0045, 057-0047, 057-0049, and 057-0051) were collected and analyzed for VOCs, TPH, and metals (Figure A1-10). Three subsurface soil samples (057-0035, 057-0037, and 057-0045) were also analyzed for SVOCs. COPCs reported included one SVOC and metals. All concentrations were below comparison criteria or, in the case of arsenic, comparable to Alameda Point background levels (IT 2001a).

A1.5.2.4 2003 POLYNUCLEAR AROMATIC HYDROCARBON STUDY

Fourteen soil borings (C3S005B099, C3S005B101 through C3S005B105, C3S005B113 through C3S005B118, C3S010B001, and C3S010B002) were advanced in Evaluation Area 5 during the 2003 PAH study (BEI 2004). Samples were collected from four depth intervals between 0 and 8 feet bgs and analyzed for PAHs. All PAH concentrations were below the screening criterion.

A1.5.2.5 TOTAL PETROLEUM HYDROCARBON INVESTIGATIONS

The paragraphs below summarize the results of soil sampling conducted as part of TPH investigations for USTs in Evaluation Area 5.

UST 261-1 and UST 261-2 were both 800-gallon steel tanks used to store kerosene, and were located south of Building 5 near Building 261 (TtEMI 2003, PWC 1996c). Both tanks were installed in 1943 and removed on December 8, 1994. Soil was not removed and samples were not collected because the tanks were housed in a concrete vault. The vault was filled with concrete during the demolition of Building 261 (PWC 1996c).

UST 261-3 was a 1,500-gallon steel tank used to store the solvent PD-680, and was located south of Building 5 near Building 261 (TtEMI 2003, PWC 1996c). The tank was installed in 1943 and removed on December 08, 1994. Soil samples were collected from

the sidewalls of the excavation (261-3E, 261-3N, 261-3S, and 261-3W) and analyzed for BTEX and TPH. All results were below comparison criteria (TtEMI 2003).

In 1995, soil sampling was conducted along a line between the former locations of USTs 261-1, 261-3, and 261-3, and Building 348, and along the western side of Building 348. Soil samples were collected at ten locations (261-S1 through 261-S10). Samples were analyzed for BTEX, TPH, and lead. TPH as diesel, as jet fuel, and as motor oil exceeded comparison criteria in three samples (261-S7 through 261-S9) and lead exceeded the comparison criteria in one sample (261-S8) from Building 348 (Tables A1-13 and A1-17). Lead was reported at a concentration of 170 mg/kg (the PRG is 150 mg/kg). The former location of these tanks was targeted for further sampling during Phase 2C of the EBS, as described in Section 1.5.2.3. Additionally, in 1999, soil samples were collected from three geoprobe sampling locations (057-001, 057-002, and 057-007) and analyzed for BTEX and TPH. Analytical results were below comparison criteria (TtEMI 2003).

UST 615-3 was a 50-gallon steel tank used to store oil and water, and was also known as OWS 615 (TtEMI 2003; PWC 1997a). The tank was removed on December 20, 1994. One soil sample (615-3C) was collected during tank excavation and analyzed for BTEX, TPH, and lead. Only TPH as diesel, as jet fuel, and as motor oil were reported and concentrations were below comparison criteria (TtEMI 2003).

UST 615-4 was an 80-gallon steel tank used to store waste oil, and was located near Building 615 (TtEMI 1999d, 2003). The tank was removed on December 9, 1998 and one soil sample was collected (030-MOD1-181) and analyzed for VOCs, TPH, SVOCs, and metals. TPH and SVOCs were reported at concentrations exceeding comparison criteria. As part of the TPH Data Gap Investigation in 2000, four soil samples (CA05-06 through CA05-09) were collected around the former location of this UST. Samples were analyzed for TPH and SVOCs. TPH as diesel and as gasoline were reported at concentrations exceeding comparison criteria (Table A1-13).

Evidence of floating product (based on a groundwater TPH concentration that exceeded the Alameda TPH Strategy indicator value of 20 mg/L) was reported in monitoring well M05-03, screened at a depth of 4 to 12 feet bgs. Well M05-03 is located in the paved area between Building 5 and Building 400, and at the southeastern corner of the vault, which formerly contained the cyanide destruction and plating wastewater pretreatment units. A groundwater sample collected from this well in 2001 contained TPH as gasoline at a concentration of 486,000,000 µg/L (Table A1-6). In order to verify the presence/absence and evaluate the extent of floating product, temporary piezometers were installed in the target areas and monitored for floating product. The piezometers were developed, sampled, and monitored for a period that included the expected seasonal high and seasonal low groundwater elevations for the sites. Soil and groundwater samples were collected from the temporary piezometers and analyzed for TPH-related constituents. Analytical results were compared to the floating product comparison criteria published in the Alameda TPH Strategy. All field activities were performed in accordance with the procedures and project-specific requirements detailed in the SAP for CAA-5B and -3A (ITSI 2004).

Indications of floating product in the initial round of piezometers installed (CAA-5B-TMP-001 through CAA-5B-TMP-004) led to the selection of six step-out locations (CAA-5B-TMP-005, CAA-5B-TMP-006, CAA-5B-TMP-007, CAA-5B-TMP-008, CAA-5B-TMP-009, and CAA-5B-TMP-010) to further evaluate the extent of floating product south of Building 5. One additional round of piezometer installation was conducted in the CAA-5B floating product investigation area in October 2005, when three piezometers (CAA-5B-TMP-011, CAA-5B-TMP-012, and CAA-5B-TMP-013) were installed to investigate the northward extent of floating product south of Building 5.

There were numerous indications of free product, with six borings yielding positive indications for one or more of the free-product indicators. The northern margin of free product may extend beneath Building 5. The southern, eastern, and western margins appear fairly well delineated.

A1.5.2.6 SOLID WASTE MANAGEMENT UNIT REPORT

Seven SWMU sites (AOC 261, NADEP GAP 25, NADEP GAP 26, OWS 005, OWS 615, SWMU 615, and UST[R]-19) were included in the 2005 SWMU Report (SulTech 2005b). The approximate locations of the SWMUs listed in the SWMU Report are shown on Figure A1-10. AOC 261 is the former location of USTs 261-1 through 261-3. The NADEP GAP units were part of the RCRA generator accumulation point hazardous waste management system initiated in 1987 and operated until base closure and building cleanup in 1997. Actual startup dates are unknown. OWS 005 was associated with the former cyanide destruction and plating wastewater pretreatment area and the SWMU Report indicates that OWS has not been removed. OWS 615, also known as UST 615-3, has been removed, and adequate soil sampling has been conducted at the former location of this OWS. SWMU 615 is Building 615 and the four associated tanks. UST(R)-19 is the location of tanks UST 615-1 and 615-2 (see Section A1.5.2.5 above).

A1.5.3 Proposed Sampling Rationale and Design

The problem statement and optimized sampling design (DQO Steps 1 and 7) proposed for Evaluation Area 5 are presented in this subsection. Sitewide DQOs that apply to Evaluation Area 5 are presented in Table 1-7 of the SAP. DQOs for OWSs are presented in Table 1-8 of the SAP. DQOs for non-OWS SWMUs that apply to Evaluation Area 5 are presented in Table 1-9 of the SAP. Proposed sampling locations are shown on Figure A1-10.

The sampling plan for Evaluation Area 5 addresses possible continuing sources of VOCs, TPH, metals(including hexavalent chromium), and cyanide in soil that may have resulted from releases from wastewater from with plating operations in Building 5, wastewater associated with Building 348, the former location of IWTP 5, former USTs, and a former hazardous waste storage area. Data collected during these investigation activities will be used in conjunction with existing data to complete characterization of the nature and extent of COPCs for this area, to conduct a risk assessment, and to support an FS.

Soil samples collected in Evaluation Area 5 during previous investigations contained VOC and metals concentrations above the comparison criteria (Tables A1-12 and A1-17). The presence of VOCs in groundwater beneath Evaluation Area 5 suggests the possible presence of VOCs in soil that could be a continuing source of VOCs released to groundwater. Therefore, soil sampling will be conducted in those portions of Evaluation Area 5 that have not been characterized for VOCs to assess the possible presence of VOCs in vadose zone soil. Evaluation Area 5 will be divided into 100-by-100-foot grids and one boring will be located within each grid with no previous VOC sampling (EA5SB01 through EA5SB17), within the grid containing Building 615 (EA5SB20), and within the grid containing only previous sampling for BTEX VOCs (EA5SB21). Samples from three borings south of former Building 348 (EA5SB15 through EA5SB17) will be analyzed for metals to address elevated chromium and lead concentrations and will also be analyzed for hexavalent chromium and cyanide. Samples from borings EA5SB13 (located within the footprint of former Building 261) and EA5SB14 (located between former Buildings 261 and 348) will also be analyzed for metals, hexavalent chromium, and cyanide. In addition, discrete groundwater samples will be collected from one location south of former Building 348 (EA5SB17) to address the extent of VOCs previously reported in groundwater in the vicinity of this building, and to evaluate the possible presence of 1,4-dioxane, metals (including hexavalent chromium), and cyanide. Discrete groundwater samples will be collected at 10 to 15 feet bgs and 25 to 30 feet bgs.

The OU-2C RI report will address all metals reported in soil (in addition to chromium and lead) and will identify which metals may represent a release. The OU-2C RI report will include a statistical comparison of metals concentrations for OU-2C to the Alameda Point background data set. The RI report will also address all metals concentrations for individual samples that exceed the Alameda Point background 95th percentile to assess whether there has been a release, regardless of whether the OU-2C data set for a given metal is comparable to background.

To address concerns regarding potential releases from industrial wastewater sewer lines in Evaluation Area 5, two borings (EA5SB18 and EA5SB19) will be placed at a location along the drain lines downstream from the plating shop. Soil and discrete groundwater samples will be analyzed for VOCs, 1,4-dioxane, metals, hexavalent chromium, and cyanide. Soil samples will be collected at depths of 0 to 0.5 foot bgs and 2 to 4 feet bgs. Discrete groundwater samples will be collected at 10 to 15 feet bgs and 25 to 30 feet bgs.

A soil sample for geotechnical analysis will be collected at boring location EA5SB14 in the 2-to-4-foot depth interval.

In the event that analytical results for soil samples from Evaluation Area 5 borings indicate the presence of constituents for which no previous groundwater sampling has been conducted, discrete groundwater sampling may be required. The decision logic for additional discrete groundwater sampling is illustrated on Figure A1-18 and described in Table A1-18. In the event that analytical results for discrete groundwater samples are above comparison criteria, additional monitoring wells may be needed. The decision logic for additional monitoring well installation is illustrated on Figure A1-17 and described in Table A1-18.

Two SWMU locations within Evaluation Area 5 will be sampled: NADEP GAP 25 and OWS 005. The following discussion presents the problem statement and optimized sampling design proposed for these SWMUs (DQO Steps 1 and 7).

- SWMU-specific issues will follow DQOs presented in Table 1-9 of the SAP. OWS-specific issues will follow DQOs presented in Table 1-8 of the SAP.
- Soil samples will be collected from one boring at each SWMU. The borings will be adjacent to and on the assumed downgradient side, where possible, of each SWMU or at the location of cracks or joints in concrete. Soil samples will be collected at three depths from each boring (0 to 0.5, 2 to 4, and 4 to 6 feet bgs); the third sampling depth will be at the water table (soil/water interface).
- For OWS SWMUs, an additional soil sample will be collected at a depth below the bottom of the OWS (up to 10 to 12 feet bgs), which is expected to be in the saturated zone.
- At SWMU locations within the boundaries of Evaluation Area 1, discrete groundwater samples will be collected in the shallower FWBZ (10 to 15 feet bgs) and the deeper FWBZ (25 to 30 feet bgs). Due to the proximity of NADEP GAP 25 and OWS 005 (see Figure A1-10), groundwater sampling will be conducted at OWS 005 only.
- Soil and groundwater samples will be analyzed for VOCs, TPH, SVOCs, 1,4-dioxane, PCBs, metals, hexavalent chromium, and cyanide. Groundwater samples will also be analyzed for TDS, if sufficient volume can be obtained.

In the event that analytical results for soil samples from either of the two SWMU locations in Evaluation Area 5 are above comparison criteria, step-out soil sampling may be required. The decision logic for additional soil sampling is illustrated on Figure A1-19 and described in Table A1-18. Additionally, although sampling for Evaluation Area 5 is within the area of known groundwater contamination, step-out discrete groundwater sampling will be considered if results of planned discrete groundwater sampling are above comparison criteria and are not consistent with known nature and extent of contamination. The decision logic for additional SWMU discrete groundwater sampling is illustrated on Figure A1-20 and described in Table A1-18. In the event that analytical results for discrete groundwater samples from the OWS 005 and GAP NADEP 25 locations are above comparison criteria, additional monitoring wells may be needed. The decision logic for additional monitoring well installation is illustrated on Figure A1-17 and described in Table A1-18.

Building 415 is located within Evaluation Area 5 and will be sampled in accordance with sitewide DQOs presented in Table 1-7 of the SAP. The discussion of the problem statement and optimized sampling design proposed for this data gap is presented in Section A1.7.5.3.

A1.6 EVALUATION AREA 6

Evaluation Area 6 is a 2.4-acre area along the eastern side of Building 5 south of Building 62, including EBS Parcel 56 and portions of EBS Parcels 54, 58, and 59

(Figure A1-11). Evaluation Area 6 includes the area adjacent to various shop activities that operated inside Building 5, Building 500, and Structure 34. Evaluation Area 6 also contains CAA-5A, which has been transferred to CERCLA for closure due to the presence of chlorinated VOCs in underlying groundwater. The majority of Evaluation Area 6 is paved open space. Former SWMUs located within Evaluation Area 6 included AOC 005 (USTs 5-2 and 5-3); ASTs 005A, 005B, 005C, 005D, 005G, and 500; and NADEP GAP 20. Two of the SWMUs (AOC 005 and NADEP GAP 20) have been identified for further sampling. On Figure A1-11, a circle with a 50-foot radius has been drawn around each of the SWMUs identified for sampling and labeled "area of interest."

Evaluation Area 6 addresses the following data gaps:

- the possible presence of VOCs, 1,4-dioxane, PCBs, and metals in soil that may represent an ongoing release to groundwater
- the possible presence of TPH in soil and groundwater associated with former USTs
- a possible release of PCBs from transformers in the former electrical substation (Building 34)
- a possible release of VOCs, TPH, SVOCs, PCBs, and metals in soil and groundwater at the former locations of two SWMUs (AOC 005 and NADEP 20)

A1.6.1 Historical Use

The area east of Building 5 was used for vehicle and equipment parking, roadway, and material storage and is completely paved. Building 500 is located at the southern end of Evaluation Area 5 and was historically used for equipment handling and transfer, office operations, chemical and equipment storage, and woodworking (IT 2001a). Building 34 was located just north of Building 500 and was formerly an electrical substation housing PCB-containing transformers. Several ASTs that were reportedly never used and UST 5-3, which was used to store waste oil and solvents, were located he central portion of Evaluation Area 5. UST 5-2, which was used to store jet fuel, was formerly located in the northern portion of Evaluation Area 5. A possible solvent tank was reportedly located outside the northeast corner of Building 5 (TtEMI 1999a). The reported location of this tank is identical to the location of former UST 5-2. The former locations of UST 5-2 and UST 5-3 have been designated as AOC 005. CAA-5A is located entirely within Evaluation Area 6.

The areas described above are shown on Figure A1-11.

A1.6.2 Previous Investigations

Four investigations plus UST removal actions have included the collection of soil samples within Evaluation Area 6:

- Phase 2B and 3 Investigation, 1991
- Follow-On Investigation, CTO-260, 1994

- EBS Phase 2B and Phase 2C
- 2003 PAH Study
- TPH Investigations

These investigations are described in Section 3 of the Work Plan. The results of these investigations for samples collected in Evaluation Area 6 are summarized below. Locations sampled in the boundaries of Evaluation Area 6 are shown on Figure A1-11. Analytical results for soil samples collected within Evaluation Area 6 are included on CD in Appendix A2 to the SAP.

A1.6.2.1 PHASE 2B AND 3 INVESTIGATION, 1991 SOIL SAMPLING

Sampling for this investigation was performed as part of the NAS Alameda RI to determine if soil and groundwater were contaminated in areas identified as potential waste release sites (Canonie Environmental 1990). The investigation focused on the industrial, sanitary, and storm sewers, and included collecting soil and groundwater samples, installing groundwater monitoring wells, and performing groundwater monitoring (PRC and JMM1992).

Within Evaluation Area 6, the investigation included installation of two borings (B05-10 and B05-11) at a location just east of Building 5 in the northern portion of Evaluation Area 6 (Figure A1-11). Soil samples collected from these borings were analyzed for VOCs, SVOCs, metals, and cyanide (PRC and JMM 1992). Samples were collected at five depths (1, 2, 6.5, 8, and 14 feet bgs). The shallowest sample was not analyzed for VOCs and the three deepest samples were likely within the saturated zone. COPCs reported included VOCs, SVOCs, and metals.

VOCs reported in soil samples included 1,1-DCA; PCE; 1,1,1-TCA; and TCE. TCE was reported at a concentration exceeding the comparison criteria from one sample collected at a depth of 14 feet bgs (Table A1-12). The only SVOCs reported at concentrations exceeding detection limits were PAHs. Metals concentrations were below comparison criteria or, in the case of arsenic, comparable to Alameda Point background levels.

A1.6.2.2 FOLLOW-ON INVESTIGATION, CTO-260, 1994 SOIL SAMPLING

The objective of this investigation was to fill data gaps from previous investigations by collecting additional chemical, geological, and hydrogeologic information, with the goal of assessing the nature and extent of soil and groundwater contamination to prepare an RI and feasibility study (PRC and MW 1996a). Field activities included performing CPT; collecting direct-push groundwater samples and HydroPunch samples; installing wells, including SWBZ monitoring wells and a reference boring; and performing four quarters of groundwater monitoring.

During the 1994 follow-on investigation under CTO-260, ten soil samples were collected from the three soil borings (B05-14, B05-14A, and B05-15) and three soil samples from the boring for well M05-07 in Evaluation Area 6. The borings were installed to further evaluate the lateral extent of elevated VOC concentrations found during the Phase 2B and 3

investigation. Soil samples were analyzed for VOCs and general chemistry parameters only. COPCs reported included 1,1,1-TCA; 1,1-DCA; 1,1-DCE; TCE; benzene; toluene; xylenes; and carbon disulfide. Similar compounds were reported during the initial Phase 2B and 3 investigation. See Table A1-4 for a summary of monitoring well data. Concentrations were below comparison criteria.

A1.6.2.3 ENVIRONMENTAL BASELINE SURVEY, 2001 SOIL SAMPLING

Evaluation Area 6 contains EBS Parcel 58 and portions of EBS Parcels 54 and 56. Sampling in EBS Parcels 54 and 58 within Evaluation Area 6 is summarized below. No EBS sampling for EBS Parcel 56 was conducted within Evaluation Area 6.

EBS Parcel 54

EBS Parcel 54 Target Area 6 included the stained area located southwest of the intersection of Second Street and Avenue D. This area may have been impacted by fuels, oils, and metals. Surface soil samples at three locations (054-005-032 through 054-006-034) were collected in this area and analyzed for TPH, SVOCs, and metals (Figure A1-11). On the basis of these data, it does not appear that EBS Parcel 54 Target 6 has been affected by constituents associated with IR Site 5. No additional EBS sampling was recommended at this target area (IT 2001a).

One sanitary sewer line sampling location (054-SN-003) and one storm drain sewer line sampling location (054-SS-005) were located within Evaluation Area 6. Soil samples were collected at depths of 8.5 to 10 feet bgs (likely in the saturated zone) and analyzed for VOCs, TPH, SVOCs, metals, and cyanide. COPCs reported in these samples included VOCs, TPH, SVOCs, and metals. TCE, TPH as diesel, and arsenic were reported at concentrations exceeding comparison criteria (Tables A1-12 and A1-13), and arsenic concentrations were comparable to background levels.

EBS Parcel 58

Phase 2A at EBS Parcel 58 included sampling at one target area. The target area included the soil beneath the hazardous materials lockers in the southern portion of the open space. Surface soil (1 to 1.5 feet bgs) and subsurface soil (3 to 5 feet bgs) samples were collected at two locations (058-001-001 and 058-001-002) (Figure A1-11). Samples were analyzed for TPH and SVOCs. Subsurface samples were analyzed for VOCs. Low levels of 1,1,1-TCA, TPH as motor oil, and phthalates were reported at EBS Parcel 58. No concentrations exceeded comparison criteria. On the basis of these data, no additional sampling was recommended in this target area (IT 2001a).

One sanitary sewer line sampling location (058-SN-001) was located within Evaluation Area 6. Soil samples were collected at depths of 6.5 to 7.5 feet bgs (likely in the saturated zone) and analyzed for VOCs, TPH, SVOCs, metals, and cyanide. COPCs reported in this samples included 1,1,1-TCA, a phthalate, and metals. No concentrations exceeded comparison criteria.

A1.6.2.4 2003 POLYNUCLEAR AROMATIC HYDROCARBON STUDY

Twelve soil borings (C3S005B049, C3S005B050, C3S005B058, C3S005B059, C3S005B066, C3S005B067, C3S010B075, C3S005B076, C3S005B083, C3S005B084, C3S005B092, and C3S010B093) were advanced in Evaluation Area 6 during the 2003 PAH study (BEI 2004). Samples were collected from four depth intervals between 0 and 8 feet bgs and analyzed for PAHs. All PAH concentrations were below the screening criterion.

A1.6.2.5 TOTAL PETROLEUM HYDROCARBON INVESTIGATIONS

The paragraphs below summarize the results of soil sampling conducted as part of TPH investigations at USTs in Evaluation Area 6.

UST 5-2, a 4,000-gallon steel tank used to store jet fuel, was located east of Building 5 (TtEMI 1997a, 2003). The tank was removed on June 24, 1997. Soil samples collected at 7 and 9 feet bgs following the UST removal (locations NAS05-01-S-07 and NAS05-02-S09) were analyzed for BTEX and TPH and contained TPH as diesel at concentrations up to 4,800 mg/kg (TtEMI 1997a). The UST closure report indicated that a jet fuel release to the soil and groundwater had occurred, and corrective action is ongoing (TtEMI 2003). The former location of UST 5-2, along with UST 5-3, is designated as AOC 005 and is being addressed under the Alameda Point TPH Program at CAA-5A.

UST 5-3 was a 320-gallon steel tank used to store waste oil and solvents, and was located east of Building 5 (TtEMI 1999c, 2003). The tank was removed on December 8, 1998. Contaminated soil was removed. The product line had a 3-inch hole (TtEMI 1999c). Soil samples collected at 5 and 7.5 feet bgs after the UST removal (locations 030-MOD1-283, -284, and -285) were analyzed for VOCs, TPH, SVOCs, and metals. Samples contained chlorinated VOCs, TPH, and SVOC bis(3-ethylhexyl)phthalate (Tables A1-12, A1-13, and A1-15) at concentrations exceeding comparison criteria. VOCs reported at concentrations exceeding comparison criteria included 1,1-DCA; 1,2-DCE; PCE; and TCE. As described above, the former location of UST 5-3 is part of AOC 005 and is within CAA-5A.

A1.6.2.6 SOLID WASTE MANAGEMENT UNIT REPORT

Seven SWMU sites (AOC 005, AST 005A through 005D, AST 005 G, and NADEP GAP 20) in Evaluation Area 6 were included in the 2005 SWMU Report (SulTech 2005b). The approximate locations of the SWMUs listed in the SWMU Report are shown on Figure A1-11. AOC 005 is the former location of USTs 5-2 and 5-3. The NADEP GAP units were part of the RCRA GAP hazardous waste management system initiated in 1987 and operated until base closure and building cleanup in 1997. Actual startup dates are unknown.

A1.6.3 Proposed Sampling Rationale and Design

The problem statement and optimized sampling design (DQO Steps 1 and 7) proposed for Evaluation Area 6 are presented in this subsection. Sitewide DQOs that apply to Evaluation Area 6 are presented in Table 1-7 of the SAP. DQOs for SWMUs within

Evaluation Area 6 are presented in Table 1-9 in the SAP. Proposed sampling locations are shown on Figure A1-11.

The sampling plan for Evaluation Area 6 addresses possible continuing sources of VOCs, TPH, and PCBs in soil that may have resulted from releases associated with former USTs and ASTs, other SWMUs, and operations within adjacent Building 5. Data collected during these investigation activities will be used in conjunction with existing data to complete characterization of the nature and extent of COPCs for this area, to conduct a risk assessment, and to support an FS.

Soil samples collected in Evaluation Area 6 during previous investigations contained VOC and TPH concentrations above the comparison criteria (Tables A1-12 and A1-13). The presence of VOCs in groundwater beneath Evaluation Area 6 suggests the possible presence of VOCs in soil that could be a continuing source of VOCs released to groundwater. Therefore, soil sampling will be conducted in Evaluation Area 6 for VOCs to assess the possible presence of VOCs in vadose zone soil. Evaluation Area 6 will be divided into 100-by-100-foot grids and one boring will be located within each grid having no previous VOC sampling for an approximate total of 10 borings. Due to the concern that USTs may have held waste oils, soil samples will also be analyzed for TPH and PCBs. Soil samples will be collected at three depths from each boring (0 to 0.5, 2 to 4, and 4 to 6 feet bgs); the third sampling depth will be at the water table (soil/water interface).

In the event that analytical results for soil samples from Evaluation Area 6 borings indicate the presence of constituents for which no previous groundwater sampling has been conducted, discrete groundwater sampling may be required. The decision logic for additional discrete groundwater sampling is illustrated on Figure A1-18 and described in Table A1-18. In the event that analytical results for discrete groundwater samples are above comparison criteria, additional monitoring wells may be needed. The decision logic for additional monitoring well installation is illustrated on Figure A1-17 and described in Table A1-18.

Three SWMU locations within Evaluation Area 6 will be sampled, including AOC 005, AST 005G, and NADEP GAP 20. The following discussion presents the problem statement and optimized sampling design proposed for these SWMUs (DQO Steps 1 and 7).

- SWMU-specific issues will follow DQOs presented in Table 1-9 in the SAP.
- Soil and discrete groundwater samples will be collected from one boring at each SWMU. The borings will be adjacent to and on the assumed downgradient side, where possible, of each SWMU or at the location of cracks or joints in concrete. Soil samples will be collected at three depths from each boring (0 to 0.5, 2 to 4, and 4 to 6 feet bgs); the third sampling depth will be at the water table (soil/water interface).
- Soil and groundwater samples will be analyzed for VOCs, TPH, SVOCs, 1,4-dioxane, PCBs, and metals,. Groundwater samples will also be analyzed for TDS, if sufficient volume can be obtained.

In the event that analytical results for soil samples from one or more of the three SWMU locations in Evaluation Area 6 are above comparison criteria, step-out soil sampling may be required. The decision logic for additional soil sampling is illustrated on Figure A1-19 and described in Table A1-18. Additionally, although sampling for Evaluation Area 6 is within the area of known groundwater contamination, step-out discrete groundwater sampling will be considered if results of planned discrete groundwater sampling are above comparison criteria and are not consistent with known nature and extent of contamination. The decision logic for additional SWMU discrete groundwater sampling is illustrated on Figure A1-20 and described in Table A1-18. In the event that analytical results for discrete groundwater samples from one or more of the three SWMU locations are above comparison criteria, additional monitoring wells may be needed. The decision logic for additional monitoring well installation is illustrated on Figure A1-17 and described in Table A1-18.

Buildings 34 and 500, which are considered data gap areas, are located in Evaluation Area 6. These areas will be sampled in accordance with sitewide DQOs presented in Table 1-9of the SAP. The discussion of the problem statement and optimized sampling design proposed for these data gaps is presented in Section A1.7.2.3

A1.7 IR SITE 5 DATA GAP AREAS

This section discusses data gap areas (Buildings 6, 34, 43, 44, 102, 282, 347, 405, 415, 500, and 505 and the PAH area) in IR Site 5 that have been identified by the draft SulTech RI Report (SulTech 2005a) or the regulators as requiring further soil and/or groundwater sampling data in order to characterize any potential contamination. The data gap areas represent various small buildings or portions of buildings, and therefore were not defined as Evaluation Areas. Discussion of data gaps is grouped by location. Proposed sampling for those data gap areas located within evaluation areas is discussed with the relevant evaluation area.

During meetings held on May 16 and June 15, 2006, the Navy and the regulatory agencies discussed data gaps identified by the regulatory agencies during their review of the draft RI Report (SulTech 2005a). During these discussions, the Navy and BEI provided a response to the agencies' request for additional sampling within OU-2C. Agency concurrence with the Navy's proposed approach to address each data gap (by sampling or by demonstrating that adequate data were already available) was received during the June 15, 2006, discussion. For data gap areas, no additional PCB sampling is proposed, except as described below, for the reason that the final PCB Summary Removal Report and PCB Equipment Inventory indicated no locations with measurable PCB concentrations (ITSI 2002). No additional sampling to address possible PCBs related to transformer at Building 10 (IR Site 12) is proposed. Although Building 10 was formerly a power plant, it was used for steam and compressed air generation and therefore did not include transformers for transmission of electricity. Additionally, previous soil sampling conducted in the vicinity of Building 10 did not indicate the presence of PCBs. No additional sampling to address cyanide in soil at Building 32 is proposed. Previous sampling beneath Building 32 was conducted using angled borings

and no cyanide or hexavalent chromium was reported at concentrations above detection limits in samples from these borings. Additionally, Building 32 was closed under a RCRA Part B permit.

A1.7.1 Buildings 6 and 282

Buildings 6 and 282 are located in EBS Parcels 68 and 186, respectively, to the east of Building 5 (Figure A1-12). The southeast corner of Building 6 and Building 282 are associated with a former diesel and motor gasoline station. Four SWMUs undergoing further evaluation under this Work Plan are also located in and around Building 6: OWS 006A, OWS 006B, NAS GAP 01, and UST(R)-02. On Figure A1-12, a circle with a 50-foot radius has been drawn around each of the SWMUs identified for sampling and labeled "area of interest."

A1.7.1.1 HISTORICAL USE

Since closure of NAS Alameda, Building 6 has been used as a Fire Station by the City of Alameda. The building was formerly used as NAS Alameda Fire Station and as a vehicle maintenance and repair facility and referred to as the Public Works Commission (PWC) transmission shop garage. The building has been used as a repair shop, steam cleaning facility, electromotor shop, storage area, and fire station. Building 6 consists of two wings that were originally constructed as two buildings (Buildings 6 and 7) in 1940 and became joined as one building in 1960. Building 6 is constructed with concrete walls and floors, a gravel composite roof, and covers approximately 40,000 square feet. There are hydraulic lift systems located in the garage bays which may or may not be operable. The reserve tanks and lines were still in place at the time of the EBS (IT 2001a). OWS 006A is located in the steam cleaning bay at the southwest corner of the east wing of the building. OWS 006B is located in the northwest corner of the west wing of Building 6. Two USTs (UST[R]-02) were located in the area between the two wings of the building. NAS GAP 01 was located in EBS Parcel 186 south of the eastern wing of Building 6.

Building 282 served as a diesel and motor oil gasoline station. This building was constructed in 1944 and covered approximately 300 feet. Fuel and other petroleum products storage occurred in and around the building, and a documented diesel fuel spill occurred north of Building 282. The date and quantity spilled was not detailed in the EBS information presented in the PEP. The area was added to the RCRA Corrective Action Program as SWMU 282. Subsequently, the two USTs at Building 282 were removed, soil and groundwater sampling was conducted, and the SWMU was closed under the TPH Program. No other documented incidents such as fires or flooding have occurred within Building 282.

A1.7.1.2 PREVIOUS INVESTIGATIONS

Two investigations and two UST removal actions were conducted in the area of Buildings 6 and 282, and results of the investigations are summarized below. Locations sampled in and around Buildings 6 and 282 are shown on Figure A1-12.

Analytical results for soil samples collected at Buildings 6 and 282 are included on CD in Appendix A2 to the SAP.

Environmental Baseline Survey

Phase 2A at EBS Parcel 68 included sampling the soils beneath the shop areas of Building 6, which may have been impacted by documented spills. In addition, scattered stains covered approximately 30 percent of the floor area. Therefore, soil beneath Building 6 was sampled to investigate the potential presence of petroleum hydrocarbons (primarily lubricating oils) from within the vehicle maintenance and repair shop. Surface and subsurface soil samples were collected from beneath the stained areas of the shop at eight locations (068-001-001 through 068-001-008) (Figure A1-12). These samples were analyzed for metals and TPH. Low levels of TPH as motor oil were reported in only one of the eight samples obtained from this target area. The detected metal concentrations were within the Alameda Point background concentrations and below the comparison criteria. On the basis of these data, no additional sampling was recommended (IT 2001a).

At two locations south of Building 6 (068-002-009 through 068-002-010), surface soil samples were collected and analyzed for TPH and subsurface soil samples were collected and analyzed for VOCs. These samples were collected to characterize an area that may have been impacted by a diesel fuel spill documented at the fuel filling station (Building 282). TPH was not reported in the surface samples. Low concentrations of a common laboratory contaminant, methylene chloride, were reported in the subsurface samples. The results were all below comparison criteria. On the basis of these data, no additional sampling was recommended in this target area (IT 2001a).

UST Removal Sampling

SWMU 282 comprises the former location of UST 282-1 and UST 282-2, two 7,500-gallon steel tanks located near Building 282. UST 282-1 stored diesel and UST 282-2 stored unleaded gasoline (TtEMI 2003, IT 1998). Both tanks were removed on October 29, 1998, in good condition. Contaminated soil was excavated. Soil and groundwater samples were collected and analyzed for TPH and BTEX. Soil samples collected from monitoring well borings (282-MW1 through 282-MW3) collected after the UST removal contained TPH concentrations up to 33 mg/kg; discrete groundwater samples collected at 14 locations (282-1-ERM through 282-14-ERM) contained BTEX and TPH concentrations up to 4,234 µg/L (Table A1-7). Three monitoring wells (282-MW1 through 282-MW3) were installed, and monitoring well groundwater samples contained TPH concentrations up to 310 µg/L (Table A1-6). Corrective action is ongoing (TtEMI 2003).

UST(R)-02 comprises the former location of UST 6-1 and UST 6-2, two 2,500-gallon steel tanks used to store petroleum solvents (PWC 1996b). The tanks were removed on February 16, 1995, in unknown condition, and contaminated soil was removed. Soil samples and a groundwater sample were collected and analyzed for TPH, BTEX, and lead. Soil samples (T6-E, T6-N, T6-S, T6-W, T6-W1, and 6-1-T) collected after the UST removal contained TPH concentrations up to 60 mg/kg, and the groundwater sample

(6-L) contained TPH concentrations up to 1,200 µg/L and lead at 100 µg/L (Tables A1-7 and A1-10). Monitoring wells were not installed. Corrective action is ongoing (TtEMI 2003).

2003 Polynuclear Aromatic Hydrocarbon Study

Twelve soil borings (C3S005B060 through C3S005B063, C3S005B068 through C3S005B071, C3S005B077 through C3S005B079, and C3S005B085) were advanced in the area of Buildings 6 and 282 during the 2003 PAH study (BEI 2004). Samples were collected from four depth intervals between 0 and 8 feet bgs and analyzed for PAHs. All PAH concentrations were below the screening criterion.

A1.7.1.3 PROPOSED SAMPLING RATIONALE AND DESIGN

The sampling plan for the data gap area comprising Buildings 6 and 282 addresses potential impacts to soil and groundwater from a possible release chemicals related to repair shop, steam cleaning facility, electromotor shop, storage area, and fire station activities. Previous sampling activities addressed fuel constituents (BTEX, TPH, and lead) or PAHs. The following discussion presents the problem statement and optimized sampling design proposed for this data gap area (DQO Steps 1 and 7). Sitewide DQOs that apply are presented in Table 1-9 in the SAP. Proposed sampling locations are shown on Figure A1-12.

Previous sampling did not address the possible presence of chlorinated solvents, non-PAH SVOCs, and PCBs associated with repair and machine shop activities. Additional soil and discrete groundwater samples will be collected to assess the possible presence of VOCs, non-PAH SVOCs, 1,4-dioxane, PCBs, and metals. These data will be used in conjunction with existing data to characterize the nature and extent of contamination (if any) and, as needed, to conduct risk assessments for this area and to support an FS.

Soil samples will be collected from five borings at Building 6 and one boring at the former location of Building 282; two soil samples will be collected from each boring (0 to 0.5 foot and 2 to 4 feet bgs). For sampling locations where TPH is a chemical of interest, a third sample will be collected at the water table (soil/water interface) in the 4-to-6-foot depth interval. Three of the soil borings will be located within Building 6 with two sampling points (DG006SB01 and DG006SB03) located in the vicinity of the former garage bays and one sampling point (DG006SB02) in the northwestern corner of the building closest to OWS 006B. Two of the soil boring locations at Building 6 will be located in the courtyard adjacent to and downgradient from OWS 006A (SOW6ASB01) and UST(R)-02 (SUSTSB01), respectively. Discrete groundwater samples will be collected from the two borings in the courtyard of Building 6 and the boring at Building 282 (DG282SB01). The proposed soil and discrete groundwater sampling locations are shown on Figure A1-12.

Discrete groundwater samples will be collected using the HydroPunch or equivalent sampling method. The discrete groundwater samples will be collected from the FWBZ from approximately 5 to 10 feet below the groundwater table in each area.

Soil and groundwater samples will be analyzed for VOCs, non-PAH SVOCs, 1,4-dioxane, PCBs, and metals. Groundwater samples will also be analyzed for TDS, if sufficient volume can be obtained. Although TPH concentrations (as motor oil) were reported in EBS soil samples, these concentrations were below comparison criteria and no further investigation of TPH will be conducted as part of this data gap investigation for the three sampling locations within Building 6.

In the event that analytical results for soil samples from borings in this data gap area indicate the presence of constituents for which no previous groundwater sampling has been conducted, discrete groundwater sampling may be required. The decision logic for additional discrete groundwater sampling is illustrated on Figure A1-18 and described in Table A1-18.

For SWMU locations, step-out discrete groundwater sampling will be considered if results of planned discrete groundwater sampling are above comparison criteria and are not consistent with known nature and extent of contamination. The decision logic for additional SWMU discrete groundwater sampling is illustrated on Figure A1-20 and described in Table A1-18. In the event that analytical results for discrete groundwater samples from OWS 006A, UST(R)-02, or the location at Building 282, or any additional discrete groundwater samples from this data gap area, are above comparison criteria, additional monitoring wells may be needed. The decision logic for additional monitoring well installation is illustrated on Figure A1-17 and described in Table A1-18.

A1.7.2 Buildings 34 and 500

Buildings 34 and 500 are located in EBS Parcels 58 and 56, respectively, and are within the boundaries of Evaluation Area 6. NADEP GAP 20 is located near the northwestern corner of Building 500. Figure A1-11 shows the locations of Buildings 34 and 500 and NADEP GAP 20.

A1.7.2.1 HISTORICAL USE

Building 34 was constructed between 1975 and 1981 and covers about 150 square feet. The building is a concrete pad with no walls or roof. Historically, this building was an electrical substation. Most recently, this building contained vacuum circuit breakers. The Phase 1 EBS information contained in the PEP reports that no chemical storage other than oils in transformers is documented for this building. Historically, PCB-containing transformers were located in this area. Some staining was noted on the concrete pad upon which the transformers are mounted (IT 2001a).

Building 500 was constructed between 1958 and 1963 and covers approximately 4,200 square feet. The building is constructed of metal on a concrete foundation. The Phase 1 EBS site inspection noted that this building has historically been used for equipment handling and transfer.

Phase 1 EBS information presented in the PEP noted that activities in the building included office operations, chemical and equipment storage, and woodworking. Materials typically used in woodworking include oils, stains, paints, solvents, and glues.

During the Phase 1 EBS site inspection, less than 50 gallons of these materials were present and were stored in flammable materials cabinets.

A hazardous waste accumulation area was present outside the southeast corner of Building 5, less than 50 feet from Building 500. No spills are documented for Building 500, and no staining was observed during the Phase 1 EBS site inspection (IT 2001a).

A1.7.2.2 PREVIOUS INVESTIGATIONS

No previous investigations targeted sampling at Buildings 34 and 500. See Section A1.6.2 for previous investigations in Evaluation Area 6.

A1.7.2.3 PROPOSED SAMPLING RATIONALE AND DESIGN

The sampling plan for the data gap area consisting of the former location of Building 34 addresses impacts from a possible release of chemicals related to use as an electrical substation. The sampling plan for the data gap area consisting of Building 500 addresses potential impacts to soil from a possible release of chemicals related to equipment handling and woodworking activities. The following discussion presents the problem statement and optimized sampling design proposed for these data gap areas (DQO Steps 1 and 7). Sitewide DQOs that apply are presented in Table 1-9 in the SAP. Proposed sampling locations are shown on Figure A1-11.

No previous sampling has been conducted at the two buildings. Soil samples will be collected to assess the possible presence of VOCs, TPH, non-PAH SVOCs, 1,4-dioxane, PCBs, and metals. These data will be used to characterize the nature and extent of contamination, if any; and as needed, conduct risk assessments for this area and support an FS.

Soil samples will be collected from one boring at the former location of Building 34 and from one boring at Building 500. Soil samples will be collected at three depths from each boring (0 to 0.5, 2 to 4, and 4 to 6 feet bgs); the third sampling depth will be at the water table (soil/water interface). Discrete groundwater samples will be collected in the shallower FWBZ (10 to 15 feet bgs) and the deeper FWBZ (25 to 30 feet bgs) from the boring at the former location of Building 34. The proposed soil and groundwater sampling locations are shown on Figure A1-11.

Soil and groundwater samples will be analyzed for VOCs, TPH, non-PAH SVOCs, 1,4-dioxane, PCBs, and metals. Groundwater samples will also be analyzed for TDS, if sufficient volume can be obtained.

In the event that analytical results for soil samples from borings in this data gap area indicate the presence of constituents for which no previous groundwater sampling has been conducted, discrete groundwater sampling may be required. The decision logic for additional discrete groundwater sampling is illustrated on Figure A1-18 and described in Table A1-18.

Although sampling for these two data gap buildings is within the area of known groundwater contamination, step-out discrete groundwater sampling will be considered if results of the planned discrete groundwater sampling are above comparison criteria and

are not consistent with known nature and extent of contamination. The decision logic for additional SWMU discrete groundwater sampling will apply and is illustrated on Figure A1-20 and described in Table A1-18. In the event that analytical results for discrete groundwater samples from the location at Building 34, or for any additional discrete groundwater samples, are above comparison criteria, additional monitoring wells may be needed. The decision logic for additional monitoring well installation is illustrated on Figure A1-17 and described in Table A1-18.

A1.7.3 Buildings 43, 44, 102, 347, 505, and PAH Data Gap Area

Buildings 43, 44, 102, 347, 505 and the PAH data gap area are located in EBS Parcels 46, 47, and 48 to the west of Building 5 (Figure A1-13).

A1.7.3.1 HISTORICAL USE

Building 43, located in EBS Parcel 47, was constructed in approximately 1941 and covers about 10,000 square feet. The building is constructed of concrete walls and floor. Historically, this building was used as an ammunition overhaul and rework shop. The EBS Phase 1 information presented in the PEP noted that the building was most recently used for ordnance storage, a recreation area, training area, and office space. All ordnance was imported and exported in a packaged condition at Alameda Point. During the EBS Phase 1 site inspection, solvents, waxes, polish, cleaning agents, and petroleum products were stored in cabinets in Building 43. No evidence of spills or staining was noted during the EBS Phase 1 site inspection.

Building 44, located in EBS Parcel 48, was constructed in approximately 1941 and covers about 5,000 square feet. The building is constructed of concrete walls and floor. This building historically was used as an engineering laboratory and administrative offices. The Phase 1 EBS site inspection information presented in the PEP noted that three 1-gallon cans of roofing cement were observed on the roof. One dry-type transformer is stored in Building 44. During the Phase 1 EBS site inspection, a sign reading "Caution Radiation Area" was noted in the area of a former test bench for aircraft dials and gauges. No evidence of spills or staining was noted during the Phase 1 EBS site inspection.

Building 102, located in EBS Parcel 46, was constructed in approximately 1943 and covers 2,000 square feet. The building has a wood frame with a concrete floor. This building historically was used as an ordnance storage area. Most recently, the building was used as an office space for ordnance supply for the base, and had a small ammunition vault that is constructed entirely of concrete. According to Phase 1 EBS information presented in the PEP, all ordnance is imported and exported in a packaged condition at NAS Alameda. The Phase 1 EBS information presented in the PEP noted that storage of paint, nonhalogenated organic compounds, and petroleum products is documented for Building 102. During the Phase 1 EBS site inspection, none of these compounds were seen in Building 102. No spills are documented to have occurred in Building 43. During the Phase 1 EBS site inspection, no staining was observed in or around the building.

Building 347 (referenced as Building 397 in the EBS Phase 1), located in EBS Parcel 54, was constructed in 1946 and served as a general purpose manufacturing and repair facility. This building covers approximately 1,200 square feet. It was not inspected during the EBS Phase 1 site inspection because it was not accessible at the time of the inspection. Very little information was collected during the EBS Phase 1 activities for Building 347. The EBS Phase 1 report indicated that data regarding industrial processes, chemical storage, disposal practices, spill incidents, and a heating, ventilation and air conditioning system did not exist. Building 347 was inspected for the Asbestos Survey Report by Mare Island Naval Shipyard personnel.

Building 505, located in EBS Parcel 47, was located immediately north of Building 43. A concrete pad with an area of approximately 600 square feet remains at this location. At the time of the Asbestos Survey (late 1994), Building 505 was identified as a 247-square-foot electrical substation (Substation No.5) consisting of two concrete pads surrounded by a fence and containing electrical equipment. A visit to this site by IT personnel in November 2000, revealed that two Connex boxes and a 100-square-foot shed are situated on the concrete pad which was the former foundation of Building 505.

The PAH data gap area is a previous sampling location (030-S05-009) along the former fuel line south of Building 44 and a previous sampling location (C3S005B048) southeast of Building 44 and approximately 30 feet north of the former fuel line. The former fuel line extended east-west between Building 5 and the hangars west of OU-2C. The eastern portion of the PAH data gap area was also used for materials storage at various times between 1947 and 1990 as determined by review of aerial photographs.

A1.7.3.2 PREVIOUS INVESTIGATIONS

No sampling has been conducted within or in conjunction with Buildings 43, 44, 102, 347, and 505. Six investigations included the collection of samples near these buildings, and results from these sampling activities are discussed in the following subsections. Locations sampled in and around Buildings 43, 44, 102, 347, and 505 are shown on Figure A1-13. Analytical results for soil samples collected within this area are included on CD in Appendix A2 to the SAP.

At the direction of the Navy, an aerial photographic review was conducted to identify any areas that might require sampling that were not already addressed by the Work Plan. As a result of this review, a possible data gap was identified west of Building 5 and southeast of Building 44. This area appears to have been used for occasional storage of materials throughout the period from 1947 through 1990. This materials storage was in the area of proposed PAH sampling locations adjacent to previous sampling location C3S005B048. Because the only historical or planned analysis for this former materials storage area is for PAHs, there is a data gap for other potential chemicals that might have been released to soil in this area. Additional analyses have been added for soil samples from borings in this area.

Phase 2B and 3 Investigation, 1991

As part of the NAS Alameda RI to determine whether soil and groundwater were contaminated in potential waste release sites, one monitoring well (M05-02) was installed in EBS Parcel 49/54 to the west of Building 347 (PRC and JMM 1992).

A soil sample collected from this area and groundwater samples collected from this well were analyzed for VOCs, SVOCs, metals, cyanide, TOC, pH, acidity, and general chemical characteristics (PRC and JMM 1992). COPCs reported included VOCs, SVOCs, metals, and cyanide. Only vinyl chloride was reported at a concentration exceeding comparison criteria (Table A1-12).

Follow-On Investigation, CTO-260, 1994

During the 1994 follow-on investigation under CTO-260, a HydroPunch sample (HP-S05-07) was collected in EBS Parcel 47 west of Building 43. The boring was advanced to the top of the SWBZ underlying the Holocene Bay Mud at a depth of 47 feet bgs and a groundwater sample was collected. Six shallow monitoring wells (M05-06 through M05-10 and M08-7) were installed at IR Site 5 to further characterize the VOC and metals concentrations in the shallow groundwater aquifer. A reference boring at IR Site 5 (REF-S05-01) was located at the northwest corner of Building 5. The boring was drilled to a depth of 117 feet bgs and terminated after penetrating into approximately 5 feet of Yerba Buena Mud. Three deep wells (D05-01 through D05-03) were installed at IR Site 5 to assess the lateral extent of VOCs in the SWBZ. Wells M05-06 and D05-01 were located in the area of Buildings 43, 44, 102, and 347 (Figure A1-13).

Environmental Baseline Survey

Investigations of storm sewer sediments and storm sewer corridors were proceeding in 1995 at the same time as the Phases 2A and 2B sampling activities (IT 2001a). These storm sewer investigations were designed to address contaminants in and adjacent to the storm sewer lines. Two locations in EBS Parcel 46 adjacent to sanitary sewer lines and two locations in EBS Parcel 48 adjacent to storm sewers were involved as part of this study (sampling locations 046-SN-001, 046-SN-002, 048-SS-001, and 048-SS-002) (IT 2001a). These samples were analyzed for SVOCs, PCBs, organic lead, reactivity, oil and grease, TPH, and metals. Results were below comparison criteria.

Fuel Line Removal Action Sampling

Fuel line removal work was conducted at Alameda Point from June 1998 to February 1999, May to June 1999 (IT 2001b), and September to December 2001 (IT 2002b). During the 1998 and 1999 work, 29,634 linear feet of fuel line was removed, and 23,788 linear feet of fuel line was abandoned in place by cleaning and grouting the lines. These removed and abandoned fuel lines included some fuel lines located at IR Site 5. As of December 2001, all underground fuel lines at IR Sites 5, 10, and 12 had been removed or closed in place (IT 2002b). As part of the removal action, soil samples were collected at three locations in EBS Parcel 48 (030-S05-005, 030-S05-006, and 030-S05-009) and analyzed for VOCs, TPH, SVOCs, and metals. No VOCs (other than benzene), TPH, or

SVOCs (other than PAHs) were reported at concentrations exceeding comparison criteria. Benzene was reported at 1 µg/kg in a sample from location 030-S05-009 collected at 7.5 feet bgs. The calculated benzo(a)pyrene equivalent concentration for PAHs reported for the sample from location 030-S05-009 was 12,300 µg/kg (Table A1-14), which exceeds the Alameda Point–specific PAH screening criterion of 620 µg/kg. Sampling location 030-S05-009 represents the western extent of the PAH data gap area.

2003 Polynuclear Aromatic Hydrocarbon Study

Thirteen soil borings (C3S005B014 through C3S005B016, C3S005B029 through C3S005B031, C3S005B035, C3S005B036, C3S005B040, C3S005B046 through C3S005B048, and C3S005B057) were advanced in the area of Buildings 43, 44, 102, 347, and 505 during the 2003 PAH study (BEI 2004). Samples were collected from four depth intervals between 0 and 8 feet bgs and analyzed for PAHs. All PAH concentrations were below the screening criterion with the exception of one sample collected from boring C3S005B048 at a depth of 4 to 8 feet bgs (Table A1-14). Sampling location C3S005B048 is approximately 30 feet north of the former fuel line and 200 feet east of previous sampling location 030-S05-009; and represents the eastern extent of the PAH data gap area.

Basewide Groundwater Monitoring

Monitoring well M05-02 has been sampled quarterly or semiannually in 1997, 1998, and annually since 2002 as part of the ongoing BGMP (Shaw 2003a, 2004b, 2004c; PRC 1996; TtEMI 1997b, 1998). Groundwater samples were analyzed for VOCs, TPH, metals, anions, sulfide, alkalinity, and dissolved gases.

A1.7.3.3 PROPOSED SAMPLING RATIONALE AND DESIGN

The regulatory agencies have requested further evaluation of Buildings 43, 44, 102, 347, 505, and the PAH data gap area, as part of the OU-2C RI. The following discussion presents the problem statement and optimized sampling design proposed for these data gap area buildings (DQO Steps 1 and 7). Proposed sampling locations are shown on Figure A1-13.

- Data gap area buildings will follow DQOs presented in Table 1-9 in the SAP. Soil and discrete groundwater samples will be collected from one boring within, or adjacent to and on the assumed downgradient (where possible) side of, each building; two soil samples will be collected from each boring (0 to 0.5 foot bgs and 2 to 4 feet bgs). For sampling locations at which TPH is a chemical of interest, a third sample will be collected at the water table (soil/water interface) in the 4-to-6-foot depth interval. For Buildings 43, 44, 102, and 505, discrete groundwater samples will be collected at two depth intervals (10 to 15 feet bgs and 25 to 30 feet bgs). Groundwater samples representative of Building 347 will be collected from existing monitoring well M05-02 and planned monitoring well L05-02. Soil and groundwater samples will be analyzed for some or all of the following parameters: VOCs, extractable-range TPH, SVOCs, 1,4-dioxane, PCBs, and metals.

- At Building 44, soil samples will also be analyzed for radium.
- At Building 347, three borings will be advanced: one inside the building and two adjacent to the building in the stained area.
- PAH data gap area will follow DQOs presented in Table 1-9 in the SAP. Soil samples will be collected from one boring near previous sampling location 030-S05-009 and from two borings near previous sampling location C3S005048. Soil samples will be collected from each boring at 4 depths (0 to 0.5 foot bgs, 0.5 foot to 2 feet bgs, 2 to 4 feet bgs, and 4 to 8 feet bgs. Samples will be analyzed for PAHs. Soil samples collected at 0 to 0.5 foot bgs, 2 to 4 feet bgs, and 4 to 8 feet bgs from the two borings near previous sampling location C3S005B048 will also be analyzed for VOCs, TPH, SVOCs, PCBs, and metals.

A soil sample for geotechnical analysis will be collected at boring location DG102SB01 in the 2-to-4-foot depth interval.

Although sampling for these data gap buildings is within the area of known groundwater contamination, step-out discrete groundwater sampling will be considered if results of planned discrete groundwater sampling are above comparison criteria and are not consistent with known nature and extent of contamination. The decision logic for additional SWMU discrete groundwater sampling will apply and is illustrated on Figure A1-20 and described in Table A1-18.

A1.7.4 Building 405

Building 405 is located in EBS Parcel 49 to the west of Building 5 (Figure A1-13). NADEP GAP 27 was located in the fenced area at the south end of Building 405. This SWMU is undergoing further evaluation under this Work Plan. On Figure A1-13, a circle with a 50-foot radius has been drawn around this SWMU and labeled "area of interest."

A1.7.4.1 HISTORICAL USE

Building 405 was constructed in approximately 1958 and covers about 5,800 square feet. The building is constructed of steel on a concrete floor. Historically, this building was used as a ground support and equipment rework shop. The EBS Phase 1 site inspection information presented in the PEP noted that chemicals including trichlorofluoroethane, tricresyl phosphate, petroleum products, solvents, and non-chlorinated organics were stored in Building 405 directly on the floor without secondary containment. Up to 2,000 gallons of these chemicals were stored in Building 405. During the EBS Phase 1 site inspection, several portable dispensing carts were observed with absorbent material underlying the carts. The EBS Phase 1 site inspection noted that up to 1,700 gallons of hazardous wastes including halogenated and nonhalogenated organics, petroleum products, fuel, paint, and asbestos were stored in Building 405.

The EBS Phase 1 site inspection noted numerous stains on the floor that appeared to be related to the storage of lubricating oils and hydraulic fluid in Building 405. Approximately one-half of the floor is stained. Extensive staining was observed in a

trench at the west end of the building, and near the north side of the building. The area north of the building was addressed as Target Area 1.

A1.7.4.2 PREVIOUS INVESTIGATIONS

Two investigations were conducted in the area of Buildings 405, and results of the investigations are summarized below. Locations sampled in and around Building 405 are shown on Figure A1-13. Analytical results for soil samples collected at Building 405 are included on CD in Appendix A2 to the SAP.

Environmental Baseline Survey

Phase 2A at Parcel 49 included sampling at Target Areas 1 and 2 associated with Building 405. Target Area 1 consisted of the northern portion of Building 405, the open space immediately north of the building, and the stained area adjacent to Building 5. Target Area 1 included the collection of six surface soil samples (1 foot to 1.5 feet bgs) from sampling locations 049-001-001 through 049-001-006, and eight subsurface soil samples (3 to 3.5 feet bgs) from sampling locations 049-001-007 through 049-001-014 (Figure A1-13). This sampling was to address extensive staining in a trench at the west end of the building and near the north side of the building. Samples were collected using direct-push techniques and analyzed for SVOCs, metals, TPH, and VOCs. Low levels of TPH as motor oil were reported at the site along with low levels of several phthalate compounds (IT 2001a).

Target Area 2 at Parcel 49 consisted of the soil beneath SWMU/GAP 11 in Open Space II. This area covered approximately 400 square feet. Target compounds included lubricating oil, hydraulic fluid, and diesel range fuels. Two surface samples from locations 049-002-015 and 049-002-016 were collected and analyzed for TPH. Low levels of TPH as motor oil were reported at the site (IT 2001a).

2003 Polynuclear Aromatic Hydrocarbon Study

Six soil borings (C3S005B073, C3S005B074, C3S005B081, C3S005B082, C3S005B090, and C3S005B092) were advanced in the area of Building 405 during the 2003 PAH study (BEI 2004). Samples were collected from four depth intervals between 0 and 8 feet bgs and analyzed for PAHs. All PAH concentrations were below the screening criterion, except for one sample collected from boring C3S005B082 (Table A1-14).

A1.7.4.3 PROPOSED SAMPLING RATIONALE AND DESIGN

The sampling plan for the data gap area consisting of Building 405 addresses potential impacts to soil from a possible release of chemicals related to ground support and equipment rework shop activities. Previous sampling activities addressed VOCs, TPH, and SVOCs or PAHs, and was limited to the northern portion of the building The following discussion presents the problem statement and optimized sampling design proposed for this data gap area (DQO Steps 1 and 7). Sitewide DQOs that apply are presented in Table 1-9 in the SAP. Proposed sampling locations are shown on Figure A1-13.

Previous sampling did not address the possible presence of PCBs or metals associated with repair shop activities or possible release in the central and southern portion of the building. Additional soil samples will be collected to assess the possible presence of VOCs, non-PAH SVOCs, 1,4-dioxane, PCBs, and metals. These data will be used to characterize the nature and extent of contamination, if any; and as needed, conduct risk assessments for this area and support an FS.

Soil samples will be collected from two borings at Building 405, one at the northern end and one at the southern end. Soil samples will be collected at three depths from each boring (0 to 0.5, 2 to 4, and 4 to 6 feet bgs); the third sampling depth will be at the water table (soil/water interface). The proposed soil sampling locations are shown on Figure A1-13.

Soil samples will be analyzed for VOCs, TPH, non-PAH SVOCs, 1,4-dioxane, PCBs, and metals.

In the event that analytical results for soil samples from borings in this data gap area indicate the presence of constituents for which no previous groundwater sampling has been conducted, discrete groundwater sampling may be required. The decision logic for additional discrete groundwater sampling is illustrated on Figure A1-18 and described in Table A1-18.

A1.7.5 Building 415

Building 415 was located in EBS Parcel 57 to the south of Building 5; the former building location is within the boundaries of Evaluation Area 5 (Figure A1-10).

A1.7.5.1 HISTORICAL USE

Building 415 was located in EBS Parcel 57 to the south of Building 5. Building 415 was constructed in 1956 and consisted of a storage shed and a hazardous waste accumulation area. Chemicals that may have been used or stored there include petroleum products, resins, solvents, oils, and lubricants.

A1.7.5.2 PREVIOUS INVESTIGATIONS

No previous investigations targeted sampling at Building 415. See Section A1.5.2 for previous investigations within Evaluation Area 5.

A1.7.5.3 PROPOSED SAMPLING RATIONALE AND DESIGN

The sampling plan for the data gap area consisting of Building 415 addresses potential impacts to soil from a possible release chemicals related to storage of petroleum products, resins, solvents, oils, and lubricants; and storage of hazardous wastes. The following discussion presents the problem statement and optimized sampling design proposed for this data gap area (DQO Steps 1 and 7). Sitewide DQOs that apply are presented in Table 1-9 in the SAP. Proposed sampling locations are shown on Figure A1-10.

Soil samples will be collected to assess the possible presence of VOCs, TPH, non-PAH SVOCs, 1,4-dioxane, PCBs, metals, hexavalent chromium, and cyanide. These data will

be used to characterize the nature and extent of contamination, if any; and as needed, to conduct risk assessments for this area and to support an FS.

Soil samples will be collected from one boring at the former location of Building 415 (DG415SB01) and from one boring within the former hazardous waste storage area that surrounded Building 415 (DG414SB02). Soil samples will be collected at three depths from each boring (0 to 0.5, 2 to 4, and 4 to 6 feet bgs); the third sampling depth will be at the water table (soil/water interface). The proposed soil sampling location is shown on Figure A1-10.

Soil samples will be analyzed for VOCs, TPH, non-PAH SVOCs, 1,4-dioxane, PCBs, metals, hexavalent chromium, and cyanide.

In the event that analytical results for soil samples from borings in this data gap area indicate the presence of constituents for which no previous groundwater sampling has been conducted, discrete groundwater sampling may be required. The decision logic for additional discrete groundwater sampling is illustrated on Figure A1-18 and described in Table A1-18.

A1.8 IR SITE 10 DATA GAP AREA

This section discusses the data gap area (the hangar floor of Building 400) in IR Site 10 that has been identified by the draft SulTech RI Report (SulTech 2005a) or the regulators as requiring further soil and/or groundwater sampling data in order to characterize any potential contamination. The data gap area represents a portion of Building 400 and therefore was not defined as an Evaluation Area.

A1.8.1 Historical Use

Building 400 was constructed in 1957 and served as a missile armament and avionics rework facility (Figure A1-14). Only control systems were handled and no explosives were within the building. The space occupied by Building 400 (approximately 85 percent of the parcel) was formerly apron space used for aircraft parking and maneuvering. The building is the only structure on the property, with approximately 126,000 square feet of floor space. The south half of the building is a high bay hanger space referred to as Building 400A. No chemical spills were documented within the hanger but routine operations may have contributed materials to soil below the concrete floor.

A1.8.2 Previous Investigations

The EBS was the only investigation that was conducted within the hangar area of Building 400, and results of this investigation are summarized below. Locations sampled during previous investigations in and around Building 400 are shown on Figure A1-14. Analytical results for soil and groundwater samples collected within Building 400 are included on CD in Appendix A2 to the SAP.

Phase 2A at EBS Parcel 52 included sampling at three target areas. Target Area 1 addressed the fiberglass shop in the northeast corner section of Building 400. Target Area 2 addressed impacts of operations of the motor test and cleaning room and of a paint shop located south of the motor test room. The motor test room was located in the northeastern section of Building 400. Target Area 3, consisted of the main hanger floor in the southern half of Building 400, also known as Building 400A (IT 2001a).

For Target Area 3, four soil organic vapor samples were collected at depths between 2.5 and 3.5 feet bgs. Subsurface samples were collected at six locations (052-003-007, 052-003-008, 052-003-010, 052-003-013, 052-003-014, and 052-003-017) at depths between 3.0 and 4.5 feet bgs). Subsurface soil and soil organic vapor samples were analyzed for VOCs. Two of the soil organic vapor samples and one subsurface soil sample were collected from locations south of the structure. The VOC 1,1-DCE was reported in three of the four soil organic vapor samples. PCE and TCE were also identified in one sample. The VOC detections were found in soil organic vapor samples from the central floor region of Building 400A. No VOC compounds were reported in any of the subsurface soil samples, even though they were in close proximity to soil organic vapor samples with high VOC concentrations (IT 2001a).

Phase 2A sampling reported widespread detections of DCE in the hangar floor area and in a sample from the motor test room. As a result, for Phase 2B, 10 subsurface soil samples, 1 soil organic vapor sample, and 12 groundwater samples were collected in Target Area 2 (052-004-017 and 052-004-018) and Target Area 3 (052-004-019 through 052-004-126), and analyzed for VOCs. Analytical results revealed low concentrations of benzene, toluene, methylene chloride, and carbon disulfide in the samples collected. DCE was not reported in any of the samples. Eight groundwater samples yielded chloroform concentrations that exceeded comparison criteria (Table A1-5). In addition, three groundwater samples yielded TCE concentrations that also exceeded the comparison criteria. The Navy recommended incorporating these data into future studies at IR Site 10 (Building 400) (IT 2001a).

A1.8.3 Proposed Sampling Rationale and Design

The sampling plan for the data gap area consisting of Building 400 addresses potential impacts to soil from a possible release of chemicals related to former hangar area operations. The following discussion presents the problem statement and optimized sampling design proposed for this data gap area (DQO Steps 1 and 7). Sitewide DQOs that apply are presented in Table 1-9 in the SAP. Proposed sampling locations are shown on Figure A1-14.

Previous sampling targeted VOCs in soil and groundwater. Soil samples will be collected to assess the possible presence of TPH, non-PAH SVOCs, 1,4-dioxane, PCBs, and metals. These data will be used to characterize the nature and extent of contamination, if any; and as needed, to conduct risk assessments for this area and to support an FS.

Soil samples will be collected from borings at eight locations within the hangar area of Building 400. Soil samples will be collected at three depths from each boring (0 to 0.5, 2 to 4, and 4 to 6 feet bgs); the third sampling depth will be at the water table (soil/water interface). The proposed soil sampling locations are shown on Figure A1-14.

Soil samples will be analyzed for VOCs, TPH, non-PAH SVOCs, 1,4-dioxane, PCBs, and metals.

In the event that analytical results for soil samples from borings in this data gap area indicate the presence of constituents for which no previous groundwater sampling has been conducted, discrete groundwater sampling may be required. The decision logic for additional discrete groundwater sampling is illustrated on Figure A1-18 and described in Table A1-18.

A1.9 SOLID WASTE MANAGEMENT UNITS

There are 69 SWMUs within OU-2C. The draft RI Report (SulTech 2005a) presented available information on these SWMUs and made a recommendation for the disposition of each one. In their comments on the draft RI Report, the regulatory agencies disagreed with the recommendation for the majority of these SWMUs. (Refer to Attachment F to the Work Plan.)

In preparation of this Supplemental RI Work Plan, the Navy held meetings and a site visit to review each of the SWMUs in April, May, and June 2006. Eighteen SWMUs have received agency concurrence for no further action. Twenty-six SWMUs are proposed for no further action, based on the results of meetings with the agencies. Three SWMUs are being addressed under the Navy's TPH Program. Twenty-two SWMUs have been specifically identified for further sampling. Refer to Table A1-19 for a summary of the agreed-upon disposition of each for these SWMUs. Although UST(R)-01 is listed in Table A1-19 for no further sampling, one of the samples to be collected near Building 347 will be located close to this UST and will serve the purpose of further characterization.

Of the 22 SWMUs identified for further sampling, 14 have been addressed above as part of Evaluation Areas 3, 4, 5, and 6. Locations of these 14 SWMUs are shown on Figures A1-7 (M-01, M-02, M-09, NADEP GAP 57, and NADEP GAP 70), A1-9 (M-05, NADEP GAP 02, NADEP GAP 04, and NADEP GAP 31), A1-10 (OWS 005 and NADEP GAP 25), and A1-11 (AOC 005, AST 005G, and NADEP GAP 20). On each of these figures, a circle with a 50-foot radius has been drawn around each of the SWMUs identified for sampling and labeled "area of interest."

A1.9.1 Solid Waste Management Unit Locations and History

This subsection provides location and description information for the 22 SWMUs included for further investigation in this SAP; 14 of these SWMUs are also addressed within the evaluation areas described in Sections A1.1 through A1.6. The generalized SWMU locations are shown on Figure A1-1. Individual SWMU locations are shown on Figure A1-7 (M-01, M-02, M-09, and NADEP GAPs 57 and 70), Figure A1-9 (M-05,

and NADEP GAPs 02, 04, and 31), Figure A1-10 (OWS 005 and NADEP GAP 25), Figure A1-10 (AOC 005, AST 005G, and NADEP GAP 20), Figure A1-12 (OWS 006A and 006B, NAS GAP 01, and UST[R]-02), Figure A1-13 (NADEP GAP 27), Figure A1-14 (M-08), Figure A1-15 (OWS 010), and Figure A1-16 (NADEP GAP 17). On each of these figures, a circle with a 50-foot radius has been drawn around each of the SWMUs identified for sampling and labeled "area of interest."

A1.9.1.1 OWS 005

OWS 005 is located in EBS Parcel 54, south of Building 5 and is within the boundaries of Evaluation Area 5 (Figure A1-10). OWS 005 was associated with the former cyanide destruction and plating wastewater pretreatment area and the SWMU Report indicates that the OWS has not been removed (SulTech 2005b). No previous sampling locations targeted this OWS; thus, a data gap exists.

A1.9.1.2 OWS 006A

OWS 006A is located in EBS Parcel 68, in the southwestern corner of the eastern wing of Building 6, the PWC mechanics shop (Figure A1-12). The OWS is associated with a catch basin inside of the bay the former transmission shop garage with access outside the building (SulTech 2005b). No previous sampling locations addressed this OWS; thus, a data gap exists.

A1.9.1.3 OWS 006B

OWS 006B is located in EBS Parcel 68, in the northwestern corner of the west wing of Building 6, the PWC mechanics shop) (Figure A1-12). The OWS is a grease trap adjacent to the west wing machine shop with a 24-by-24-foot steel manhole cover (SulTech 2005b). No previous sampling locations addressed this OWS; thus, a data gap exists.

A1.9.1.4 OWS 0010

OWS 010 is located in EBS Parcel 69, in the western portion of Building 10, the power plant (Figure A1-15). The OWS is an oil interceptor tied into the trench system around floors in the compressor area of the building (SulTech 2005b). No previous sampling locations addressed the OWS; thus, a data gap exists.

A1.9.1.5 AST 005G

Former AST 005G was located in EBS Parcel 54, east of Building 5, (Figure A1-11) and was within the boundaries of Evaluation Area 6. The AST was a waste-oil tank and was removed (SulTech 2005b). No previous sampling locations targeted the former AST; thus, a data gap exists.

A1.9.1.6 DISTILLATION UNIT M-01

M-01 was located in EBS Parcel 54 inside the southern portion of Building 5, and was within the boundaries of Evaluation Area 3 (Figure A1-7). M-01 consisted of a portable

15-gallon solvent distillation unit. The unit was located in the metal treatment/heat exchange shop of Building 5. According to the RFA, no RCRA facility investigation was recommended for M-01 because the unit was located inside and on a concrete floor (DTSC 1992). No description of M-01 was included in the EBS Zone 10 Parcel 54 evaluation data summary report (IT 2001a). Because the unit was portable, it could have been moved or removed before the EBS (SulTech 2004). During the April 18, 2006 site walk, the approximate former location of M-01 was identified and designated for further sampling.

A1.9.1.7 DISTILLATION UNIT M-02

M-02 was located in EBS Parcel 54 inside the southern portion of Building 5, and was within the boundaries of Evaluation Area 3 (Figure A1-7). M-02 consisted of a portable 15-gallon solvent distillation unit. The unit was located in the former foundry and heat treatment area of Building 5. According to the RFA, no RCRA facility investigation was recommended for M-02, since the unit was located inside and on a concrete floor (DTSC 1992). No description of M-02 was included in the EBS Zone 10 Parcel 54 evaluation data summary report (IT 2001a). Because the unit was portable, it could have been moved or removed before the EBS (SulTech 2004). During the April 18, 2006 site walk, the approximate former location of M-02 was identified and designated for further sampling.

A1.9.1.8 DISTILLATION UNIT M-05

M-05 was located in EBS Parcel 54 inside the northern portion of Building 5, and was within the boundaries of Evaluation Area 4 (Figure A1-9). M-05 consisted of a portable 15-gallon solvent distillation unit. The unit was located in Aircraft Maintenance Line area of Building 5. According to the RFA, no RCRA facility investigation was recommended for M-05, since the unit was located inside and on a concrete floor (DTSC 1992). No description of M-05 was included in the EBS Zone 10 Parcel 54 evaluation data summary report (IT 2001a). Because the unit was portable, it could have been moved or removed before the EBS (SulTech 2004). During the April 18, 2006 site walk, the approximate former location of M-05 was identified and joints and cracks were observed in the floor near this location. Both the former location of M-05 and the area of joints and cracks were identified for further sampling.

A1.9.1.9 DISTILLATION UNIT M-08

M-08 was located in EBS Parcel 52 inside the northern portion of Building 400, the missile armament and avionics rework facility (Figure A1-14). M-08 consisted of a portable 15-gallon solvent distillation unit. The unit was located in the instrument reprocessing shop of Building 400. According to the RFA, no RCRA facility investigation was recommended for M-08, since the unit was located inside and on a concrete floor (DTSC 1992). No description of M-08 was included in the EBS Zone 11 Parcel 52 evaluation data summary report (IT 2001a). Because the unit was portable, it could have been moved or removed before the EBS (SulTech 2004). During the April

18, 2006 site walk, the former location of M-08 was identified as near a floor drain, and was designated for further sampling.

A1.9.1.10 COOLANT RECOVERY SYSTEM M-09

M-09 is located in EBS Parcel 54 inside the southern portion of Building 5, and is within the boundaries of Evaluation Area 3 (Figure A1-7). M-09 consisted of a permanent installation for solvent coolant recovery with four 500-gallon tanks within a concrete berm. The unit and berm are still present. The unit is located in the former machine shops area of Building 5. According to the RFA, no RCRA facility investigation was recommended for M-09 because the unit was located inside and had a concrete berm (DTSC 1992). No description of M-09 was included in the EBS Zone 10 Parcel 54 evaluation data summary report (IT 2001a). During the April 18, 2006 site walk, the location of M-09 was identified and designated for further sampling.

A1.9.1.11 NADEP GAP 02

NADEP GAP 02 was located in EBS Parcel 54 inside the northern portion of Building 5, and was within the boundaries of Evaluation Area 4 (Figure A1-9). The NADEP GAP units were administered under the RCRA GAP hazardous waste management system initiated in 1987 and operated until base closure and building cleanup in 1997. Actual startup dates are unknown (SulTech 2005b). According to the EBS, NADEP GAP 02 was located on concrete inside Building 5. The SWMU consisted of a temporary accumulation point for poly paint, thinner, and naphtha. The EBS concluded that NADEP GAP 02 did not require further investigation because the site was paved, relatively new, and staining was not observed by the site inspectors (IT 2001a). However, due to the nature of materials collected at this GAP (solvents), and no previous sampling nearby, this SWMU location was identified for further sampling.

A1.9.1.12 NADEP GAP 04

NADEP GAP 04 was located in EBS Parcel 54 inside the northern portion of Building 5, and was within the boundaries of Evaluation Area 4, in the shop area adjoining the Aircraft Maintenance Line (Figure A1-9). The NADEP GAP units were administered under the RCRA GAP hazardous waste management system initiated in 1987 and operated until base closure and building cleanup in 1997. Actual startup dates are unknown (SulTech 2005b). According to the EBS, NADEP GAP 04 was located on concrete inside Building 5. The SWMU consisted of 15 gallons of acid and one pallet of batteries. The COCs associated with this site include battery acid and nickel/cadmium solution. The EBS concluded that NADEP GAP 04 did not require further investigation because the site was paved, relatively new, and staining was not observed by the site inspectors (IT 2001a). During the April 18, 2006 site walk, the former location of this SWMU was identified in a room adjacent to the battery acid shop known as the paint-mixing area. However, due to the nature of materials collected at this GAP (metals and acids), and no previous sampling nearby, this SWMU location was identified for further sampling.

A1.9.1.13 NADEP GAP 17

NADEP GAP 17 was located in EBS Parcel 54 inside Building 5, overhaul repair shop 93433 (Figure A1-16). The NADEP GAP units were administered under the RCRA GAP hazardous waste management system initiated in 1987 and operated until base closure and building cleanup in 1997. Actual startup dates are unknown (SulTech 2005b). According to the EBS, NADEP GAP 17 was located on concrete inside Building 5. The SWMU consisted of 30- and 55-gallon storage drums, plus large poly bags. NADEP GAP 17 was not included in the RFA. The EBS concluded that NADEP GAP 17 did not require further investigation because the site was paved, relatively new, and staining was not observed by the site inspectors (IT 2001a). However, due to the nature of materials collected at this GAP (machine and grinding coolant with high nickel and chromium, some cadmium, aluminum oxide, and silicone carbide), and no previous sampling nearby, this SWMU location was identified for further sampling.

A1.9.1.14 NADEP GAP 20

NADEP GAP 20 was located in EBS Parcel 56, east of Building 5 and north of Building 500, and was within the boundaries of Evaluation Area 6 (Figure A1-11). The NADEP GAP units were administered under the RCRA GAP hazardous waste management system initiated in 1987 and operated until base closure and building cleanup in 1997. Actual startup dates are unknown (SulTech 2005b). According to the EBS, NADEP GAP 20 was located on concrete outside Building 500. The SWMU consisted of 55-gallon storage drums containing lead-contaminated items. The EBS identified a drum of methyl ethyl ketone and a 55-gallon drum of shop debris mixed with oil at this location. The EBS concluded that NADEP GAP 20 did not require further investigation because the site was paved, relatively new, and staining was not observed by the site inspectors (IT 2001a). However, due to the nature of materials collected at this GAP (possible solvent and lead), and no previous sampling nearby, this SWMU location was identified for further sampling.

A1.9.1.15 NADEP GAP 25

NADEP GAP 25 was located in EBS Parcel 54 south of Building 5, and was within the boundaries of Evaluation Area 5 (Figure A1-10). This location was formerly inside an extension to Building 5 that has since been removed. The NADEP GAP units were administered under the RCRA GAP hazardous waste management system initiated in 1987 and operated until base closure and building cleanup in 1997. Actual startup dates are unknown (SulTech 2005b). According to the EBS, NADEP GAP 25 was located on concrete inside Building 5. The SWMU consisted of 55-gallon drums and large bags. The COCs associated with this site included blasting grit (glass and garnet grit, and plastic media blast), ethyl acetate, and aluminum oxide. The EBS concluded that NADEP GAP 25 did not require further investigation because the site was paved, relatively new, and staining was not observed by the site inspectors (IT 2001a). However, due to the nature of materials collected at this GAP (metals in blasting grit), and no previous sampling nearby, this SWMU location was identified for further sampling.

A1.9.1.16 NADEP GAP 27

NADEP GAP 27 was located in EBS Parcel 54 on the southern side of Building 405, ground support and equipment rework facility, shop 93531 (Figure A1-13). The NADEP GAP units were administered under the RCRA GAP hazardous waste management system initiated in 1987 and operated until base closure and building cleanup in 1997. Actual startup dates are unknown (SulTech 2005b). According to the EBS, NADEP GAP 27 was located on concrete inside Building 5. The SWMU consisted of a 10-by-10-foot area located outdoors on asphalt in a fenced compound on the southern side of Building 405. Metal drums sitting on the asphalt held solid wastes. Two poly safety packs held liquid wastes. According to the RFA, NADEP GAP 27 exhibited a low potential for releases into soil and groundwater because the unit was on asphalt and liquid wastes were in self-contained packs (DTSC 1992). No stains were observed during the EBS Phase I investigation. A letter from DTSC dated November 4, 1999, recommended no further action for this SWMU (DTSC 1999b). However, due to the nature of materials collected at this GAP (hydraulic oils), and no previous sampling having been conducted nearby, this SWMU location was identified for further investigation.

A1.9.1.17 NADEP GAP 31

NADEP GAP 31 was located in EBS Parcel 54 inside the northern portion of Building 5, and was within the boundaries of Evaluation Area 4 (Figure A1-9). The NADEP GAP units were administered under the RCRA GAP hazardous waste management system initiated in 1987 and operated until base closure and building cleanup in 1997. Actual startup dates are unknown (SulTech 2005b). According to the EBS, NADEP GAP 31 was located on concrete inside Building 5. The SWMU consisted of 30- and 55-gallon drums containing various oils, solvents, and paint. The EBS concluded that NADEP GAP 31 did not require further investigation because the site was paved, relatively new, and staining was not observed by the site inspectors (IT 2001a). However, due to the nature of materials collected at this GAP (solvents and paint), and no previous sampling nearby, this SWMU location was identified for further sampling.

A1.9.1.18 NADEP GAP 57

NADEP GAP 57 was located in EBS Parcel 54, inside the southern portion of Building 5, and was within the boundaries of Evaluation Area 3 (Figure A1-7). The NADEP GAP units were administered under the RCRA GAP hazardous waste management system initiated in 1987 and operated until base closure and building cleanup in 1997. Actual startup dates are unknown (SulTech 2005b). According to the EBS, NADEP GAP 57 was located on concrete inside Building 5. The SWMU consisted of temporary accumulations of plating and cadmium solutions. The EBS concluded that NADEP GAP 57 did not require further investigation because the site was paved, relatively new, and staining was not observed by the site inspectors (IT 2001a). However, due to the nature of materials collected at this GAP (solvents and metals), and no previous sampling nearby, this SWMU location was identified for further sampling.

A1.9.1.19 NADEP GAP 70

NADEP GAP 70 was located in EBS Parcel 54 inside the southern portion of Building 5, and was within the boundaries of Evaluation Area 3 (Figure A1-7). The NADEP GAP units were administered under the RCRA GAP hazardous waste management system initiated in 1987 and operated until base closure and building cleanup in 1997. Actual startup dates are unknown (SulTech 2005b). According to the EBS, NADEP GAP 70 was located on concrete inside Building 5. The SWMU consisted of 30- and 55-gallon drums of cyanide, chromic acid plating solutions, sulfuric acid, and nickel chloride. The EBS concluded that NADEP GAP 70 did not require further investigation because the site was paved, relatively new, and staining was not observed by the site inspectors (IT 2001a). However, due to the nature of materials collected at this GAP (cyanide, solvents, acids, and metals), and no previous sampling nearby, this SWMU location was identified for further sampling.

A1.9.1.20 NAS GAP 01

NAS GAP 01 was located in EBS Parcel 186, south of the eastern wing of Building 6, the PWC transmission shop garage (Figure A1-12). The NAS GAP units were administered under the RCRA GAP hazardous waste management system initiated in 1987 and operated until base closure and building cleanup in 1997. Actual startup dates are unknown. According to the RFA, NAS GAP 01 consisted of two 20-by-20-foot areas for drummed liquid waste and a 15-by-20-foot area for solid waste located on asphalt. No soil sampling results are available within 100 feet of the GAP. According to the RFA, NAS GAP 01 exhibited a low potential for releases (none known) into soil and groundwater because the GAP was located on asphalt (DTSC 1992). A letter from DTSC dated November 4, 1999, recommended NFA for this SWMU (DTSC 1999b). However, due to the nature of materials collected at this GAP (oily liquids), and no previous sampling having been conducted nearby, this SWMU location was identified for further sampling.

A1.9.1.21 RCRA AOC 005

AOC 005 is located in EBS Parcel 54, east of Building 5, (Figure A1-11) and was within the boundaries of Evaluation Area 6. The AOC represents the former locations of UST 5-2 and UST 5-3. AOC 005 is located within the Alameda Point TPH Program's Corrective Action Area (CAA)-5A. UST 5-2 was a 4,000-gallon steel tank used to store jet fuel (TtEMI 1997a, 2003). The tank was removed on June 24, 1997. UST 5-3 was a 320-gallon steel tank used to store waste oil and solvents, and was located east of Building 5 (TtEMI 1999c, 2003). The tank was removed on December 8, 1998. Contaminated soil was removed. The product line was reported to have a 3-inch hole (TtEMI 1999a). The former location of UST 5-2 may also have been the location of a solvent tank. Limited sampling was conducted in conjunction with removal of these USTs; thus, a data gap exists.

A1.9.1.22 UST(R)-02

UST(R)-02 is located in EBS Parcel 68, east of the west wing of Building 6, the PWC transmission shop garage, and is the former location of two 2,500-gallon steel USTs (Figure A1-12). The USTs (UST 6-1 and 6-2) were used to store petroleum solvents and were removed in 1995 (SulTech 2005b). Due to the presence of lead in groundwater at this location, this SWMU location was identified for further sampling.

A1.9.2 Previous Investigations

The SWMU Report for OU-2C and the AST assessment report summarize results of all past assessments and investigations of the SWMUs at OU-2C (SulTech 2004, 2005b). Locations sampled during previous investigations in the vicinity of each SWMU are shown on Figures A1-7 and A1-9through A1-16; however, only those samples collected in close proximity to the SWMUs are described below.

A1.9.2.1 OWS 005

Two previous sampling locations are adjacent to OWS 005: monitoring well M05-03 and PAH soil boring C3S005B101. Groundwater samples from M05-03 had elevated levels of VOCs, TPH, and metals, as described in Section A1.1.2. Soil collected from the boring for M05-03 contained the SVOC bis(2-ethylhexyl)phthalate and iron at concentrations exceeding PRGs (Tables A1-15 and A1-17). Soil samples collected from boring C3S005B101 had PAH concentrations that were below the B(a)P equivalent screening criterion (BEI 2004).

A1.9.2.2 OWS 006A

The nearest direct-push groundwater samples (282-6-ERM located approximately 30 feet southeast of the OWS and 282-11-ERM located approximately 30 feet southwest of the OWS) were reported below detection limits for TPH as diesel and TPH as gasoline in groundwater. BTEX compounds were reported below detection limits as well, with the exception of xylenes reported at a concentration of 3.4 µg/L at 282-11-ERM. TPH concentrations in soil were below detection limits in the closest well borings (282-MW1 and 282-MW3, up to 30 feet away). VOCs reported in soil samples from the well borings included benzene and toluene at concentrations up to 6 mg/kg, exceeding the comparison criterion for benzene. Associated locations were sampled during a UST investigation for UST 282-1 and UST 282-2 (TtEMI 2003).

A1.9.2.3 OWS 006B

The closest groundwater sampling location (S05-DGS-VE02, located approximately 55 feet northeast of the OWS) contained TPH as diesel at a concentration of 670 µg/L. The nearest soil sampling location (C3S005B060, located about 18 feet northeast of the OWS) was sampled for PAHs and concentrations were below the B(a)P equivalent screening criterion (BEI 2004).

A1.9.2.4 OWS 010

For the closest soil sample (B12-06, approximately 15 feet away and outside the building), TPH concentrations were below detection limits.

A1.9.2.5 AST 005G

Sampling near AST 005G was performed in conjunction with removal of nearby UST 5-3 (AOC 005) and the PAH investigation. Soil samples collected after the removal of UST 5-3 (locations 030-MOD1-283, 284, and 285) contained chlorinated VOCs and TPH (Tables A1-12 and A1-13). As part of the TPH Data Gap Investigation in 2000, one groundwater sample (CA05-03) was collected near the former location of AST 005G. Samples were analyzed for VOCs and TPH. Chlorinated VOCs and TPH as motor oil were reported at concentrations exceeding comparison criteria (Tables A1-5 and A1-7). Nearby soil sampling location C3S005B075 was sampled for PAHs and concentrations were below the B(a)P equivalent screening criterion (BEI 2004).

A1.9.2.6 DISTILLATION UNIT M-01

One EBS soil sampling location (054-002-008) was within 50 feet of this SWMU. No analytes were reported at concentrations exceeding comparison criteria.

A1.9.2.7 DISTILLATION UNIT M-02

Two EBS soil sampling locations (054-002-011 and 054-002-012) were within 50 feet of this SWMU. The two soil samples were from the foundry and heat treatment shop and had metals concentrations exceeding comparison criteria. One surface soil sample (0 to 0.5 foot bgs) from location 054-002-011 contained lead at a concentration (547 mg/kg) that exceeded the PRG (150 mg/kg). One surface soil sample (0 to 0.5 foot bgs) from location 054-002-012 had iron (37,100 mg/kg), thallium (5.9 mg/kg), and vanadium (95.3 mg/kg) at concentrations exceeding comparison criteria (PRGs of 23,000, 5.2, and 78 mg/kg, respectively).

A1.9.2.8 DISTILLATION UNIT M-05

Sampling has not been conducted within 50 feet of this SWMU.

A1.9.2.9 DISTILLATION UNIT M-08

Soil samples have not been collected at the former location of M-08; however, two EBS soil sampling locations were within 50 feet of this SWMU. During the EBS, soil samples were collected as follows:

- 052-002-003 from 2.5 to 3 feet bgs; analyzed for VOCs
- 052-002-018 from 4 to 4.5 feet bgs; analyzed for VOCs

No VOCs were reported at concentrations above detection limits.

A1.9.2.10 COOLANT RECOVERY SYSTEM M-09

One EBS soil sampling location (054-003-021) was within 50 feet of this SWMU. No analytes were reported at concentrations exceeding comparison criteria.

A1.9.2.11 NADEP GAP 02

Sampling has not been conducted within 50 feet of this SWMU.

A1.9.2.12 NADEP GAP 04

Follow-on work at Building 5 was based on the results of the sampling conducted along the perimeter of Building 5 during the Phase 2B and 3 investigation conducted in 1991 (PRC and JMM 1992). Two boreholes (B05BS-01 and B05BS-02) were drilled at the following locations near NADEP GAP 04:

- outside the battery acid shop area at the northeastern corner of Building 5 where the sink discharged to the storm drain sewer
- inside the battery acid shop area, immediately adjacent to where the piping from the sink entered the floor (Figure A1-9)

Soil samples were collected at the ground surface from both borings and at 2, 5, and 15 feet bgs from the boring outside the building. All soil samples were analyzed for VOCs, SVOCs, metals, hexavalent chromium, cyanide, and pH. One soil sample was analyzed for total organic carbon. The borehole outside the building was converted to a monitoring well (M05BS-01). See Section A1.1.2.3 for groundwater results. COPCs reported included acetone, one PAH, metals, and hexavalent chromium.

No analytes exceeded comparison criteria, with the exception of arsenic at concentrations comparable to background. One lead concentration (94.8 mg/kg) exceeded the background level (37.66 mg/kg) in a sample from the boring outside Building 5. No other analytes were reported at concentrations exceeding background levels from the location within Building 5 (PRC and MW 1995).

A1.9.2.13 NADEP GAP 17

Sampling has not been conducted within 50 feet of this SWMU.

A1.9.2.14 NADEP GAP 20

One EBS soil sampling location (058-001-001) and one PAH investigation sampling location (C3S005B083) were within 50 feet of this SWMU. No analytes were reported at concentrations exceeding comparison criteria.

A1.9.2.15 NADEP GAP 25

Two previous sampling locations are near to NADEP GAP 25: monitoring well M05-03 and PAH soil boring C3S005B101. Groundwater samples M05-03 have had elevated levels of VOCs, TPH, and metals, as described in Section A1.1.2. Soil collected from the boring for M05-03 contained the SVOC bis(2-ethylhexyl)phthalate and iron at

concentrations exceeding PRGs (Tables A1-15 and A1-17). Samples from boring C3S005B101 had PAH concentrations that were below the B(a)P equivalent screening criterion (BEI 2004).

A1.9.2.16 NADEP GAP 27

Sampling has not been conducted within 50 feet of this SWMU.

A1.9.2.17 NADEP GAP 31

Sampling has not been conducted within 50 feet of this SWMU.

A1.9.2.18 NADEP GAP 57

One EBS soil sampling location (054-004-025) was within 50 feet of this SWMU. No analytes were reported at concentrations exceeding comparison criteria.

A1.9.2.19 NADEP GAP 70

One EBS soil sampling location (054-003-018) was within 50 feet of this SWMU. No analytes were reported at concentrations exceeding comparison criteria.

A1.9.2.20 NAS GAP 01

The nearest direct-push groundwater sampling location (282-9-ERM, located within approximately 20 feet of the SWMU) had concentrations below detection limits for BTEX, TPH as diesel, and TPH as gasoline in groundwater (TtEMI 2003). Soil samples have not been collected at NAS GAP 01; however, several soil samples were collected within 50 feet of the SWMU during the 2003 PAH study and characterization of IR Site 12. During the PAH study, four soil samples were collected at 0 to 8 feet bgs from sampling location C3S005B87. Sampling location B12-09 is within 50 feet of NAS GAP 01 and samples were analyzed for VOCs, SVOCs, pesticides, PCBs, and metals. All concentrations were reported below detection limits or below comparison criteria.

A1.9.2.21 RCRA AOC 005

Previous sampling for AOC 005 was done in conjunction with removal of each tank (UST 5-2 and UST 5-3). Soil samples and a groundwater sample were collected following the UST 5-2 removal (TtEMI 1997a). The groundwater sample (NAS05-01-S-07-W) contained benzene at a concentration of 7 µg/L and TPH as diesel at 864,000 µg/L (Tables A1-5 and A1-7). As part of the TPH Data Gap Investigation in 2000, two groundwater samples were collected near the former location of UST 5-2 (CA05-01 and CA05-02). Samples were analyzed for VOCs and TPH. Chlorinated VOCs and TPH were reported at concentrations exceeding comparison criteria (Tables A1-5 and A1-7, respectively).

Two monitoring wells (FWBZ well M05-07 and SWBZ well D05-02) near the former location of UST 5-2 were sampled for TPH in 2001. Groundwater samples collected

from M05-07 contained TPH as diesel and TPH as gasoline, and samples from D05-02 contained TPH as motor oil (Table A1-6). The closure report indicated that a jet fuel release to the soil and groundwater had occurred, and corrective action is ongoing (TtEMI 2003).

Soil samples collected after the removal of UST 5-3 (locations 030-MOD1-283, 284, and 285) contained chlorinated VOCs and TPH (Tables A1-12 and A1-13). No groundwater samples were collected at the time of UST 5-3 removal. As part of the TPH Data Gap Investigation in 2000, one groundwater sample (CA05-03) was collected near the former location of UST 5-3. Samples were analyzed for VOCs and TPH. Chlorinated VOCs and TPH as motor oil were reported at concentrations exceeding comparison criteria (Tables A1-5 and A1-7). A groundwater sample collected from nearby well M05-04 in 2001 was analyzed for TPH and contained TPH as gasoline at a concentration of 220 µg/L.

A1.9.2.22 UST(R)-02

Soil and groundwater samples collected during tank excavation were analyzed for fuel constituents. Low levels (0.15 to 60 mg/kg) of benzene, xylenes, and TPH as diesel, gasoline, jet propellant grade 5 (JP-5), and motor oil were reported in soil. Lead (100 µg/L), xylenes (0.56 µg/L), and low levels of TPH as gasoline, JP-5, and motor oil (0.42 to 1.2 mg/L) were reported in groundwater.

A1.9.3 Proposed Sampling Rationale and Design

The regulatory agencies have requested further evaluation of these 22 SWMUs as part of the OU-2C RI. The following discussion presents the problem statement and optimized sampling design proposed for these SWMUs (DQO Steps 1 and 7). Proposed sampling locations are shown on Figures A1-7 and A1-9 through A1-16.

Investigation of OWS- and UST-specific issues will follow DQOs presented in Table 1-8 of the SAP. Soil and discrete groundwater samples will be collected from one boring adjacent to and on the assumed downgradient (where possible) side of each OWS and of UST(R)-02; two or three soil samples will be collected from each boring (0 to 0.5, 2 to 4, and 4 to 6 feet bgs) depending on the depth at which the water table is encountered. The third sample will be collected at the water table (soil/water interface). A third or fourth soil sample from the borings next to OWSs (OWS 005, OWS 006A, OWS 006B, and OWS 010) and former UST locations will be collected in the 10-to-12-foot depth interval, which is below the bottoms of the OWSs and USTs. A discrete groundwater sample will also be collected from the soil boring. Soil and groundwater samples will be analyzed for some or all of the following parameters: VOCs, extractable-range TPH, SVOCs, 1,4-dioxane, PCBs, and metals. Groundwater samples will also be analyzed for TDS, if sufficient volume can be obtained.

Investigation of SWMU-specific issues will follow DQOs presented in Table 1-9 of the SAP. Soil and discrete groundwater samples will be collected from one boring at each SWMU. The borings will be adjacent to and on the assumed downgradient side, where possible, of each SWMU. For SWMUs with no nearby historical or current sampling a

second boring will be installed near the SWMU. Soil samples and one discrete groundwater sample will be collected from one boring at M-8 and NAS GAP 01, and soil samples and two discrete groundwater samples will be collected from SWMUs located within Evaluation Areas 3, 4, 5, and 6. Soil samples will be collected at three depths from each boring (0 to 0.5, 2 to 4, and 4 to 6 feet bgs); the third sampling depth will be at the water table (soil/water interface). Soil samples will be collected from a second boring at NADEP GAP 17, NADEP GAP 27, and NADEP GAP 31. Soil and groundwater samples will be analyzed for VOCs, extractable-range TPH, SVOCs, 1,4-dioxane, PCBs, and metals. Groundwater samples will also be analyzed for TDS, if sufficient volume can be obtained.

At SWMU and OWS locations within the boundaries of Evaluation Area 1, discrete groundwater samples will be collected in the shallower FWBZ (10 to 15 feet bgs) and the deeper FWBZ (25 to 30 feet bgs). At SWMU and OWS locations near the former plating shop and the industrial wastewater sewer lines and treatment areas, samples also will be analyzed for metals, hexavalent chromium, and cyanide.

To address the possible release of radium associated with previous operations in Building 5 to groundwater in the shallower portion of the FWBZ, the discrete groundwater sample collected at 10 to 15 feet bgs from selected SWMU locations (SND57SB01, SM09SB01, and NADEP GAP 70) will be analyzed for radium-226 and radium-228 using U.S. EPA Methods 903.1 and 904.0, respectively.

In the event that analytical results for soil samples from OWS, UST, or other SWMU locations are above comparison criteria, step-out soil sampling may be required. The decision logic for additional soil sampling is illustrated on Figure A1-19 and described in Table A1-18. Additionally, step-out discrete groundwater sampling will be considered if results of planned discrete groundwater sampling are above comparison criteria and are not consistent with known nature and extent of contamination. The decision logic for additional SWMU discrete groundwater sampling is illustrated on Figure A1-20 and described in Table A1-18. In the event that analytical results for discrete groundwater samples from OWS, UST, or other SWMU locations are above comparison criteria, additional monitoring wells may be needed. The decision logic for additional monitoring well installation is illustrated on Figure A1-17 and described in Table A1-18.

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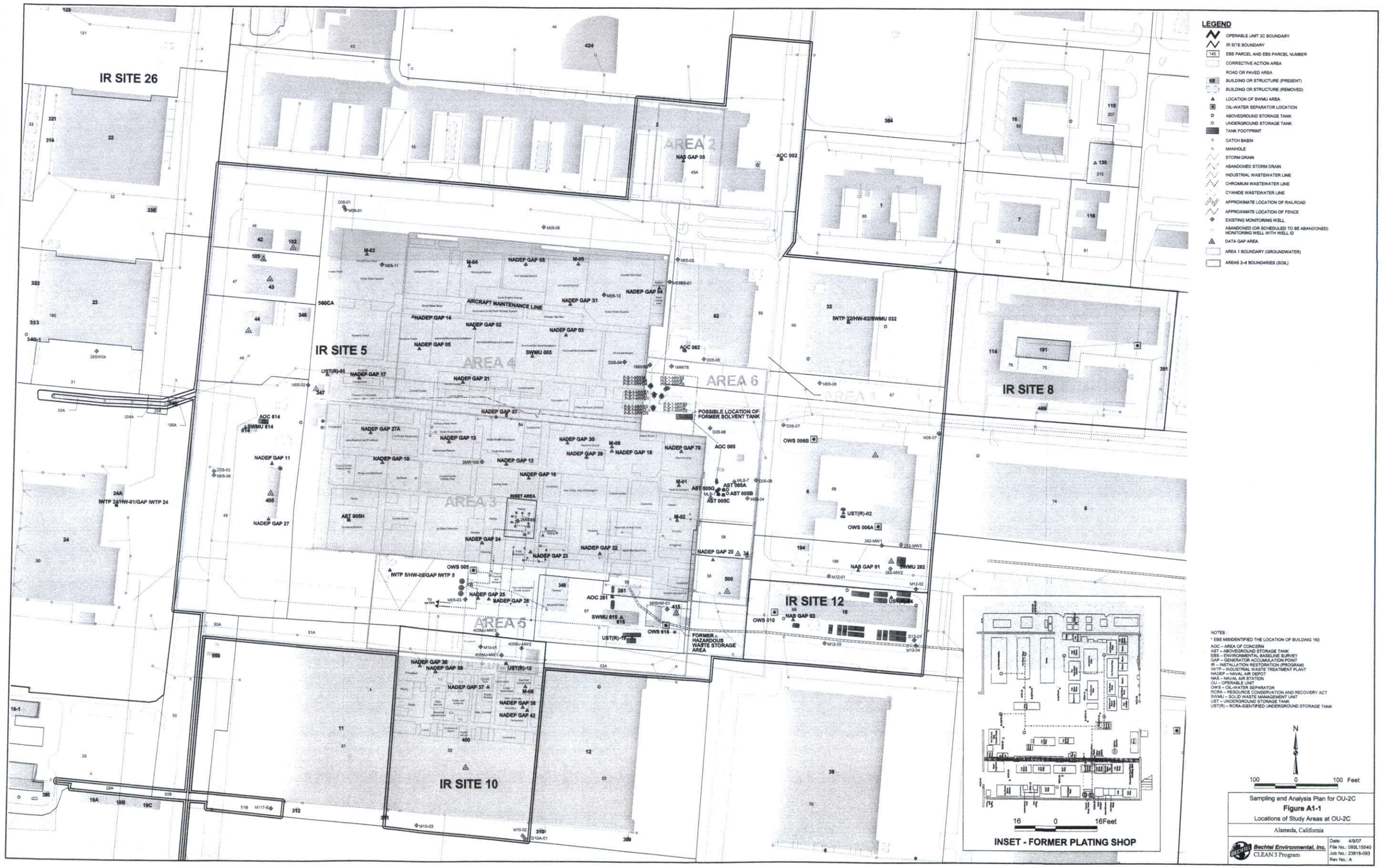
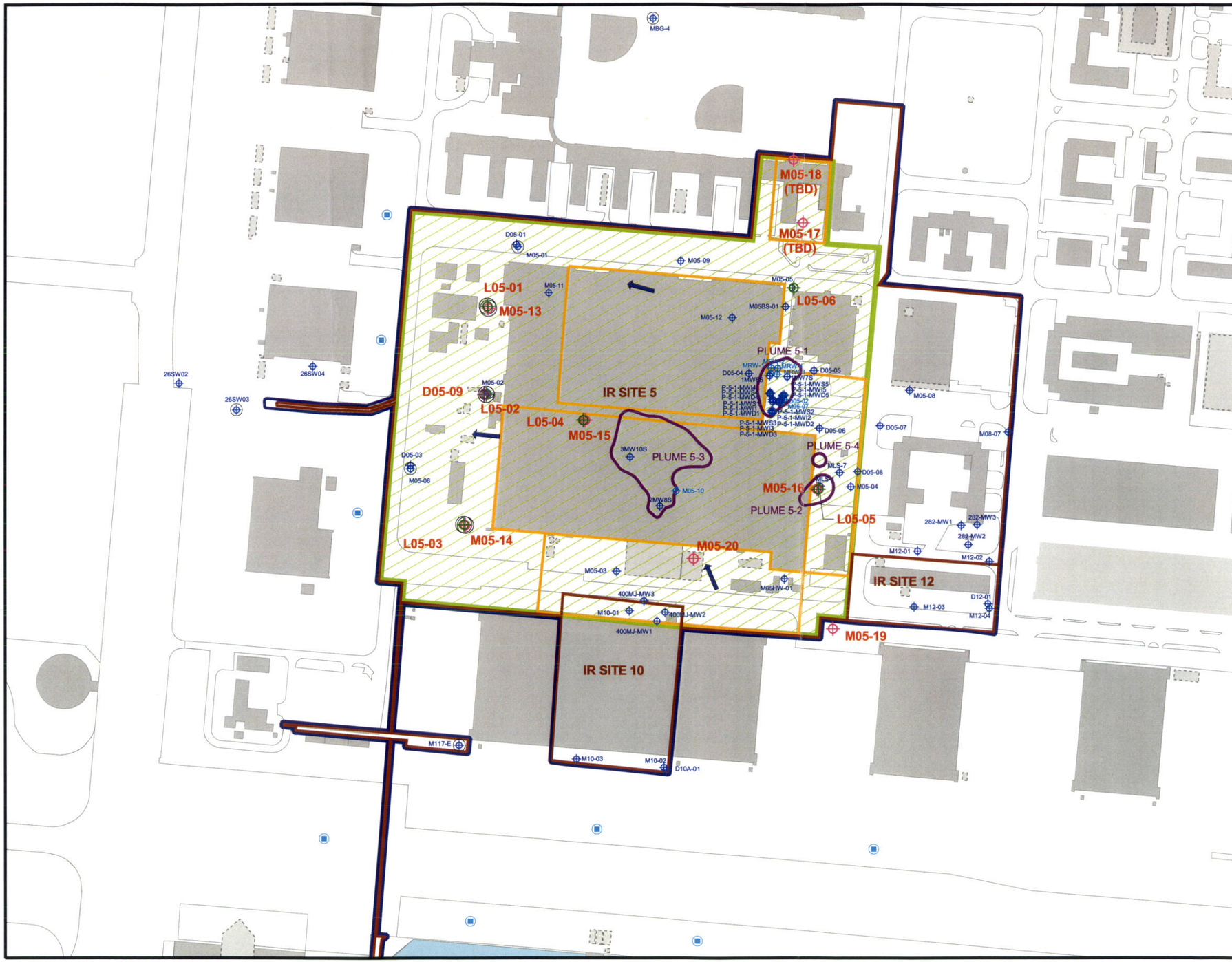

IR SITE 26
IR SITE 5
IR SITE 8
IR SITE 12
IR SITE 10
AREA 2
AREA 3
AREA 4
AREA 5
AREA 6
AIRCRAFT MAINTENANCE LINE
POSSIBLE LOCATION OF FORMER SOLVENT TANK
FORMER HAZARDOUS WASTE STORAGE AREA
INSET AREA
INSET - FORMER PLATING SHOP
16 0 16Feet
LEGEND
OPERABLE UNIT 2C BOUNDARY
IR SITE BOUNDARY
EBS PARCEL AND EBS PARCEL NUMBER
CORRECTIVE ACTION AREA
ROAD OR PAVED AREA
BUILDING OR STRUCTURE (PRESENT)
BUILDING OR STRUCTURE (REMOVED)
LOCATION OF SWMU AREA
OIL-WATER SEPARATOR LOCATION
ABOVEGROUND STORAGE TANK
UNDERGROUND STORAGE TANK
TANK FOOTPRINT
CATCH BASIN
MANHOLE
STORM DRAIN
ABANDONED STORM DRAIN
INDUSTRIAL WASTEWATER LINE
CHROMIUM WASTEWATER LINE
CYANIDE WASTEWATER LINE
APPROXIMATE LOCATION OF RAILROAD
APPROXIMATE LOCATION OF FENCE
EXISTING MONITORING WELL
ABANDONED (OR SCHEDULED TO BE ABANDONED) MONITORING WELL WITH WELL ID
DATA GAP AREA
AREA 1 BOUNDARY (GROUNDWATER)
AREAS 2-6 BOUNDARIES (SOIL)
NOTES :
* EBS MISIDENTIFIED THE LOCATION OF BUILDING 182
AOC – AREA OF CONCERN
AST – ABOVEGROUND STORAGE TANK
EBS – ENVIRONMENTAL BASELINE SURVEY
GAP – GENERATOR ACCUMULATION POINT
IR – INSTALLATION RESTORATION (PROGRAM)
IWTP – INDUSTRIAL WASTE TREATMENT PLANT
NADEP – NAVAL AIR DEPOT
NAS – NAVAL AIR STATION
OU – OPERABLE UNIT
OWS – OIL-WATER SEPARATOR
RCRA – RESOURCE CONSERVATION AND RECOVERY ACT
SWMU – SOLID WASTE MANAGEMENT UNIT
UST – UNDERGROUND STORAGE TANK
UST(R) – RCRA-IDENTIFIED UNDERGROUND STORAGE TANK
N
100 0 100 Feet
Sampling and Analysis Plan for OU-2C
Figure A1-1
Locations of Study Areas at OU-2C
Alameda, California
Bechtel Environmental, Inc.
CLEAN 3 Program
Date: 4/9/07
File No.: 093L15540
Job No.: 23818-093
Rev No.: A



LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- ROAD OR PAVED AREA
- BUILDING OR STRUCTURE (PRESENT)
- BUILDING OR STRUCTURE (REMOVED)
- GROUNDWATER FLOW DIRECTION (FIRST WATER-BEARING ZONE)
- 10,000 µg/L VOC CONCENTRATION CONTOUR
- AREA 1 BOUNDARY (GROUNDWATER)
- AREAS 2–6 BOUNDARIES (SOIL)
- EXISTING MONITORING WELL WITH WELL ID
- ABANDONED (OR SCHEDULED TO BE ABANDONED) MONITORING WELL WITH WELL ID
- PROPOSED SHALLOWER FIRST WATER-BEARING ZONE MONITORING WELL LOCATION
- PROPOSED DEEPER FIRST WATER-BEARING ZONE MONITORING WELL LOCATION
- PROPOSED SECOND WATER-BEARING ZONE MONITORING WELL LOCATION
- PROPOSED PIEZOMETER LOCATION
- WELL TO BE INCLUDED IN WATER LEVEL STUDY

NOTES :

IR – INSTALLATION RESTORATION (PROGRAM)

µg/L – MICROGRAMS PER LITER

OU – OPERABLE UNIT

TBD – TO BE DETERMINED

VOC – VOLATILE ORGANIC COMPOUND

N

300 0 300 Feet

Sampling and Analysis Plan for OU-2C

Figure A1-2

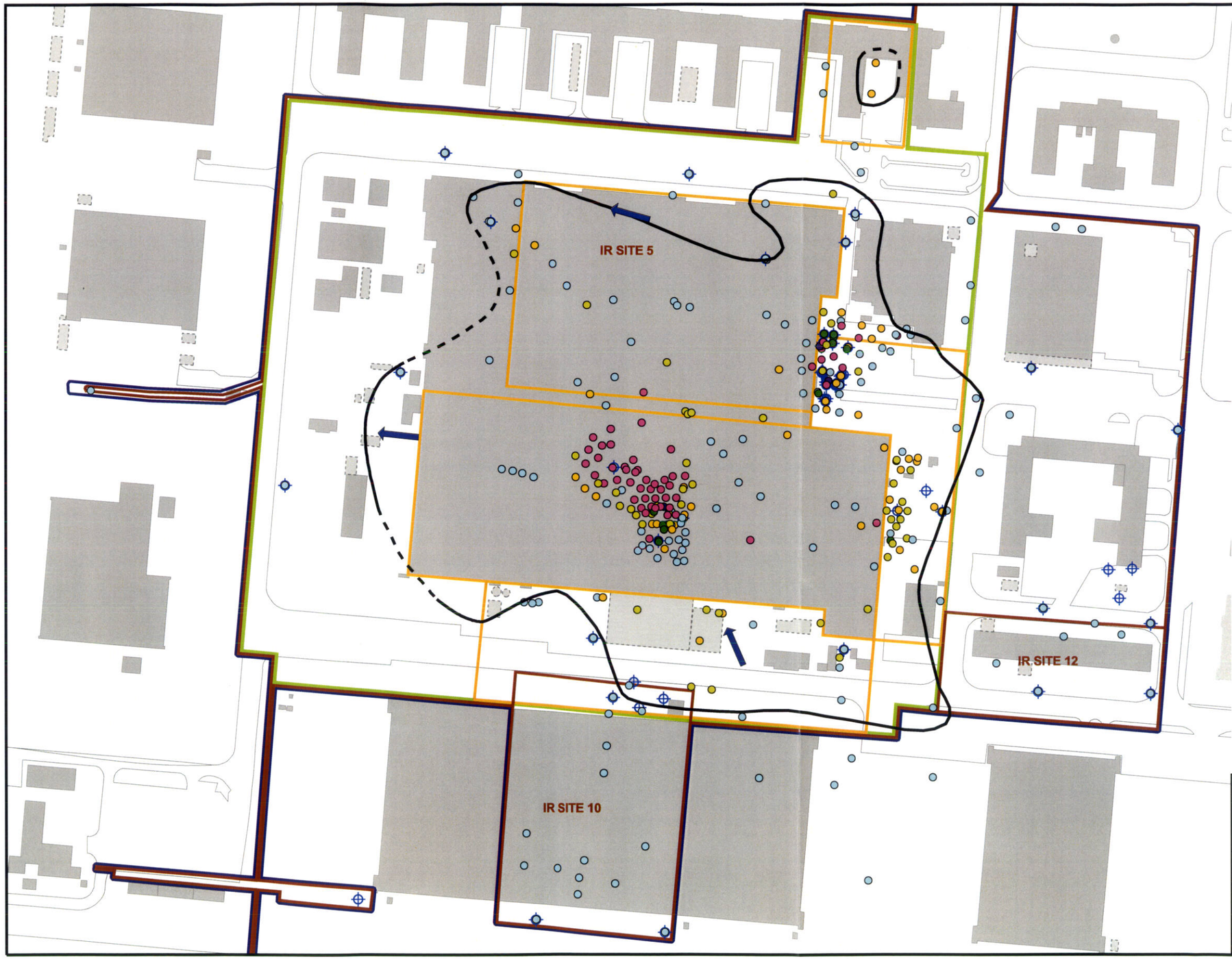
Evaluation Area 1

Alameda, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 4/5/07
File No.: 093Q15361
Job No.: 23818-093
Rev No.: F



LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- ROAD OR PAVED AREA
- BUILDING OR STRUCTURE (PRESENT)
- BUILDING OR STRUCTURE (REMOVED)
- GROUNDWATER FLOW DIRECTION (FIRST WATER-BEARING ZONE)
- AREA 1 BOUNDARY (GROUNDWATER)
- AREAS 2–6 BOUNDARIES (SOIL)
- EXISTING MONITORING WELL

COMBINED SELECTED VOC CONCENTRATION IN SHALLOWER FWBZ SAMPLES (µg/L)

- 0–250
- 250–1,000
- 1,000–10,000
- 10,000–100,000
- 100,000–500,000
- > 500,000

0.5 µg/L VINYL CHLORIDE CONCENTRATION CONTOUR (MCL) DASHED WHERE INFERRED

NOTES :

CONCENTRATION IS THE SUM OF NINE CHLORINATED VOCs AT EACH LOCATION FOR THE GIVEN DEPTH INTERVAL:
1,1-DICHLOROETHANE
1,2-DICHLOROETHANE
1,1-DICHLOROETHENE
CIS-1,2-DICHLOROETHENE
TRANS-1,2-DICHLOROETHENE
TETRACHLOROETHENE
1,1,1-TRICHLOROETHANE
TRICHLOROETHENE
VINYL CHLORIDE

VINYL CHLORIDE CONTOUR USED TO APPROXIMATE EXTENT OF VOC PLUME

bgs – BELOW GROUND SURFACE
IR – INSTALLATION RESTORATION (PROGRAM)
µg/L – MICROGRAMS PER LITER
MCL – MAXIMUM CONTAMINATION LEVEL
OU – OPERABLE UNIT
FWBZ – FIRST WATER-BEARING ZONE
VOC – VOLATILE ORGANIC COMPOUND

N

200 0 200 Feet

Sampling and Analysis Plan for OU-2C

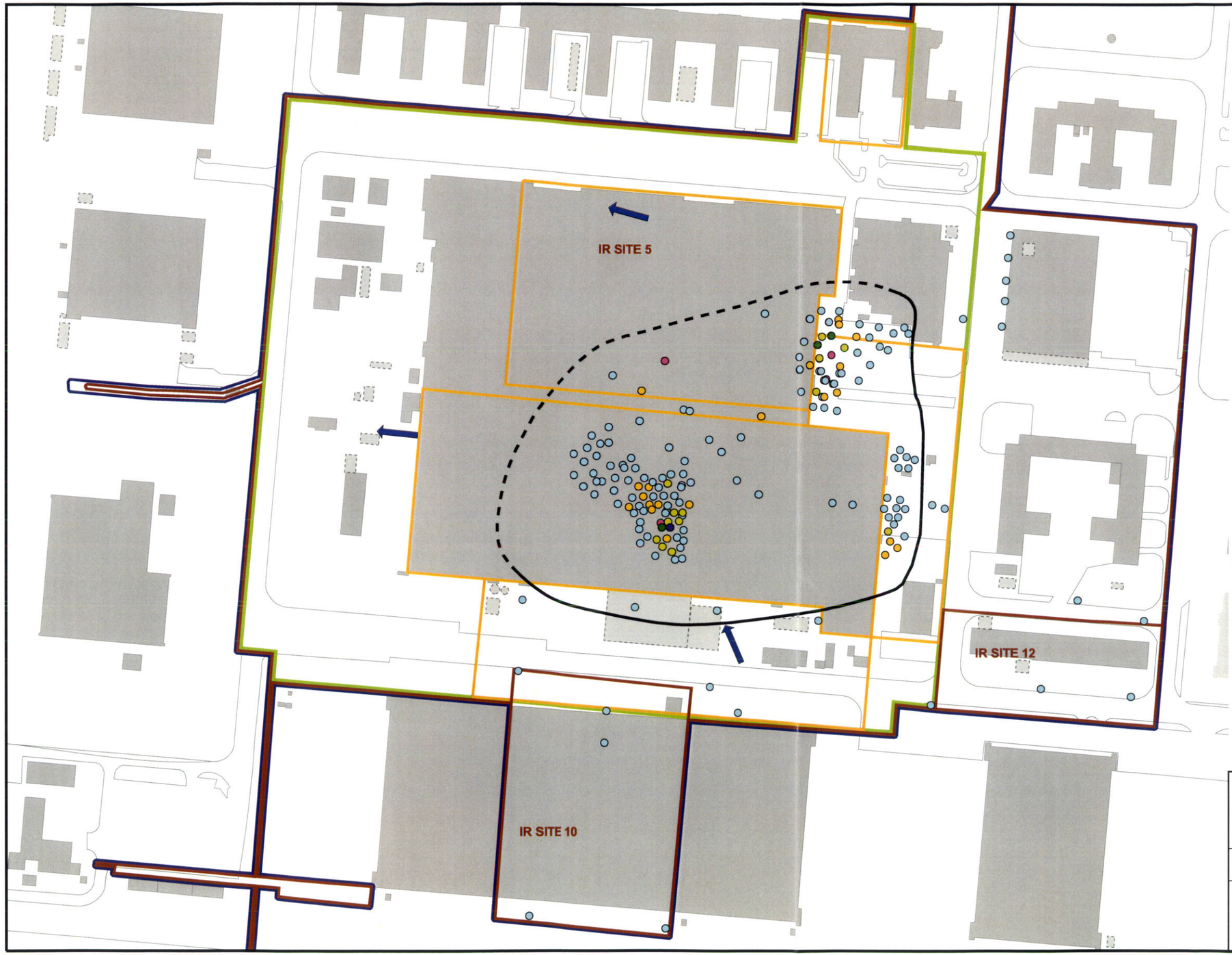
Figure A1-3

Chlorinated VOCs in Groundwater in the Shallower First Water-Bearing Zone (5 to 18 feet bgs)

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 4/9/07
File No.: 093L15541
Job No.: 23818-093
Rev No.: A



LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- ROAD OR PAVED AREA
- BUILDING OR STRUCTURE (PRESENT)
- BUILDING OR STRUCTURE (REMOVED)
- GROUNDWATER FLOW DIRECTION (FIRST WATER-BEARING ZONE)
- AREA 1 BOUNDARY (GROUNDWATER)
- AREAS 2–6 BOUNDARIES (SOIL)

COMBINED SELECTED VOC CONCENTRATION IN DEEPER FWBZ SAMPLES (µg/L)

- 0–250
- 250–1,000
- 1,000–10,000
- 10,000–100,000
- 100,000–500,000
- > 500,000

0.5 µg/L VINYL CHLORIDE CONCENTRATION CONTOUR (MCL) DASHED WHERE INFERRED

NOTES :

CONCENTRATION IS THE SUM OF NINE CHLORINATED VOCs AT EACH LOCATION FOR THE GIVEN DEPTH INTERVAL:
1,1-DICHLOROETHANE
1,2-DICHLOROETHANE
1,1-DICHLOROETHENE
CIS-1,2-DICHLOROETHENE
TRANS-1,2-DICHLOROETHENE
TETRACHLOROETHENE
1,1,1-TRICHLOROETHANE
TRICHLOROETHENE
VINYL CHLORIDE

VINYL CHLORIDE CONTOUR USED TO APPROXIMATE EXTENT OF VOC PLUME

bgs – BELOW GROUND SURFACE
IR – INSTALLATION RESTORATION (PROGRAM)
FWBZ – FIRST WATER-BEARING ZONE
µg/L – MICROGRAMS PER LITER
MCL – MAXIMUM CONTAMINATION LEVEL
OU – OPERABLE UNIT
VOC – VOLATILE ORGANIC COMPOUND

N

200 0 200 Feet

Sampling and Analysis Plan for OU-2C

Figure A1-4

Chlorinated VOCs in Groundwater in the Deeper First Water-Bearing Zone (20 to 40 feet bgs)

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 1/4/07
File No.: 081L14734
Job No.: 23818-093
Rev No.: C

LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- ROAD OR PAVED AREA
- BUILDING OR STRUCTURE (PRESENT)
- BUILDING OR STRUCTURE (REMOVED)
- GROUNDWATER FLOW DIRECTION (FIRST WATER-BEARING ZONE)
- AREA 1 BOUNDARY (GROUNDWATER)
- AREAS 2–6 BOUNDARIES (SOIL)

COMBINED SELECTED VOC CONCENTRATION IN SWBZ SAMPLES (µg/L)

- 0–250
- 250–1,000
- 1,000–10,000
- 10,000–100,000
- 100,000–500,000
- > 500,000

0.5 µg/L VINYL CHLORIDE CONCENTRATION CONTOUR (MCL) DASHED WHERE INFERRED

NOTES :

CONCENTRATION IS THE SUM OF NINE CHLORINATED VOCs AT EACH LOCATION FOR THE GIVEN DEPTH INTERVAL:
1,1-DICHLOROETHANE
1,2-DICHLOROETHANE
1,1-DICHLOROETHENE
CIS-1,2-DICHLOROETHENE
TRANS-1,2-DICHLOROETHENE
TETRACHLOROETHENE
1,1,1-TRICHLOROETHANE
TRICHLOROETHENE
VINYL CHLORIDE

VINYL CHLORIDE CONTOUR USED TO APPROXIMATE EXTENT OF VOC PLUME

bgs – BELOW GROUND SURFACE
IR – INSTALLATION RESTORATION (PROGRAM)
µg/L – MICROGRAMS PER LITER
MCL – MAXIMUM CONTAMINATION LEVEL
OU – OPERABLE UNIT
SWBZ – SECOND WATER-BEARING ZONE
VOC – VOLATILE ORGANIC COMPOUND

N

200 0 200 Feet

Sampling and Analysis Plan for OU-2C

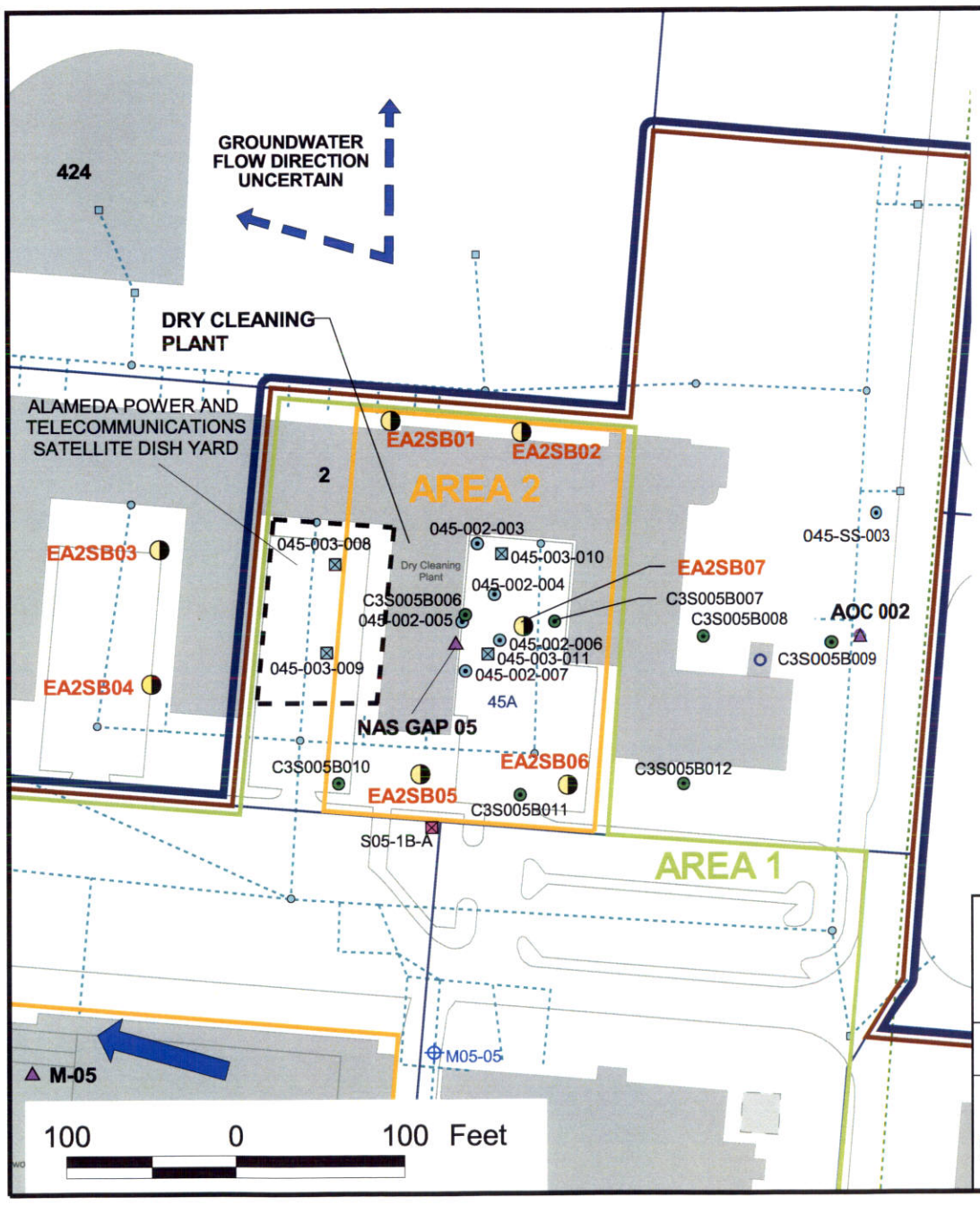
Figure A1-5

Chlorinated VOCs in Groundwater in the Second Water-Bearing Zone (40 to 70 feet bgs)

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 1/3/07
File No.: 093L15363
Job No.: 23818-093
Rev No.: A



LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- 140 EBS PARCEL AND EBS PARCEL NUMBER
- ROAD OR PAVED AREA
- 68 BUILDING OR STRUCTURE (PRESENT)
- BUILDING OR STRUCTURE (REMOVED)
- LOCATION OF SWMU AREA
- UNDERGROUND STORAGE TANK
- CATCH BASIN
- MANHOLE
- STORM DRAIN
- GROUNDWATER FLOW DIRECTION (FIRST WATER-BEARING ZONE)
- EXISTING MONITORING WELL
- AREA 1 BOUNDARY (GROUNDWATER)
- AREAS 2–6 BOUNDARIES (SOIL)
- PROPOSED SOIL AND HYDROPUNCH SAMPLING LOCATION AND STATION ID

HISTORICAL SOIL SAMPLING LOCATIONS
- EBS, 1995–1999
- PAH STUDY, 2003

HISTORICAL DISCRETE GROUNDWATER SAMPLING LOCATIONS
- EBS, 1995–1999
- GEOCHEMICAL PROFILING SITES 4 AND 5, 1997–1998

N

NOTES :

AOC – AREA OF CONCERN
AST – ABOVEGROUND STORAGE TANK
EBS – ENVIRONMENTAL BASELINE SURVEY
GAP – GENERATOR ACCUMULATION POINT
IR – INSTALLATION RESTORATION (PROGRAM)
NAS – NAVAL AIR STATION
OU – OPERABLE UNIT
PAH – POLYNUCLEAR AROMATIC HYDROCARBON
SWMU – SOLID WASTE MANAGEMENT UNIT

Sampling and Analysis Plan for OU-2C

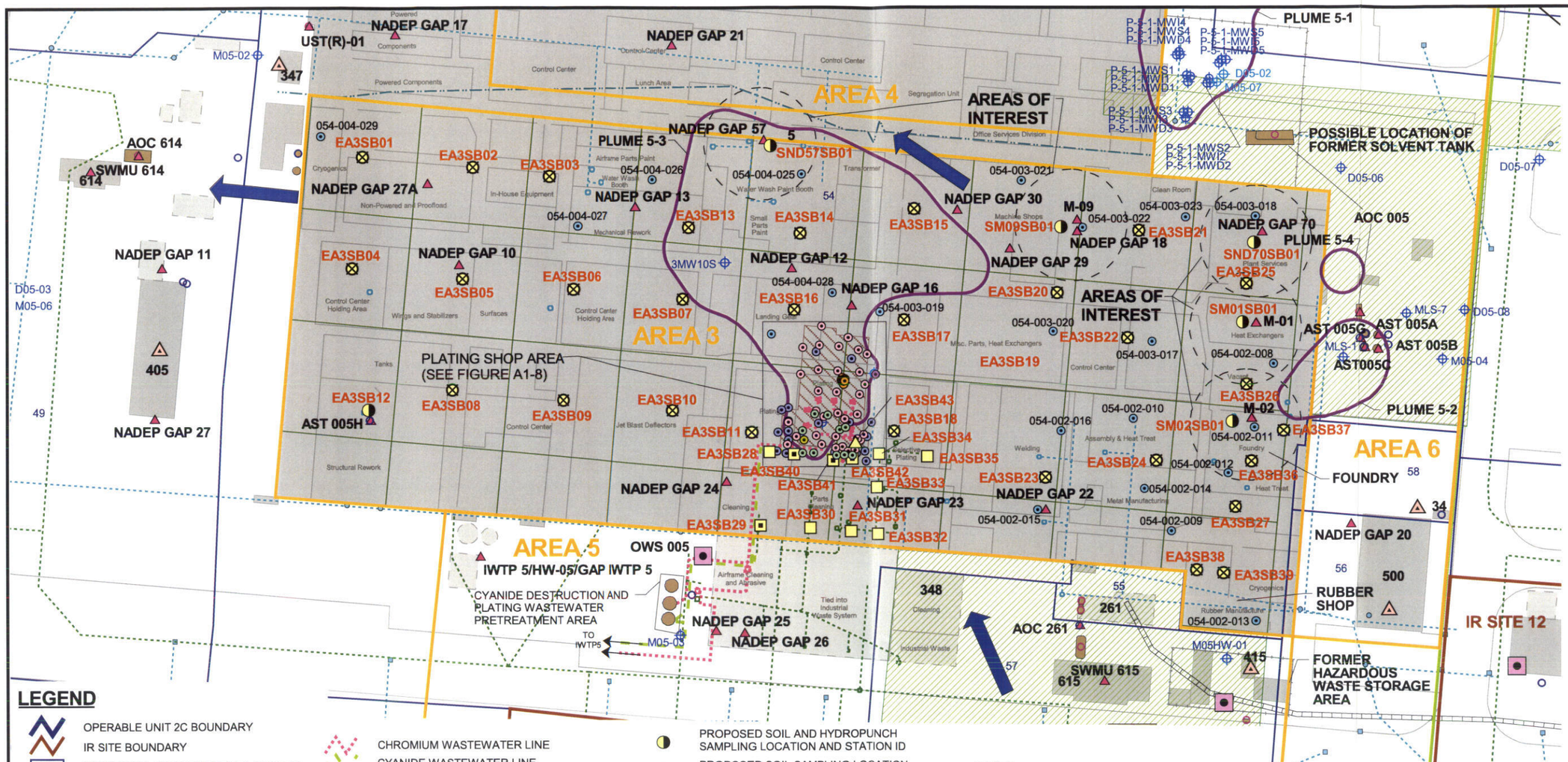
Figure A1-6

Evaluation Area 2

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 04/05/07
File No.: 093L14735
Job No.: 23818-093
Rev No.: E



LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- 140 EBS PARCEL AND EBS PARCEL NUMBER
- CORRECTIVE ACTION AREA
- ROAD OR PAVED AREA
- 68 BUILDING OR STRUCTURE (PRESENT)
- BUILDING OR STRUCTURE (REMOVED)
- LOCATION OF SWMU AREA
- OIL-WATER SEPARATOR LOCATION
- ABOVEGROUND STORAGE TANK
- UNDERGROUND STORAGE TANK
- TANK FOOTPRINT
- CATCH BASIN
- MANHOLE
- STORM DRAIN
- ABANDONED STORM DRAIN
- INDUSTRIAL WASTEWATER LINE
- CHROMIUM WASTEWATER LINE
- CYANIDE WASTEWATER LINE
- APPROXIMATE LOCATION OF RAILROAD
- APPROXIMATE LOCATION OF FENCE
- 10,000 µg/L VOC CONCENTRATION CONTOUR
- EXISTING MONITORING WELL
- ABANDONED (OR SCHEDULED TO BE ABANDONED) MONITORING WELL WITH WELL ID
- DATA GAP AREA
- EXCAVATION AREA
- AREA 1 BOUNDARY (GROUNDWATER)
- AREAS 2–6 BOUNDARIES (SOIL)
- GROUNDWATER FLOW DIRECTION (FIRST WATER-BEARING ZONE)
- 100-FOOT-SQUARE GRID LINES
- PROPOSED SOIL AND HYDROPUNCH SAMPLING LOCATION AND STATION ID
- PROPOSED SOIL SAMPLING LOCATION AND STATION ID
- PROPOSED INDUSTRIAL WASTEWATER LINE SOIL SAMPLING LOCATION AND STATION ID
- PROPOSED INDUSTRIAL WASTEWATER LINE SOIL AND HYDROPUNCH SAMPLING LOCATION AND STATION ID
- PROPOSED DISCRETE GROUNDWATER SAMPLING LOCATION AND STATION ID

HISTORICAL SOIL SAMPLING LOCATIONS

- RI/FS PHASES 2B AND 3, 1991
- ADDITIONAL WORK SITES 4 AND 5, 1992
- CTO 260 AND 280 FOLLOW-ON INVESTIGATIONS, 1994–1995
- EBS, 1995–1999
- ELECTROKINETIC TREATABILITY STUDY, 1998
- DATA GAP SAMPLING, 2001
- SITES 5 AND 14 REMOVAL ACTIONS, 2002

NOTES :

AOC – AREA OF CONCERN
AST – ABOVEGROUND STORAGE TANK
CTO – CONTRACT TASK ORDER
EBS – ENVIRONMENTAL BASELINE SURVEY
GAP – GENERATOR ACCUMULATION POINT
IR – INSTALLATION RESTORATION (PROGRAM)
IWTP – INDUSTRIAL WASTEWATER TREATMENT PLANT
µg/L – MICROGRAMS PER LITER
NADEP – NAVAL AVIATION DEPOT
OU – OPERABLE UNIT
OWS – OIL-WATER SEPARATOR
RI/FS – REMEDIAL INVESTIGATION/FEASIBILITY STUDY
RCRA – RESOURCE CONSERVATION AND RECOVERY ACT
SWMU – SOLID WASTE MANAGEMENT UNIT
UST – UNDERGROUND STORAGE TANK
UST(R) – RCRA-IDENTIFIED UNDERGROUND STORAGE TANK
VOC – VOLATILE ORGANIC COMPOUND

AREA OF INTEREST – CIRCLE WITH 50-FOOT RADIUS ENCOMPASSING OWSs AND SWMUs TARGETED FOR SAMPLING UNDER THE SAMPLING AND ANALYSIS PLAN FOR OU-2C

100 0 100 Feet

Sampling and Analysis Plan for OU-2C

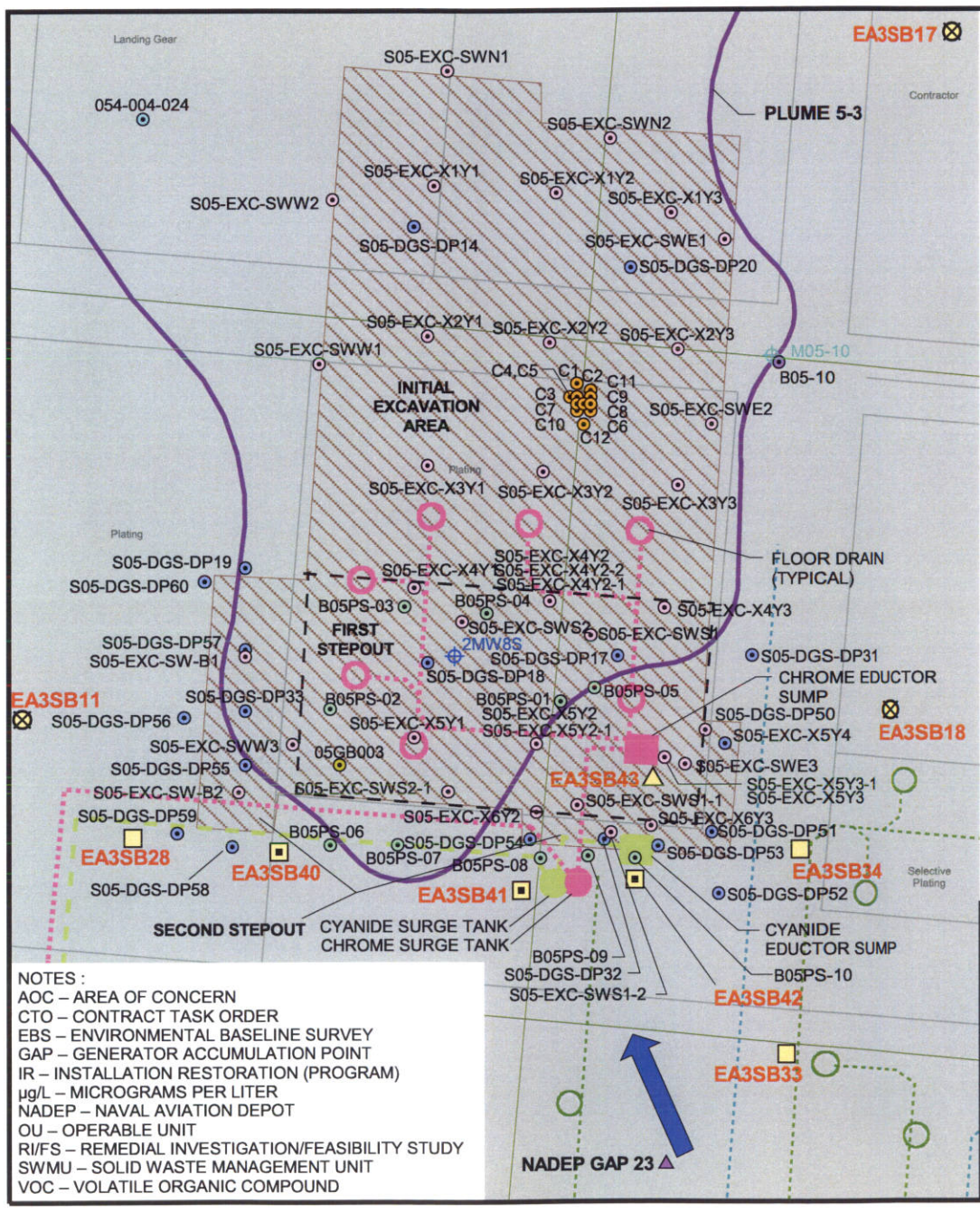
Figure A1-7

Evaluation Area 3

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 4/9/07
File No.: 093L15544
Job No.: 23818-093
Rev No.: A



NOTES :
AOC – AREA OF CONCERN
CTO – CONTRACT TASK ORDER
EBS – ENVIRONMENTAL BASELINE SURVEY
GAP – GENERATOR ACCUMULATION POINT
IR – INSTALLATION RESTORATION (PROGRAM)
µg/L – MICROGRAMS PER LITER
NADEP – NAVAL AVIATION DEPOT
OU – OPERABLE UNIT
RI/FS – REMEDIAL INVESTIGATION/FEASIBILITY STUDY
SWMU – SOLID WASTE MANAGEMENT UNIT
VOC – VOLATILE ORGANIC COMPOUND

LEGEND

- 68 BUILDING OR STRUCTURE (PRESENT)
- LOCATION OF SWMU AREA
- CATCH BASIN
- MANHOLE
- FLOOR DRAIN
- STORM DRAIN
- INDUSTRIAL WASTEWATER LINE
- CHROMIUM WASTEWATER LINE
- CYANIDE WASTEWATER LINE
- EXISTING MONITORING WELL
- ABANDONED (OR SCHEDULED TO BE ABANDONED) MONITORING WELL WITH WELL ID
- GROUNDWATER FLOW DIRECTION (FIRST WATER-BEARING ZONE)
- 10,000 µg/L VOC CONCENTRATION CONTOUR
- EXCAVATION AREA
- PROPOSED SOIL SAMPLING LOCATION AND STATION ID
- PROPOSED INDUSTRIAL WASTEWATER LINE SOIL SAMPLING LOCATION AND STATION ID
- PROPOSED INDUSTRIAL WASTEWATER LINE SOIL AND HYDROPUNCH SAMPLING LOCATION AND STATION ID
- PROPOSED DISCRETE GROUNDWATER SAMPLING LOCATION AND STATION ID

HISTORICAL SOIL SAMPLING LOCATIONS

- RI/FS PHASES 2B AND 3, 1991
- ADDITIONAL WORK SITES 4 AND 5, 1992
- CTO 260 AND 280 FOLLOW-ON INVESTIGATIONS, 1994–1995
- EBS, 1995–1999
- ELECTROKINETIC TREATABILITY STUDY, 1998
- DATA GAP SAMPLING, 2001
- SITES 5 AND 14 REMOVAL ACTIONS, 2002

N

25 0 25 Feet

Sampling and Analysis Plan for OU-2C

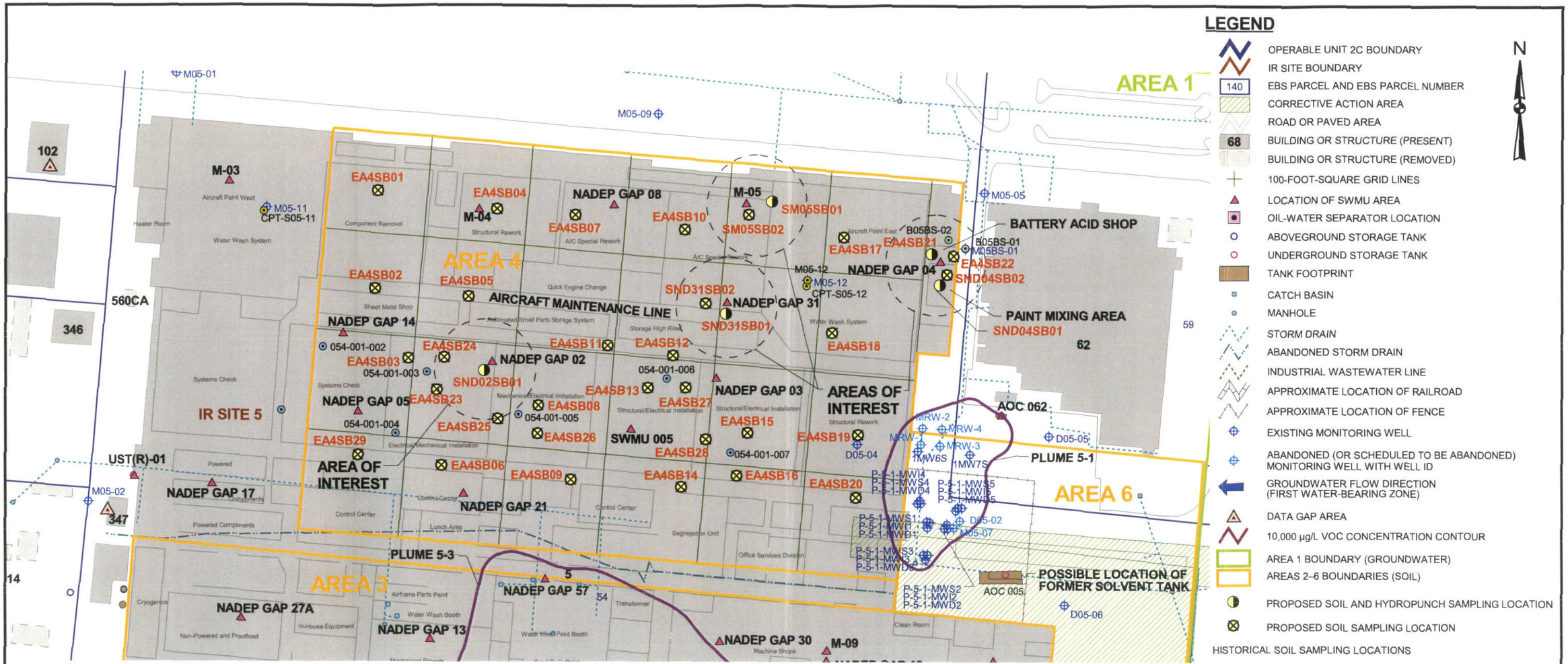
Figure A1-8

Evaluation Area 3:
Detail of Former Metal Plating Shop Area

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 1/31/07
File No.: 081L14737
Job No.: 23818-093
Rev No.: E



LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- 140 — EBS PARCEL AND EBS PARCEL NUMBER
- CORRECTIVE ACTION AREA
- ROAD OR PAVED AREA
- 68 — BUILDING OR STRUCTURE (PRESENT)
- BUILDING OR STRUCTURE (REMOVED)
- 100-FOOT-SQUARE GRID LINES
- LOCATION OF SWMU AREA
- OIL-WATER SEPARATOR LOCATION
- ABOVEGROUND STORAGE TANK
- UNDERGROUND STORAGE TANK
- TANK FOOTPRINT
- CATCH BASIN
- MANHOLE
- STORM DRAIN
- ABANDONED STORM DRAIN
- INDUSTRIAL WASTEWATER LINE
- APPROXIMATE LOCATION OF RAILROAD
- APPROXIMATE LOCATION OF FENCE
- EXISTING MONITORING WELL
- ABANDONED (OR SCHEDULED TO BE ABANDONED) MONITORING WELL WITH WELL ID
- GROUNDWATER FLOW DIRECTION (FIRST WATER-BEARING ZONE)
- DATA GAP AREA
- 10,000 µg/L VOC CONCENTRATION CONTOUR
- AREA 1 BOUNDARY (GROUNDWATER)
- AREAS 2–6 BOUNDARIES (SOIL)
- PROPOSED SOIL AND HYDROPUNCH SAMPLING LOCATION
- PROPOSED SOIL SAMPLING LOCATION

HISTORICAL SOIL SAMPLING LOCATIONS

- ADDITIONAL WORK SITES 4 AND 5, 1992
- CTO 260 AND 280 FOLLOW-ON INVESTIGATIONS, 1994–1995
- EBS, 1995–1999

N

NOTES :

AOC – AREA OF CONCERN
AST – ABOVEGROUND STORAGE TANK
CTO – CONTRACT TASK ORDER
EBS – ENVIRONMENTAL BASELINE SURVEY
GAP – GENERATOR ACCUMULATION POINT
IR – INSTALLATION RESTORATION (PROGRAM)
µg/L – MICROGRAMS PER LITER
NADEP – NAVAL AVIATION DEPOT
OU – OPERABLE UNIT
OWS – OIL-WATER SEPARATOR
RI/FS – REMEDIAL INVESTIGATION/FEASIBILITY STUDY
RCRA – RESOURCE CONSERVATION AND RECOVERY ACT
SWMU – SOLID WASTE MANAGEMENT UNIT
UST – UNDERGROUND STORAGE TANK
UST(R) – RCRA-IDENTIFIED UNDERGROUND STORAGE TANK
VOC – VOLATILE ORGANIC COMPOUND

AREA OF INTEREST – CIRCLE WITH 50-FOOT RADIUS ENCOMPASSING OWSs AND SWMUs TARGETED FOR SAMPLING UNDER THE SAMPLING AND ANALYSIS PLAN FOR OU-2C

100 0 100 Feet

Sampling and Analysis Plan for OU-2C

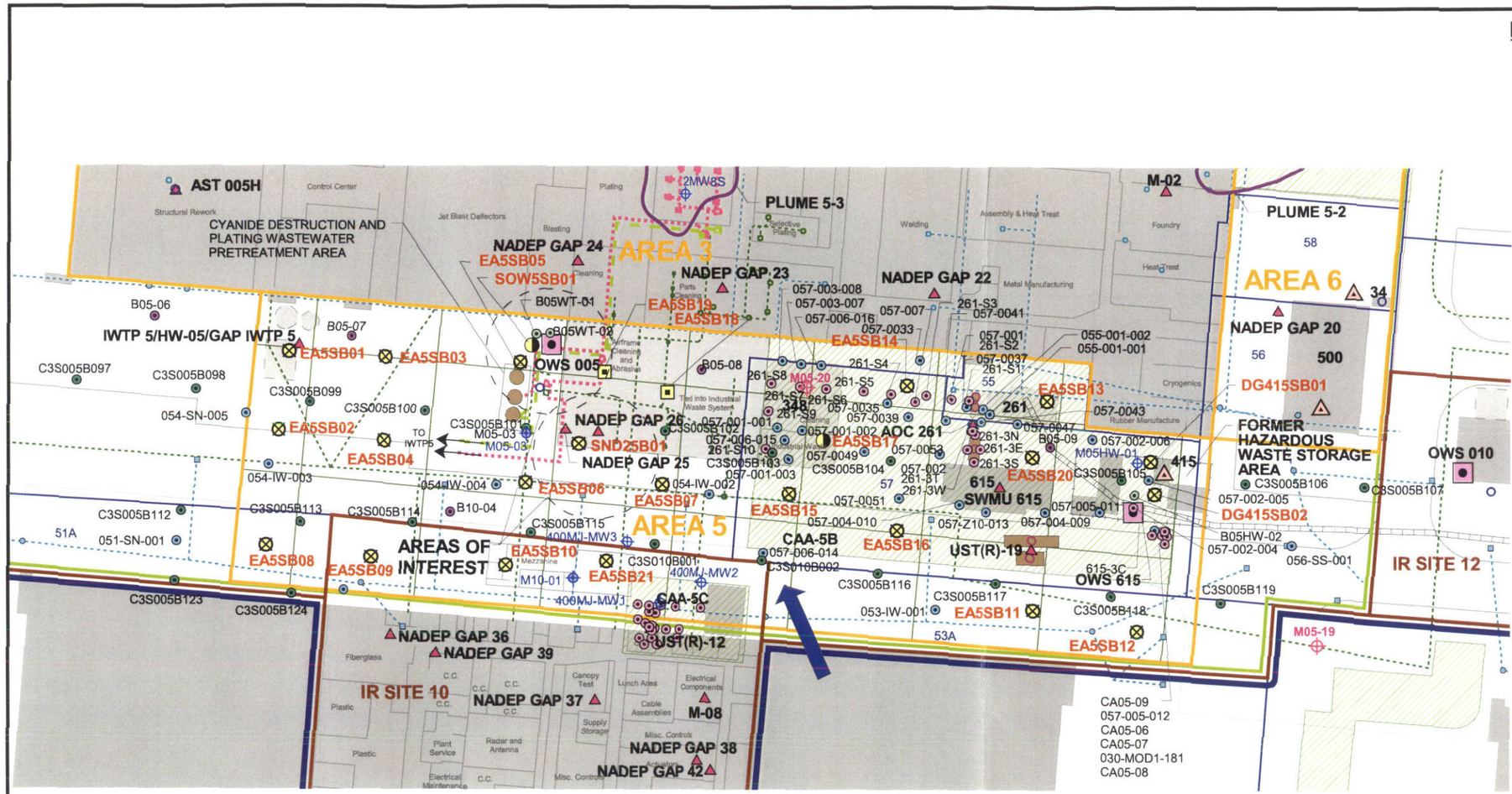
Figure A1-9

Evaluation Area 4

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 4/9/07
File No.: 093L15371
Job No.: 23818-093
Rev No.: D



LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- 140 EBS PARCEL AND EBS PARCEL NUMBER
- CORRECTIVE ACTION AREA
- ROAD OR PAVED AREA
- 68 BUILDING OR STRUCTURE (PRESENT)
- BUILDING OR STRUCTURE (REMOVED)
- 100-FOOT-SQUARE GRID LINES
- LOCATION OF SWMU AREA
- OIL-WATER SEPARATOR LOCATION
- ABOVEGROUND STORAGE TANK
- UNDERGROUND STORAGE TANK
- TANK FOOTPRINT
- CATCH BASIN
- MANHOLE
- STORM DRAIN
- INDUSTRIAL WASTEWATER LINE
- CHROMIUM WASTEWATER LINE
- CYANIDE WASTEWATER LINE
- APPROXIMATE LOCATION OF RAILROAD
- APPROXIMATE LOCATION OF FENCE
- EXISTING MONITORING WELL
- PROPOSED UPPER FIRST WATER-BEARING ZONE MONITORING WELL LOCATION
- GROUNDWATER FLOW DIRECTION (FIRST WATER-BEARING ZONE)
- DATA GAP AREA
- 10,000 µg/L VOC CONCENTRATION CONTOUR
- AREA 1 BOUNDARY (GROUNDWATER)
- AREAS 2–6 BOUNDARIES (SOIL)
- PROPOSED SOIL SAMPLING LOCATION AND STATION ID
- PROPOSED SOIL AND HYDROPUNCH SAMPLING LOCATION AND STATION ID
- PROPOSED INDUSTRIAL WASTEWATER LINE SOIL AND HYDROPUNCH SAMPLING LOCATION AND STATION ID

HISTORICAL SOIL SAMPLING LOCATIONS

- RI/FS PHASES 2B AND 3, 1991
- ADDITIONAL WORK SITES 4 AND 5, 1992
- TPH PROGRAM INVESTIGATIONS, 1993–2000
- EBS, 1995–1999
- DATA GAP SAMPLING, 2001
- PAH STUDY, 2003

N

NOTES :

AOC – AREA OF CONCERN
AST – ABOVEGROUND STORAGE TANK
CAA – CORRECTIVE ACTION AREA
EBS – ENVIRONMENTAL BASELINE SURVEY
GAP – GENERATOR ACCUMULATION POINT
IR – INSTALLATION RESTORATION (PROGRAM)
IWTP – INDUSTRIAL WASTEWATER TREATMENT PLANT
µg/L – MICROGRAMS PER LITER
NADEP – NAVAL AVIATION DEPOT
OU – OPERABLE UNIT
OWS – OIL-WATER SEPARATOR
PAH – POLYNUCLEAR AROMATIC HYDROCARBON
RI/FS – REMEDIAL INVESTIGATION/FEASIBILITY STUDY
RCRA – RESOURCE CONSERVATION AND RECOVERY ACT
SWMU – SOLID WASTE MANAGEMENT UNIT
TPH – TOTAL PETROLEUM HYDROCARBONS
UST – UNDERGROUND STORAGE TANK
UST(R) – RCRA-IDENTIFIED UNDERGROUND STORAGE TANK
VOC – VOLATILE ORGANIC COMPOUND

AREA OF INTEREST – CIRCLE WITH 50-FOOT RADIUS ENCOMPASSING OWSs AND SWMUs TARGETED FOR SAMPLING UNDER THE SAMPLING AND ANALYSIS PLAN FOR OU-2C

100 0 100 Feet

Sampling and Analysis Plan for OU-2C

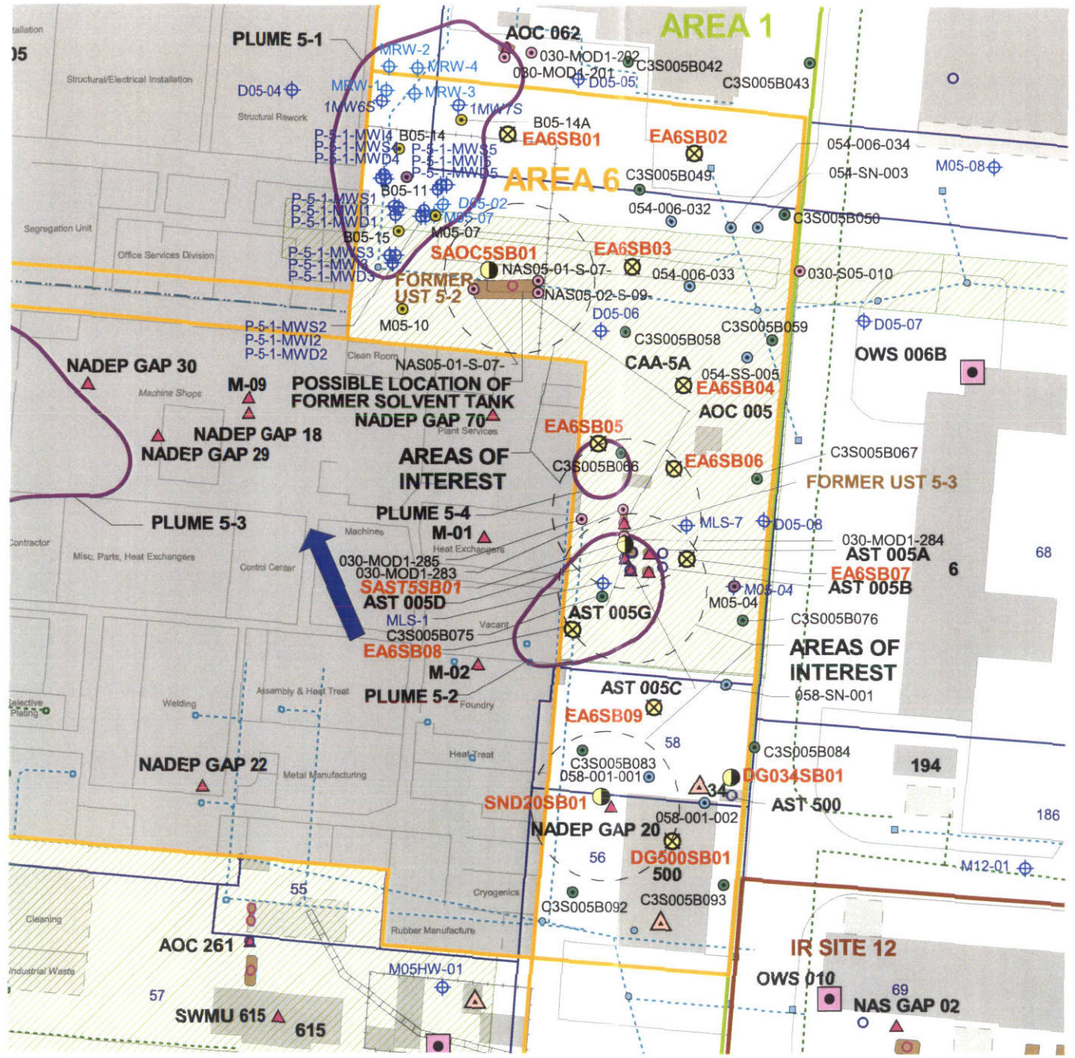
Figure A1-10

Evaluation Area 5

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 4/9/07
File No.: 093L15543
Job No.: 23818-093
Rev No.: B



LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- 140 EBS PARCEL AND EBS PARCEL NUMBER
- CORRECTIVE ACTION AREA
- ROAD OR PAVED AREA
- 68 BUILDING OR STRUCTURE (PRESENT)
- BUILDING OR STRUCTURE (REMOVED)
- LOCATION OF SWMU AREA
- OIL-WATER SEPARATOR LOCATION
- ABOVEGROUND STORAGE TANK
- UNDERGROUND STORAGE TANK
- TANK FOOTPRINT
- CATCH BASIN
- MANHOLE
- STORM DRAIN
- ABANDONED STORM DRAIN
- INDUSTRIAL WASTEWATER LINE
- EXISTING MONITORING WELL
- ABANDONED (OR SCHEDULED TO BE ABANDONED) MONITORING WELL WITH WELL ID
- GROUNDWATER FLOW DIRECTION (FIRST WATER-BEARING ZONE)
- DATA GAP AREA
- 10,000 µg/L VOC CONCENTRATION CONTOUR
- APPROXIMATE LOCATION OF FENCE
- AREA 1 BOUNDARY (GROUNDWATER)
- AREAS 2–6 BOUNDARIES (SOIL)
- PROPOSED SOIL AND HYDROPUNCH SAMPLING LOCATION AND STATION ID
- PROPOSED SOIL SAMPLING LOCATION AMD STATION ID

HISTORICAL SOIL SAMPLING LOCATIONS

- RI/FS PHASES 2B AND 3, 1991
- TPH PROGRAM INVESTIGATIONS, 1993–2000
- CTO 260 AND 280 FOLLOW-ON INVESTIGATIONS, 1994–1995
- EBS, 1995–1999
- PAH STUDY, 2003

N

100 0 100 Feet

NOTES :
AOC – AREA OF CONCERN
AST – ABOVEGROUND STORAGE TANK
CAA – CORRECTIVE ACTION AREA
CTO – CONTRACT TASK ORDER
EBS – ENVIRONMENTAL BASELINE SURVEY
GAP – GENERATOR ACCUMULATION POINT
IR – INSTALLATION RESTORATION (PROGRAM)
µg/L – MICROGRAMS PER LITER
NADEP – NAVAL AVIATION DEPOT
NAS – NAVAL AIR STATION
OU – OPERABLE UNIT
OWS – OIL-WATER SEPARATOR
PAH – POLYNUCLEAR AROMATIC HYDROCARBON
RI/FS – REMEDIAL INVESTIGATION/FEASIBILITY STUDY
RCRA – RESOURCE CONSERVATION AND RECOVERY ACT
SWMU – SOLID WASTE MANAGEMENT UNIT
TPH – TOTAL PETROLEUM HYDROCARBONS
UST – UNDERGROUND STORAGE TANK
UST(R) – RCRA-IDENTIFIED UNDERGROUND STORAGE TANK
VOC – VOLATILE ORGANIC COMPOUND

AREA OF INTEREST – CIRCLE WITH 50-FOOT RADIUS ENCOMPASSING OWSs AND SWMUs TARGETED FOR SAMPLING UNDER THE SAMPLING AND ANALYSIS PLAN FOR OU-2C

Sampling and Analysis Plan for OU-2C

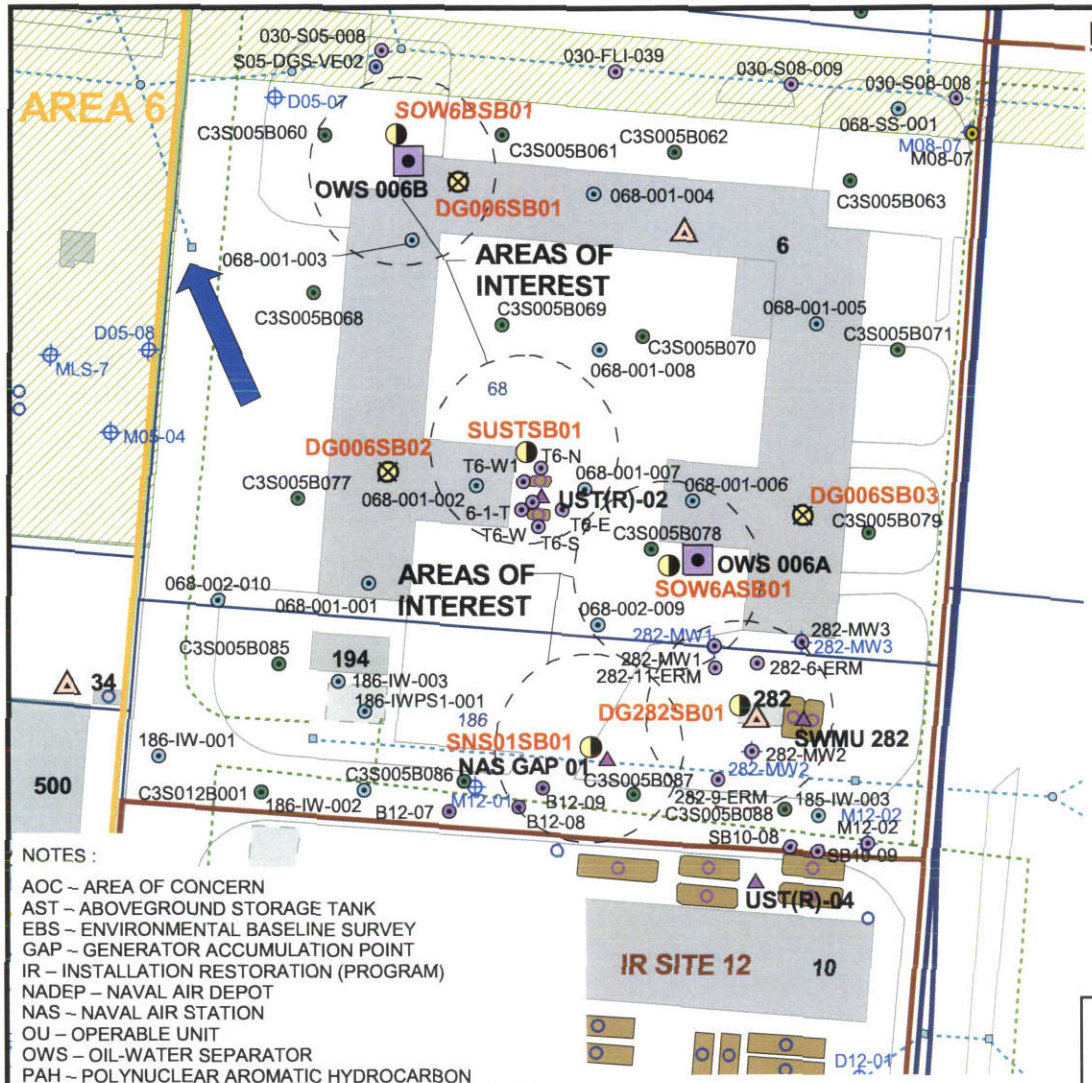
Figure A1-11

Evaluation Area 6

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 4/10/07
File No.: 093Q15372
Job No.: 23818-093
Rev No.: E



NOTES :

AOC – AREA OF CONCERN
AST – ABOVEGROUND STORAGE TANK
EBS – ENVIRONMENTAL BASELINE SURVEY
GAP – GENERATOR ACCUMULATION POINT
IR – INSTALLATION RESTORATION (PROGRAM)
NADEP – NAVAL AIR DEPOT
NAS – NAVAL AIR STATION
OU – OPERABLE UNIT
OWS – OIL-WATER SEPARATOR
PAH – POLYNUCLEAR AROMATIC HYDROCARBON
RCRA – RESOURCE CONSERVATION AND RECOVERY ACT
SWMU – SOLID WASTE MANAGEMENT UNIT
TPH – TOTAL PETROLEUM HYDROCARBONS
UST – UNDERGROUND STORAGE TANK
UST(R) – RCRA-IDENTIFIED UNDERGROUND STORAGE TANK

AREA OF INTEREST – CIRCLE WITH 50-FOOT RADIUS ENCOMPASSING OWSs AND SWMUs TARGETED FOR SAMPLING UNDER THE SAMPLING AND ANALYSIS PLAN FOR OU-2C

100 0 100 Feet

LEGEND

- OPERABLE UNIT 2C BOUNDARY
- *IR SITE BOUNDARY*
- 140 EBS PARCEL AND EBS PARCEL NUMBER
- CORRECTIVE ACTION AREA
- ROAD OR PAVED AREA
- 68 BUILDING OR STRUCTURE (PRESENT)
- BUILDING OR STRUCTURE (REMOVED)
- LOCATION OF SWMU AREA
- OIL-WATER SEPARATOR LOCATION
- ABOVEGROUND STORAGE TANK
- UNDERGROUND STORAGE TANK
- TANK FOOTPRINT
- CATCH BASIN
- MANHOLE
- STORM DRAIN
- INDUSTRIAL WASTEWATER LINE
- EXISTING MONITORING WELL
- GROUNDWATER FLOW DIRECTION (FIRST WATER-BEARING ZONE)
- DATA GAP AREA
- AREA 1 BOUNDARY (GROUNDWATER)
- AREAS 2–6 BOUNDARIES (SOIL)
- PROPOSED SOIL AND HYDROPUNCH SAMPLING LOCATION AND STATION ID
- PROPOSED SOIL SAMPLING LOCATION AND STATION ID

HISTORICAL SOIL OR GROUNDWATER SAMPLING LOCATIONS

- TPH PROGRAM INVESTIGATIONS, 1993–2000
- EBS, 1995–1999
- PAH STUDY, 2003
- *DATA GAP SAMPLING, 2001*

N

Sampling and Analysis Plan for OU-2C

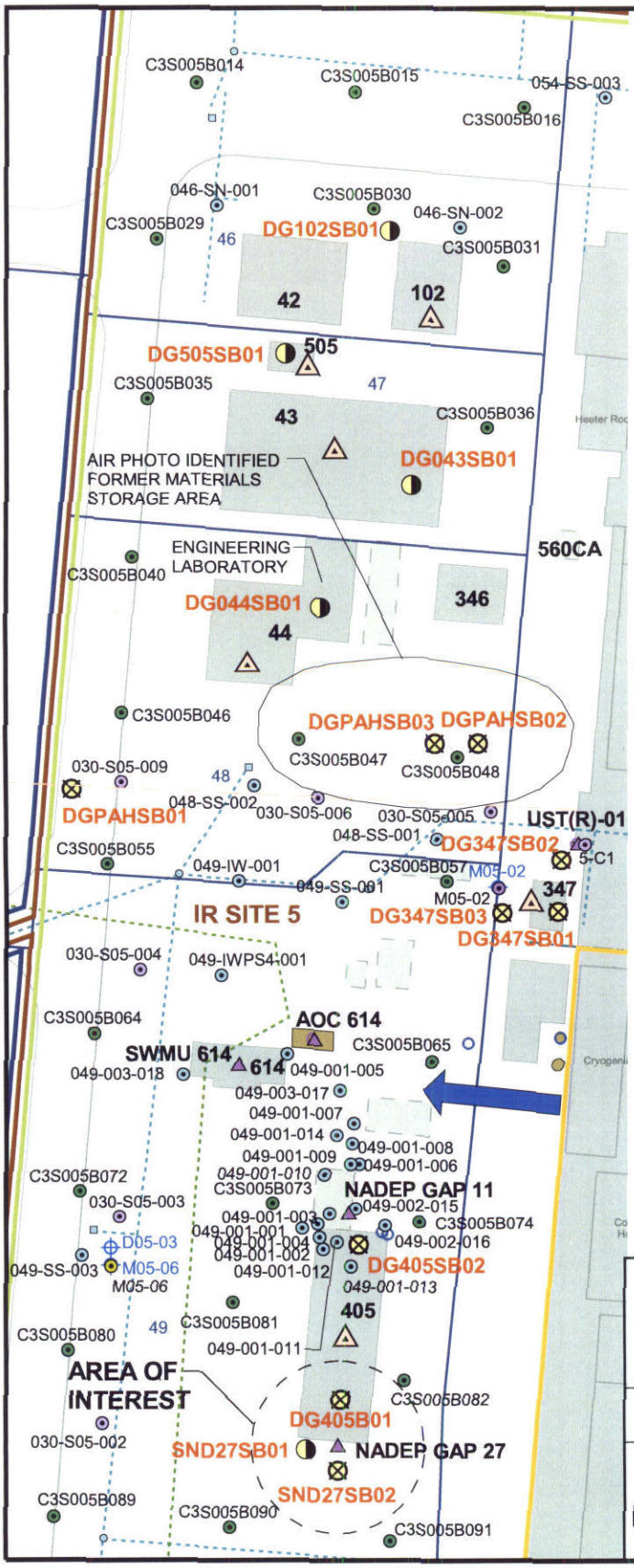
Figure A1-12

Data Gap Buildings 6 and 282, and SWMUs
OWS 006A, OWS 006B, NAS GAP 01, and UST(R)-02

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 4/9/07
File No.: 093L15369
Job No.: 23818-093
Rev No.: C



LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- 140 EBS PARCEL AND EBS PARCEL NUMBER
- CORRECTIVE ACTION AREA
- ROAD OR PAVED AREA
- 68 BUILDING OR STRUCTURE (PRESENT)
- BUILDING OR STRUCTURE (REMOVED)
- *LOCATION OF SWMU AREA*
- ABOVEGROUND STORAGE TANK
- UNDERGROUND STORAGE TANK
- TANK FOOTPRINT
- CATCH BASIN
- MANHOLE
- STORM DRAIN
- ABANDONED STORM DRAIN
- INDUSTRIAL WASTEWATER LINE
- FUEL LINE (REMOVED OR CLOSED IN PLACE)
- *EXISTING MONITORING WELL*
- GROUNDWATER FLOW DIRECTION (FIRST WATER-BEARING ZONE)
- DATA GAP AREA
- AREA 1 BOUNDARY (GROUNDWATER)
- AREAS 2–6 BOUNDARIES (SOIL)
- PROPOSED SOIL AND HYDROPUNCH SAMPLING LOCATION AND STATION ID
- PROPOSED SOIL SAMPLING LOCATION AND STATION ID

HISTORICAL SOIL SAMPLING LOCATIONS

- RI/FS PHASES 2B AND 3, 1991
- EBS, 1995–1999
- CTO 260 AND 280 FOLLOW-ON INVESTIGATIONS, 1994–1995
- PAH STUDY, 2003
- TPH PROGRAM INVESTIGATIONS, *1993–2000*

NOTES :

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GAP – GENERATOR ACCUMULATION POINT
IR – INSTALLATION RESTORATION (PROGRAM)
NADEP – NAVAL AVIATION DEPOT
OU – OPERABLE UNIT
PAH – POLYNUCLEAR AROMATIC HYDROCARBON
RI/FS – REMEDIAL INVESTIGATION/FEASIBILITY STUDY
RCRA – RESOURCE CONSERVATION AND RECOVERY ACT
SWMU – SOLID WASTE MANAGEMENT UNIT
TPH – TOTAL PETROLEUM HYDROCARBONS
UST – UNDERGROUND STORAGE TANK
UST(R) – RCRA-IDENTIFIED UNDERGROUND STORAGE TANK

AREA OF INTEREST – CIRCLE WITH 50-FOOT RADIUS ENCOMPASSING OWSs AND SWMUs TARGETED FOR SAMPLING UNDER THE SAMPLING AND ANALYSIS PLAN FOR OU-2C

N

100 0 100 Feet

Sampling and Analysis Plan for OU-2C

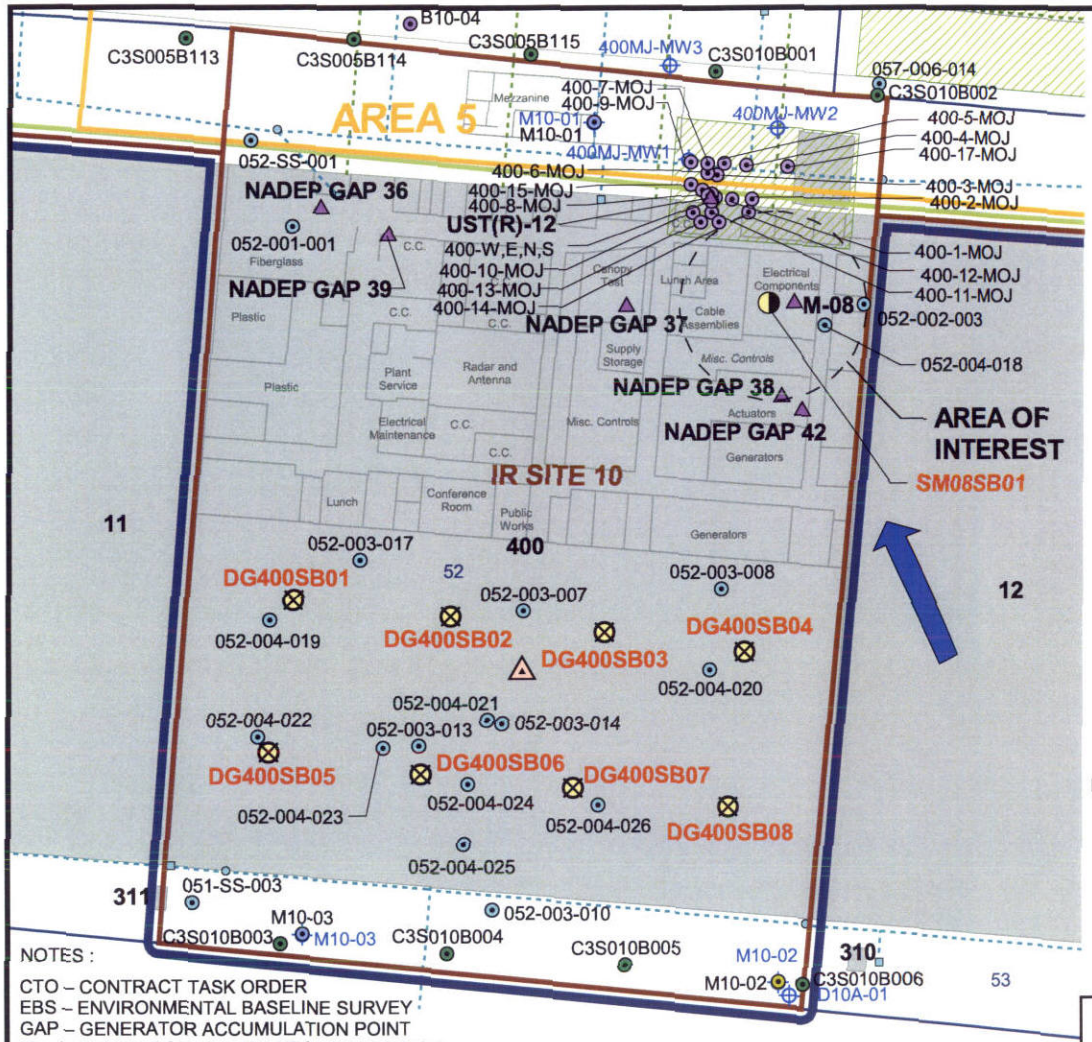
Figure A1-13

Data Gap Buildings 43, 44, 102, 347, 405, and 505, and SWMU NADEP GAP 27

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 4/9/07
File No.: 093L15376
Job No.: 23818-093
Rev No.: C



NOTES :

CTO – CONTRACT TASK ORDER
EBS – ENVIRONMENTAL BASELINE SURVEY
GAP – GENERATOR ACCUMULATION POINT
IR – INSTALLATION RESTORATION (PROGRAM)
NADEP – NAVAL AVIATION DEPOT
OU – OPERABLE UNIT
OWS – OIL-WATER SEPARATOR
PAH – POLYNUCLEAR AROMATIC HYDROCARBON
RI/FS – REMEDIAL INVESTIGATION/FEASIBILITY STUDY
RCRA – RESOURCE CONSERVATION AND RECOVERY ACT
SWMU – SOLID WASTE MANAGEMENT UNIT
TPH – TOTAL PETROLEUM HYDROCARBONS
UST – UNDERGROUND STORAGE TANK
UST(R) – RCRA-IDENTIFIED UNDERGROUND STORAGE TANK

AREA OF INTEREST – CIRCLE WITH A 50-FOOT RADIUS ENCOMPASSING OWSs AND SWMUs TARGETED FOR SAMPLING UNDER THE SAMPLING AND ANALYSIS PLAN FOR OU-2C

100 0 100 Feet

LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- 140 EBS PARCEL AND EBS PARCEL NUMBER
- CORRECTIVE ACTION AREA
- ROAD OR PAVED AREA
- 68 BUILDING OR STRUCTURE (PRESENT)
- BUILDING OR STRUCTURE (REMOVED)
- LOCATION OF SWMU AREA
- UNDERGROUND STORAGE TANK
- CATCH BASIN
- MANHOLE
- STORM DRAIN
- INDUSTRIAL WASTEWATER LINE
- EXISTING MONITORING WELL
- GROUNDWATER FLOW DIRECTION (FIRST WATER-BEARING ZONE)
- DATA GAP AREA
- AREA 1 BOUNDARY (GROUNDWATER)
- AREAS 2–6 BOUNDARIES (SOIL)
- PROPOSED SOIL AND HYDROPUNCH SAMPLING LOCATION AND STATION ID
- PROPOSED SOIL SAMPLING LOCATION AND STATION ID

HISTORICAL SOIL SAMPLING LOCATIONS

- RI/FS PHASES 2B AND 3, 1991
- TPH PROGRAM INVESTIGATIONS, 1993–2000
- CTO 260 AND 280 FOLLOW-ON INVESTIGATIONS, 1994–1995
- EBS, 1995–1999
- DATA GAP SAMPLING, 2001
- PAH STUDY, 2003

N

Sampling and Analysis Plan for OU-2C

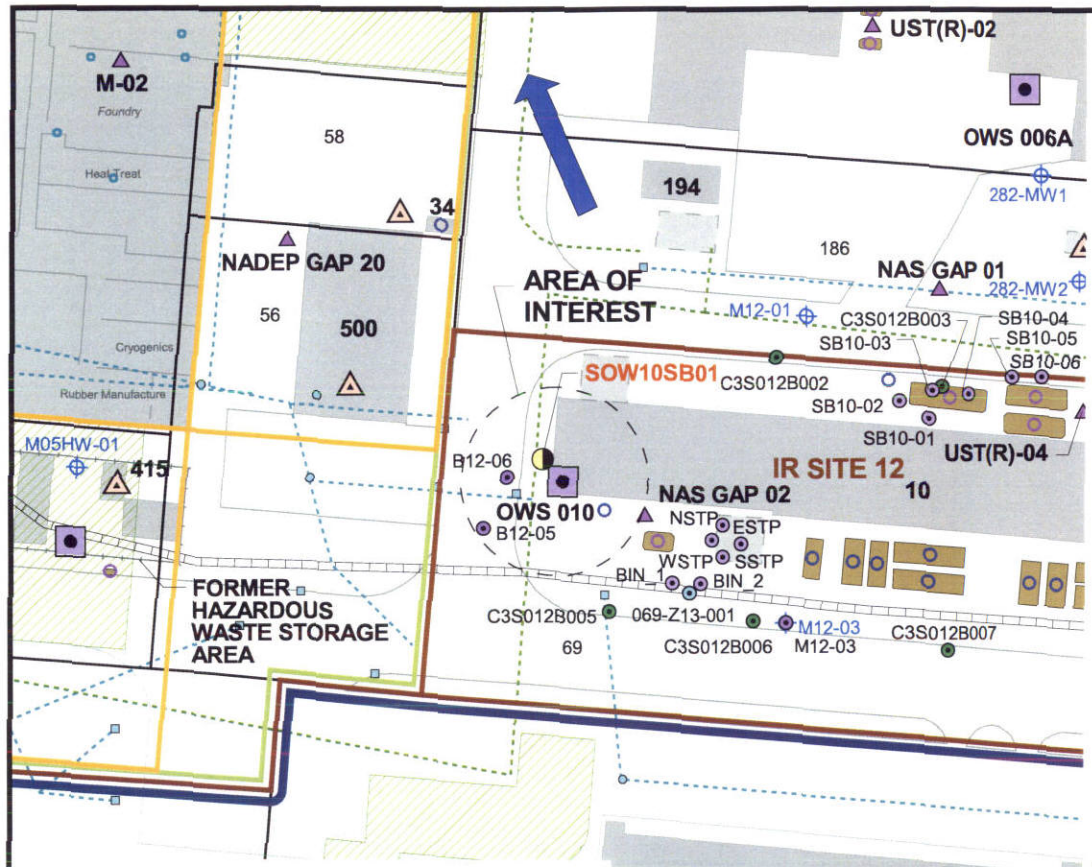
Figure A1-14

Data Gap Building 400 and SWMU M-08

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 4/7/07
File No.: 093L15377
Job No.: 23818-093
Rev No.: C



LEGEND

- OPERABLE UNIT 2C BOUNDARY
- *IR SITE BOUNDARY*
- 140 EBS PARCEL AND EBS PARCEL NUMBER
- CORRECTIVE ACTION AREA
- ROAD OR PAVED AREA
- 68 BUILDING OR STRUCTURE (PRESENT)
- BUILDING OR STRUCTURE (REMOVED)
- LOCATION OF SWMU AREA
- OIL-WATER SEPARATOR LOCATION
- ABOVEGROUND STORAGE TANK
- UNDERGROUND STORAGE TANK
- TANK FOOTPRINT
- CATCH BASIN
- MANHOLE
- STORM DRAIN
- INDUSTRIAL WASTEWATER LINE
- APPROXIMATE LOCATION OF RAILROAD
- *APPROXIMATE LOCATION OF FENCE*
- GROUNDWATER FLOW DIRECTION (FIRST WATER-BEARING ZONE)
- EXISTING MONITORING WELL
- DATA GAP AREA
- AREA 1 BOUNDARY (GROUNDWATER)
- AREAS 2–6 BOUNDARIES (SOIL)
- PROPOSED SOIL AND HYDROPUNCH SAMPLING LOCATION AND STATION ID

HISTORICAL SOIL SAMPLING LOCATIONS

- RI/FS PHASES 2B AND 3, 1991
- TPH PROGRAM INVESTIGATIONS, 1993–2000
- EBS, 1995–1999
- PAH STUDY, 2003

N

NOTES :

AST – ABOVEGROUND STORAGE TANK
EBS – ENVIRONMENTAL BASELINE SURVEY
GAP – GENERATOR ACCUMULATION POINT
IR – INSTALLATION RESTORATION (PROGRAM)
NADEP – NAVAL AVIATION DEPOT
NAS – NAVAL AIR STATION
OU – OPERABLE UNIT
OWS – OIL-WATER SEPARATOR
PAH – POLYNUCLEAR AROMATIC HYDROCARBON
RI/FS – REMEDIAL INVESTIGATION/FEASIBILITY STUDY
RCRA – RESOURCE CONSERVATION AND RECOVERY ACT
SWMU – SOLID WASTE MANAGEMENT UNIT
TPH – TOTAL PETROLEUM HYDROCARBONS
UST – UNDERGROUND STORAGE TANK
UST(R) – RCRA-IDENTIFIED UNDERGROUND STORAGE TANK

AREA OF INTEREST – CIRCLE WITH 50-FOOT RADIUS ENCOMPASSING OWSs AND SWMUs TARGETED FOR SAMPLING UNDER THE SAMPLING AND ANALYSIS PLAN FOR OU-2C

100 0 100 Feet

Sampling and Analysis Plan for OU-2C

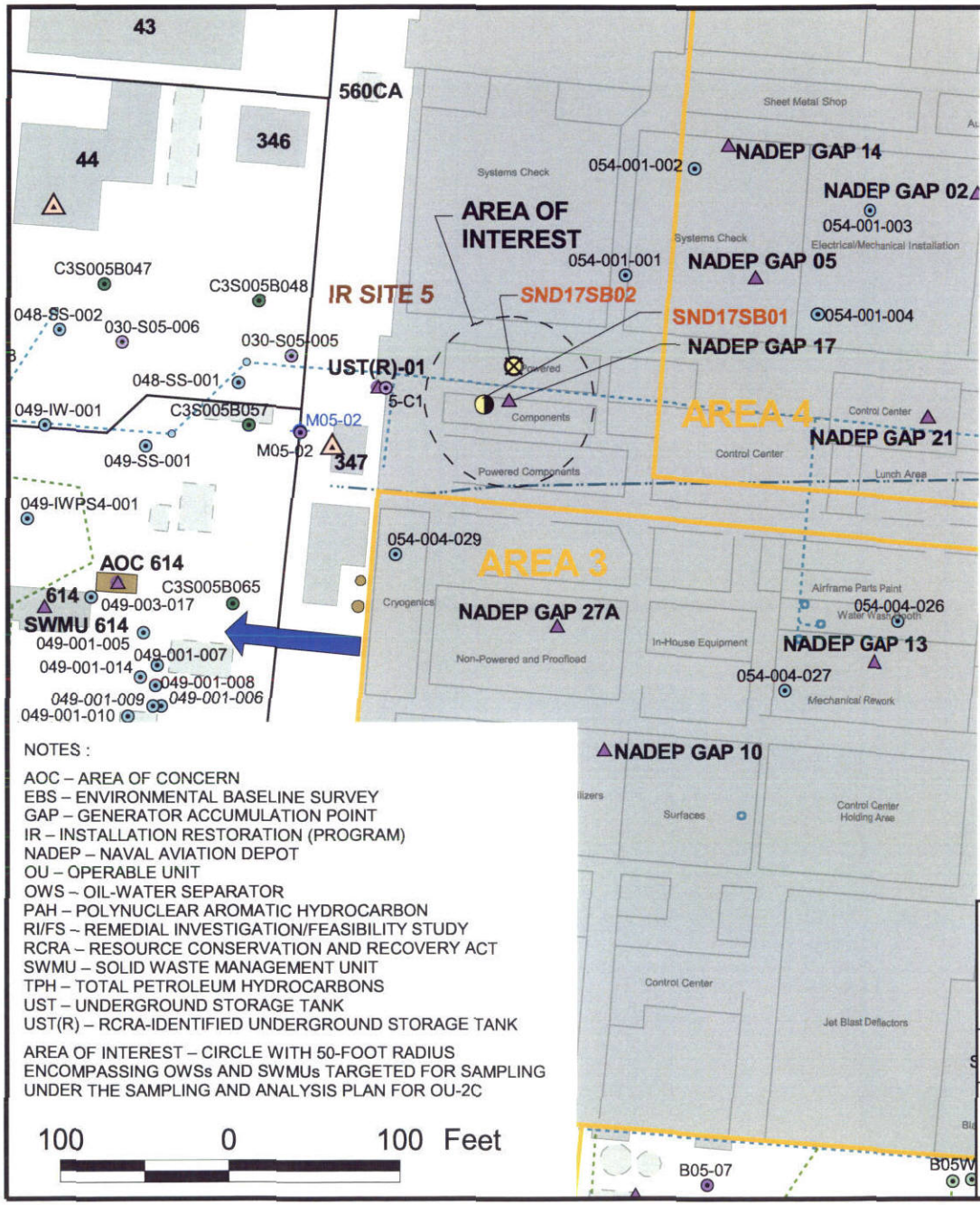
Figure A1-15

SWMU OWS 010

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 4/10/06
File No.: 093L15370
Job No.: 23818-093
Rev No.: B



NOTES :

AOC – AREA OF CONCERN
EBS – ENVIRONMENTAL BASELINE SURVEY
GAP – GENERATOR ACCUMULATION POINT
IR – INSTALLATION RESTORATION (PROGRAM)
NADEP – NAVAL AVIATION DEPOT
OU – OPERABLE UNIT
OWS – OIL-WATER SEPARATOR
PAH – POLYNUCLEAR AROMATIC HYDROCARBON
RI/FS – REMEDIAL INVESTIGATION/FEASIBILITY STUDY
RCRA – RESOURCE CONSERVATION AND RECOVERY ACT
SWMU – SOLID WASTE MANAGEMENT UNIT
TPH – TOTAL PETROLEUM HYDROCARBONS
UST – UNDERGROUND STORAGE TANK
UST(R) – RCRA-IDENTIFIED UNDERGROUND STORAGE TANK

AREA OF INTEREST – CIRCLE WITH 50-FOOT RADIUS ENCOMPASSING OWSs AND SWMUs TARGETED FOR SAMPLING UNDER THE SAMPLING AND ANALYSIS PLAN FOR OU-2C

100 0 100 Feet

LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- 140 — EBS PARCEL AND EBS PARCEL NUMBER
- ROAD OR PAVED AREA
- 68 — BUILDING OR STRUCTURE (PRESENT)
- BUILDING OR STRUCTURE (REMOVED)
- LOCATION OF SWMU AREA
- *UNDERGROUND STORAGE TANK*
- TANK FOOTPRINT
- CATCH BASIN
- MANHOLE
- STORM DRAIN
- ABANDONED STORM DRAIN
- INDUSTRIAL WASTEWATER LINE
- EXISTING MONITORING WELL
- GROUNDWATER FLOW DIRECTION (FIRST WATER-BEARING ZONE)
- DATA GAP AREA
- AREA 1 BOUNDARY (GROUNDWATER)
- AREAS 2–6 BOUNDARIES (SOIL)
- PROPOSED SOIL AND HYDROPUNCH SAMPLING LOCATION AND STATION ID
- PROPOSED SOIL SAMPLING LOCATION AMD STATION ID

HISTORICAL SOIL SAMPLING LOCATIONS

- RI/FS PHASES 2B AND 3, 1991
- TPH PROGRAM INVESTIGATIONS, 1993–2000
- EBS, 1995–1999
- PAH STUDY, 2003

N

Sampling and Analysis Plan for OU-2C

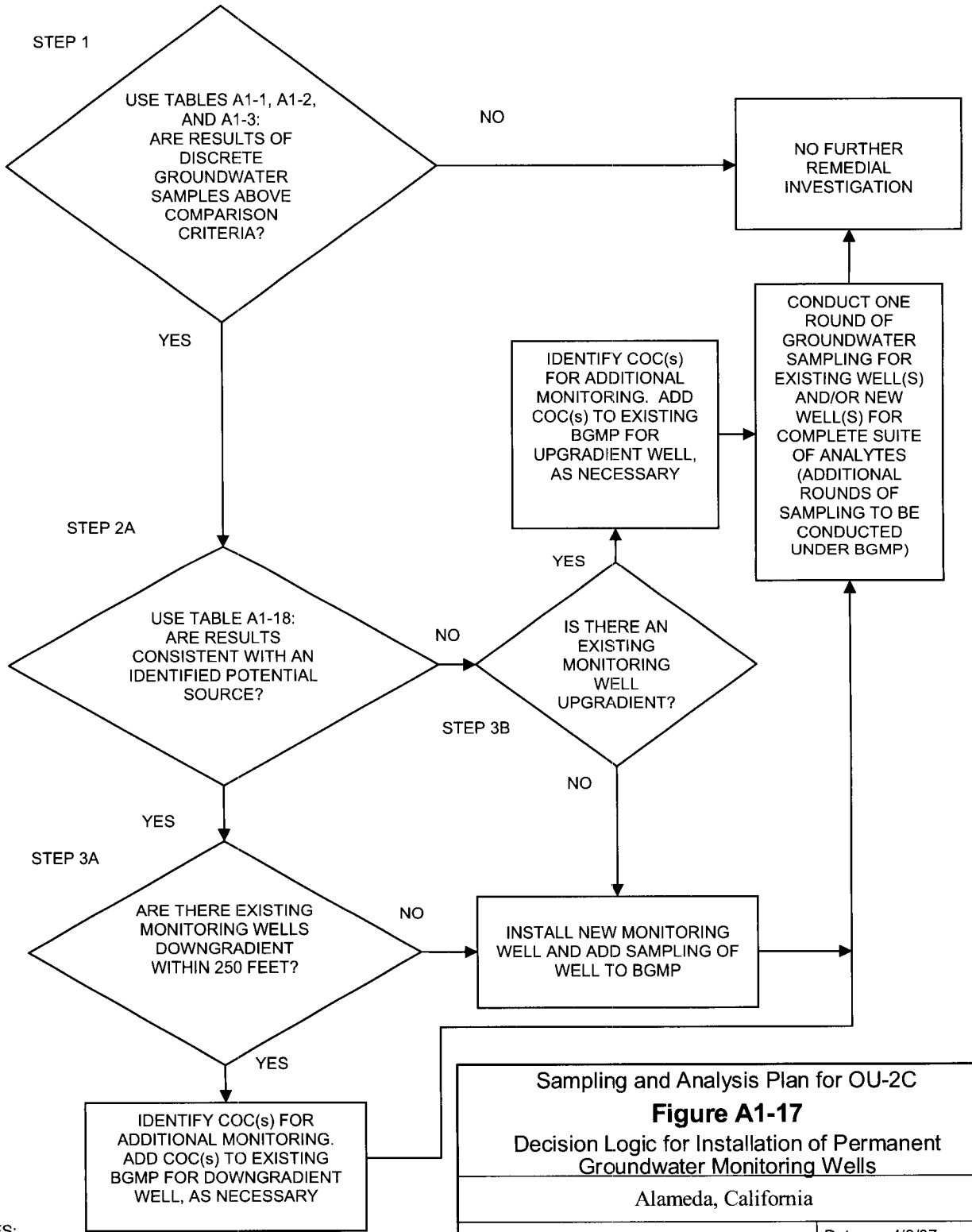
Figure A1-16

SWMU NADEP GAP 17

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 1/3/07
File No.: 093L15368
Job No.: 23818-093
Rev No.: B



NOTES:

BGMP – BASEWIDE GROUNDWATER MONITORING PROGRAM
COC – CHEMICAL OF CONCERN
OU – OPERABLE UNIT

Sampling and Analysis Plan for OU-2C

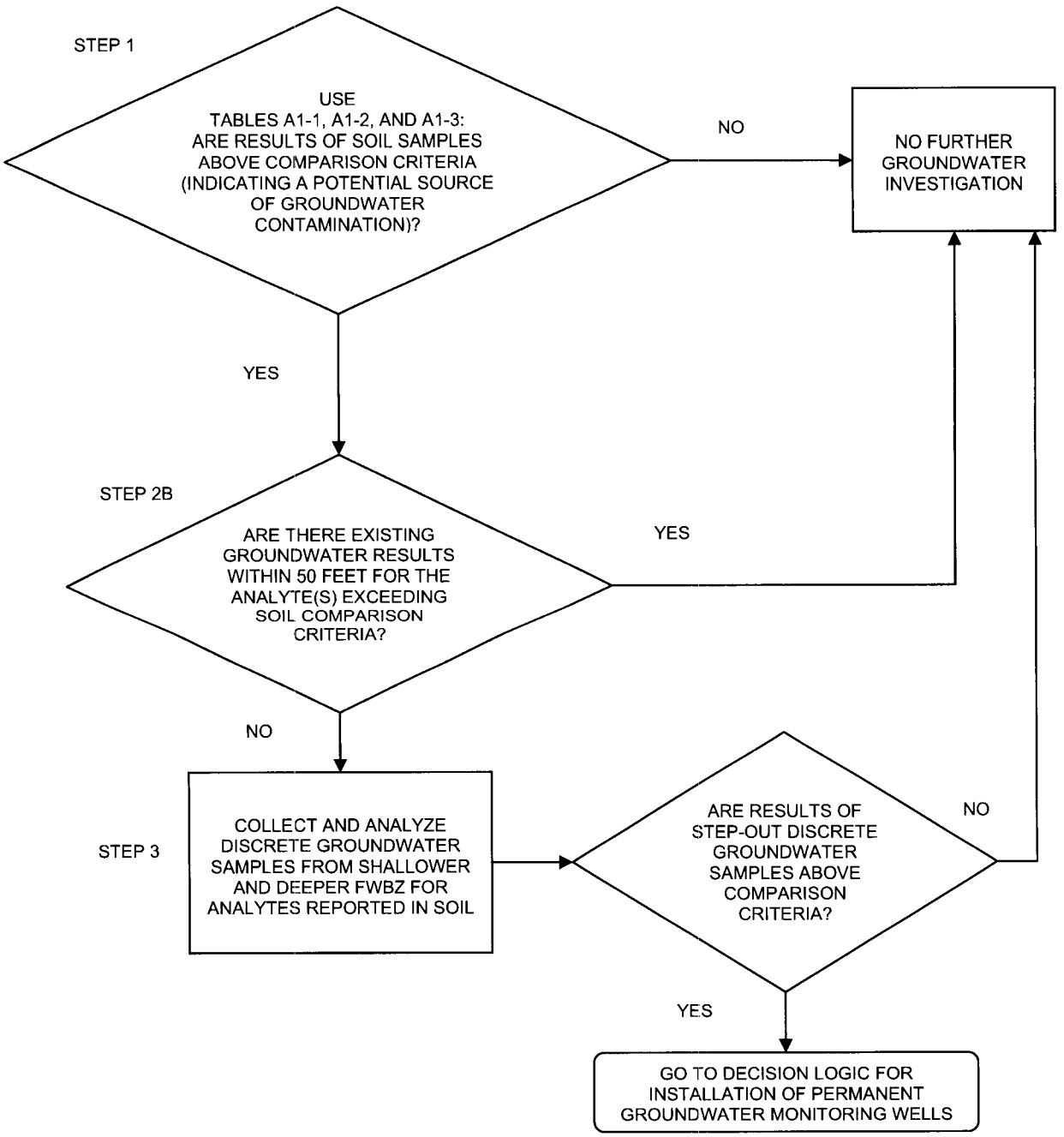
Figure A1-17

Decision Logic for Installation of Permanent Groundwater Monitoring Wells

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 4/9/07
File No.:figA1-17.doc
Job No.: 23818-093
Rev No.: G



NOTES:

FWBZ – FIRST WATER-BEARING ZONE
OU – OPERABLE UNIT

Sampling and Analysis Plan for OU-2C

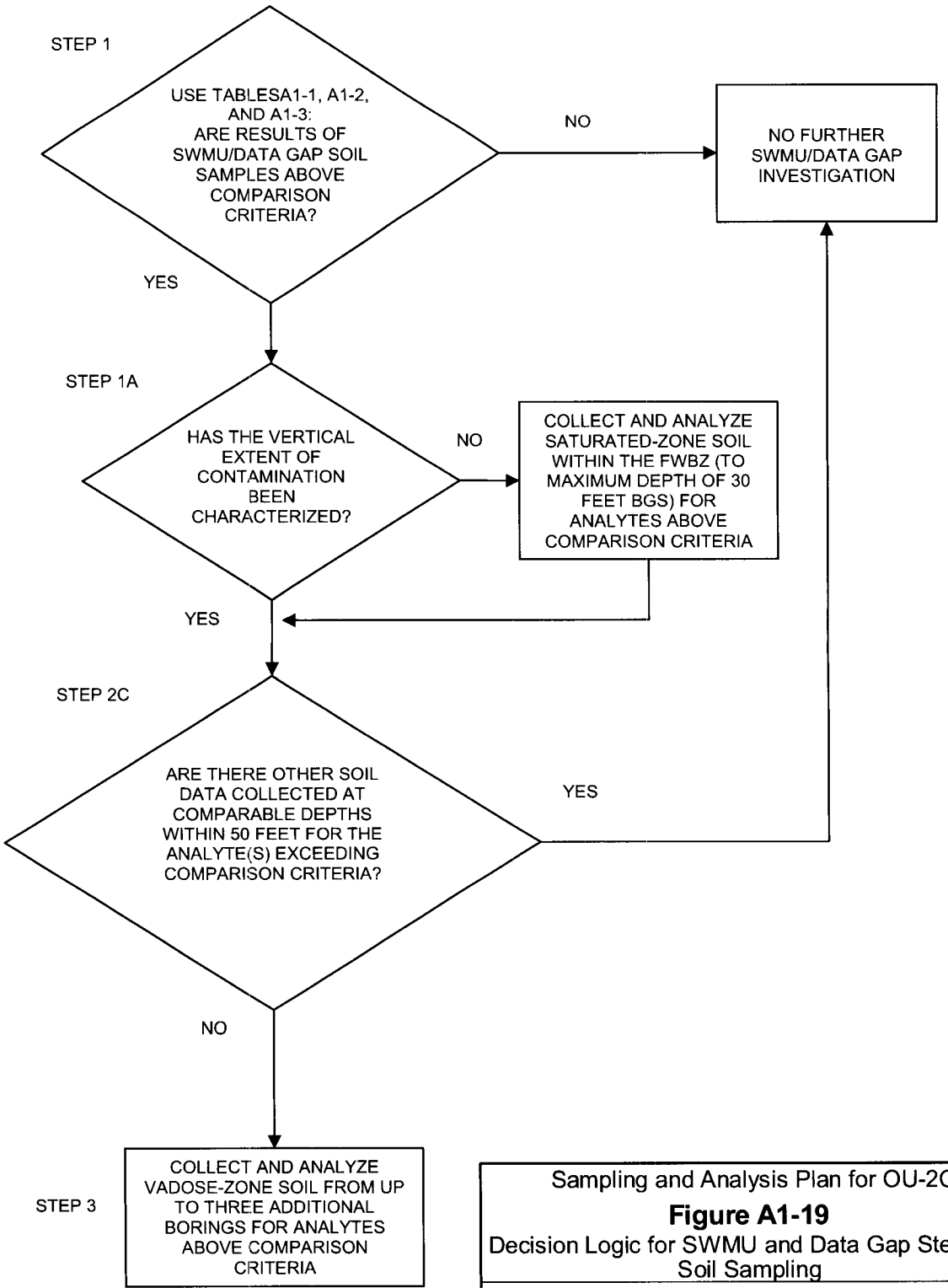
Figure A1-18

Decision Logic for Discrete Groundwater Step-Out Sampling

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 4/16/07
File No.:figA1-18.doc
Job No.: 23818-093
Rev No.: D



NOTES:

BGS – BELOW GROUND SURFACE
FWBZ – FIRST WATER-BEARING ZONE
OU – OPERABLE UNIT
SWMU – SOLID WASTE MANAGEMENT UNIT

Sampling and Analysis Plan for OU-2C

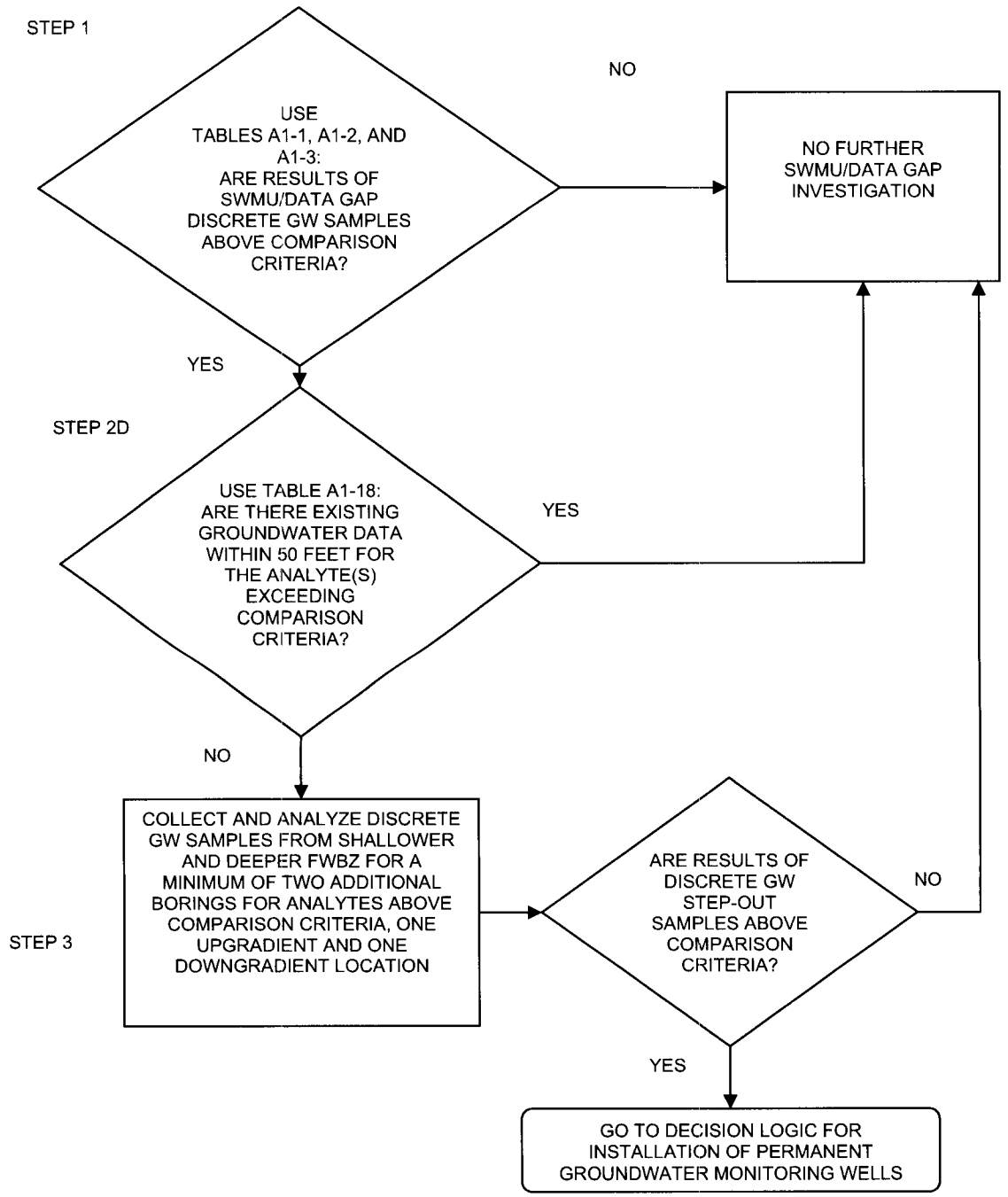
Figure A1-19

Decision Logic for SWMU and Data Gap Step-Out Soil Sampling

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 4/16/07
File No.:figA1-19.doc
Job No.: 23818-093
Rev No.: F



NOTES:

FWBZ – FIRST WATER BEARING ZONE
GW – GROUNDWATER
OU – OPERABLE UNIT
SWMU – SOLID WASTE MANAGEMENT UNIT

Sampling and Analysis Plan for OU-2C

Figure A1-20

Decision Logic for SWMU and Data Gap Step-Out Discrete Groundwater Sampling

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 4/16/07
File No.:figA1-20.doc
Job No.: 23818-093
Rev No.: C

Table A1-1
Comparison Criteria[a] for Organic Compounds Previously Reported[b] in Soil and Groundwater

Analyte	SOIL	GROUNDWATER		SURFACE WATER	
	Residential PRG (mg/kg)	Federal MCL (µg/L)	California-Modified MCL (µg/L)	CTR Saltwater Criterion Continuous Concentration (µg/L)	CTR Human Health Consumption of Organisms Only (µg/L)
Volatile Organic Compounds					
benzene	0.6	5	1	—	71
chlorobenzene	150	100	—[c]	—	21,000
1,1-dichloroethane	2.8	—	5	—	—
1,2-dichloroethane	0.28	5	0.5	—	99
cis-1,2-dichloroethene	43	70	6	—	—
trans-1,2-dichloroethene	69	100	10	—	140,000
1,2-dichloropropane	0.34	5	5	—	39
ethylbenzene	8.9	700	300	—	29,000
methyl tert-butyl ether	32	—	13	—	—
methylene chloride	9.1	5	5	—	—
styrene	1,700	100	100	—	—
tetrachloroethene	1.5	5	5	—	8.85
toluene	520	1,000	150	—	200,000
trichloroethene	0.053	5	5	—	81
trichlorofluoromethane	390	—	150	—	—
vinyl chloride	0.079	2	0.5	—	525
xylenes, total	270	10,000	1,750	—	—
Semivolatile Organic Compounds					
benzo(a)pyrene	0.062	0.2	0.2	—	0.049
bis(2-chloroethyl)ether	0.21	—	—	—	0.53
bis(2-ethylhexyl)phthalate	35	6	4	—	5.9
1,2-dichlorobenzene	370	600	600	—	17,000
1,4-dichlorobenzene	3.4	75	5	—	2,600
1,4-dioxane	44	—	3[d]	—	—
pentachlorophenol	3	1	—	7.9	8.2
Pesticides/PCBs					
aldrin	0.029	—	—	—	0.00014
Aroclor 1260	0.22	0.5	0.5	0.03	0.00017
beta-BHC	0.32	—	—	—	0.046
delta-BHC	—	—	—	—	—
alpha-chlordane	—	2	0.1	0.00081	0.00059
gamma-chlordane	—	2	0.1	0.00081	0.00059
4,4'-DDT	1.7	—	—	0.001	0.00059
endrin aldehyde	—	—	—	—	0.81
heptachlor	0.11	0.4	0.01	0.0036	0.00021

Table A1-1 (continued)

[a] for groundwater samples, MCLs (lower of either federal or California) are used for comparison purposes in subsequent Tables A1-4, A1-5, and A1-8 through A1-11, although they may not be directly applicable to groundwater quality at OU-2C
[b] plus chemicals potentially present for which no previous analysis has been conducted
[c] dash indicates value not established
[d] advisory level

Acronyms/Abbreviations:
BHC – benzene hexachloride
CTR – California Toxics Rule
DDT – dichlorodiphenyltrichloroethane
µg/kg –micrograms per kilogram
µg/L – micrograms per liter
MCL – maximum contaminant level
OU – operable unit
PCB – polychlorinated biphenyl

Table A1-2
Comparison Criteria[a] for Inorganic Analytes in Soil and Groundwater

Analyte	SOIL		GROUNDWATER			SURFACE WATER	
	Residential PRG (mg/kg)	Alameda Point "Pink" Background 95th Soil Percentile[b] (mg/kg)	Federal MCL[a] (µg/L)	California-Modified MCL[a] (µg/L)	Alameda Point Background 95th Percentile[b] (µg/L)	CTR Saltwater Criterion Continuous Concentration (µg/L)	CTR Human Health Consumption of Organisms Only (µg/L)
Cyanide	1,200	—[c]	200	150	—	—	—
Metals							
aluminum	76,000	13,960	1,000	1,000	1,070	—	—
antimony	31	9.5	6	6	37.50	—	4,300
arsenic	0.39	9.14	10	50	20.72	36	—
barium	5,400	93.68	2,000	1,000	569.50	—	—
beryllium	150	1.27	4	4	2.50	—	—
cadmium	37	1.72	5	5	—	9.3	—
calcium	—	16,800	—	—	—	—	—
chromium, total	210	54.84	100	50	12.45	—	—
chromium, hexavalent	30	—	2	—	—	50	—
cobalt	900	14.3		—	—	—	—
copper	3,100	39.14		—	24.03	3.1	—
iron	23,000	22,280		—	6,586	—	—
lead	150	37.66	15[d]	—	11.45	8.1	—
magnesium	—	7304		—	—	—	—
manganese	1,800	383		—	1,741	—	—
mercury	23	0.52	2	—	—	0.025	0.051
nickel	1,600	55.72		100	—	8.2	4,600
potassium	—	1,232		—	—	—	—
silver	390	2.22	50	50	—	—	—

Table A1-2 (continued)

Analyte	SOIL		GROUNDWATER			SURFACE WATER	
	Residential PRG (mg/kg)	Alameda Point "Pink" Background 95th Soil Percentile[b] (mg/kg)	Federal MCL[a] (µg/L)	California-Modified MCL[a] (µg/L)	Alameda Point Background 95th Percentile[b] (µg/L)	CTR Saltwater Criterion Continuous Concentration (µg/L)	CTR Human Health Consumption of Organisms Only (µg/L)
sodium	—	1,230		—	—	—	—
thallium	5.2	—	2	2	—	—	6.3
vanadium	550	47.34	—	—	26.27	—	—
zinc	23,000	67.48	—	—	36.39	81	—
Radionuclides							
gross alpha	—	—	15 pCi/L	15 pCi/L	—	—	—
gross beta	—	—	—	50 pCi/L	—	—	—

Notes:

[a] for soil samples, residential PRGs are used for comparison purposes in subsequent Table A1-17; for groundwater samples, MCLs (lower of either federal or California) are used for comparison purposes in subsequent Tables A1-4, A1-5, and A1-8 through A1-11, although they may not be directly applicable to groundwater quality at OU-2C; note that for the RI report, analytical results at concentrations exceeding background but less than PRGs or MCLs, or for which no MCLs exist, will be addressed as a possible indication of a release

[b] TtEMI 2004

[c] dash indicates value not established

[d] advisory level

Acronyms/Abbreviations:

µg/L – micrograms per liter

mg/kg – milligrams per kilogram

Table A1-3
Comparison Criteria for TPH in Soil and Groundwater

TPH Constituent	SOIL CRITERIA			WATER CRITERIA	
	Alameda Point–Specific Screening Criteria[a] (mg/kg)	RWQCB ESL for Residential Land Use[b] (mg/kg)	RWQCB ESL for Commercial Land Use[c] (mg/kg)	RWQCB ESL for Groundwater[d] (µg/L)	RWQCB ESL for Groundwater or Surface Water[e] (µg/L)
TPH as gasoline	1,030	100	400	100	500
TPH as diesel	1,380	100	500	100	640
TPH as motor oil	1,900	500	1,000	100	640

Notes:
[a] for previous investigations, concentrations of TPH in soil were compared to Alameda Point–specific residential preliminary remediation criteria (DON 2001); however, as requested by the regulatory agencies, the remedial investigation will compare TPH concentrations to RWQCB ESLs (RWQCB 2005)
[b] values for shallow soil (less than or equal to 3 meters bgs) from ESL Tables A and B (RWQCB 2005)
[c] values for shallow soil (less than or equal to 3 meters bgs) from ESL Table B (RWQCB 2005)
[d] values for groundwater that is a potential source of drinking water from ESL Table A (RWQCB 2005)
[e] values for groundwater that is not a potential source of drinking water and for surface water from ESL Tables B and F (RWQCB 2005)

Acronyms/Abbreviations:
bgs – below ground surface
ESL – environmental screening level
µg/L – micrograms per liter
mg/kg – milligrams per kilogram
RWQCB – (California) Regional Water Quality Control Board
TPH – total petroleum hydrocarbons

Table A1-4
Monitoring Well Groundwater Data: Maximum Concentrations of Volatile Organic Compounds[a, b]
(reported in micrograms per liter)

YEAR/VOC	PLUME AREA SOUTHEAST OF BUILDING 5		PLUME 5-1 AREA EAST OF BUILDING 5				BUILDING 5 PLATING SHOP AREA	SOUTH OF BUILDING 5	EASTERN PERIMETER OF EA 1		NORTHERN PERIMETER OF EA 1		WESTERN PERIMETER OF EA 1	
1991	FWBZ Well M05-04	No SWBZ Well Installed	No FWBZ Wells Installed			No SWBZ Well Installed	No FWBZ Wells Installed	FWBZ Wells M05-03 and M10-01	FWBZ Wells M12-01 and M12-03	No SWBZ Well Installed	FWBZ Wells M05-01 and M05-05	No SWBZ Well Installed	FWBZ Well M05-02	No SWBZ Well Installed
1,1-dichloroethane	**810**[c]	NA	NA	NA	NA	NA	NA	**29**	ND	NA	**14**[c]	NA	ND	NA
1,1-dichloroethene	**570**[c]	NA	NA	NA	NA	NA	NA	ND	ND	NA	ND	NA	ND	NA
1,2-dichloroethene[d]	**640**[c]	NA	NA	NA	NA	NA	NA	3.4	ND	NA	**190**[c]	NA	**71**[c]	NA
1,1,1-trichloroethane	36	NA	NA	NA	NA	NA	NA	ND	ND	NA	ND	NA	ND	NA
trichloroethene	**920**[c]	NA	NA	NA	NA	NA	NA	2.1	ND	NA	ND	NA	**8.8**[c]	NA
vinyl chloride	**200**[c]	NA	NA	NA	NA	NA	NA	ND	ND	NA	**47**[c]	NA	**95**[c]	NA
1992	FWBZ Well Not Sampled	No SWBZ Well Installed	No FWBZ Wells Installed			No SWBZ Well Installed	No FWBZ Wells Installed	FWBZ Well M05HW-01	FWBZ Wells M12-01 and M12-03	No SWBZ Well Installed	FWBZ Well M05BS-01	No SWBZ Well Installed	No Wells Sampled	No SWBZ Well Installed
benzene	NA	NA	NA	NA	NA	NA	NA	ND	ND	NA	**1.5**[c]	NA	NA	NA
1,1-dichloroethane	NA	NA	NA	NA	NA	NA	NA	**97**[c]	ND	NA	**15**[c]	NA	NA	NA
1,1-dichloroethene	NA	NA	NA	NA	NA	NA	NA	3.9	ND	NA	1.5	NA	NA	NA
1,2-dichloroethene[d]	NA	NA	NA	NA	NA	NA	NA	**46**[c]	ND	NA	**70**[c]	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA	NA	NA	NA	2.9	ND	NA	ND	NA	NA	NA
trichloroethene	NA	NA	NA	NA	NA	NA	NA	**16**[c]	ND	NA	1.2	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	**33**[c]	ND	NA	**98**[c]	NA	NA	NA
1994	FWBZ Well M05-04	No SWBZ Well Installed	FWBZ Well M05-07	No Deeper FWBZ Wells Installed		SWBZ Well D05-02	FWBZ Well M05-10	FWBZ Wells M05-03, M05HW-01, M10-01	FWBZ Wells M05-08, M12-01 and M12-03	No SWBZ Well Installed	FWBZ Wells M05-01, M05-05, M05-09 and M05BS-01	SWBZ Well D05-01	FWBZ Wells M05-02 and M05-06	SWBZ Well D05-03
benzene	1	NA	ND	NA	NA	ND	ND	**2**[c]	0.5	NA	**2**[c]	ND	**2**[c]	ND
1,1-dichloroethane	**370**[c]	NA	**60,000**[c]	NA	NA	ND	**64**[c]	**53**[c]	**75**[c]	NA	**13**[c]	ND	**21**[c]	ND
1,2-dichloroethane	**2**[c]	NA	ND	NA	NA	ND	ND	ND	ND	NA	ND	ND	ND	ND
1,1-dichloroethene	**120**[c]	NA	**12,000**[c]	NA	NA	ND	**39**[c]	**8**[c]	**11**[c]	NA	1	ND	6	ND
1,2-dichloroethene[d]	**440**[c]	NA	**1,300**[c]	NA	NA	**11**[c]	1	**56**[c]	3	NA	**84**[c]	ND	**12**[c]	ND
tetrachloroethene	**11**[c]	NA	ND	NA	NA	ND	ND	**5**[c]	3	NA	0.2	ND	2	ND
1,1,1-trichloroethane	34	NA	**56,000**[c]	NA	NA	ND	**440**[c]	ND	38	NA	ND	ND	32	ND
trichloroethene	**480**[c]	NA	**5,400**[c]	NA	NA	**42**[c]	**6**[c]	**270**[c]	**20**[c]	NA	**15**[c]	ND	**8**[c]	ND
vinyl chloride	**140**[c]	NA	**1**[c]	NA	NA	**1**[c]	ND	**43**[c]	ND	NA	**110**[c]	ND	**42**[c]	ND

Table A1-4 (continued)

YEAR/VOC	PLUME AREA SOUTHEAST OF BUILDING 5		PLUME 5-1 AREA EAST OF BUILDING 5				BUILDING 5 PLATING SHOP AREA	SOUTH OF BUILDING 5	EASTERN PERIMETER OF EA 1		NORTHERN PERIMETER OF EA 1		WESTERN PERIMETER OF EA 1	
1995	FWBZ Well M05-04	No SWBZ Well Installed	FWBZ Well M05-07	No Deeper FWBZ Wells Installed		SWBZ Well D05-02	FWBZ Well M05-10	FWBZ Wells M05-03, M05HW-01, and M10-01	FWBZ Wells M05-08, M12-01 and M12-03	No SWBZ Well Installed	FWBZ Wells M05-01, M05-05, M05-09, M05-11, M05-12 and M05BS-01	SWBZ Well D05-01	FWBZ Wells M05-02 and M05-06	SWBZ Well D05-03
benzene	4[c]	NA	ND	NA	NA	ND	ND	4[c]	ND	NA	2[c]	ND	4[c]	ND
1,1-dichloroethane	240[c]	NA	14,000[c]	NA	NA	ND	7	120[c]	ND	NA	4	ND	4	ND
1,1-dichloroethene	120[c]	NA	930[c]	NA	NA	ND	0.6	0.8	ND	NA	0.3	ND	6	ND
1,2-dichloroethene[d]	440[c]	NA	620[c]	NA	NA	ND	1	160[c]	ND	NA	37[c]	ND	22[c]	ND
tetrachloroethene	7	NA	40[c]	NA	NA	ND	ND	3	3	NA	ND	ND	4	ND
1,1,1-trichloroethane	34[c]	NA	2,600[c]	NA	NA	ND	5	0.4	ND	NA	ND	ND	2	ND
trichloroethene	360[c]	NA	1,100[c]	NA	NA	ND	2	12[c]	ND	NA	2	ND	8[c]	ND
vinyl chloride	30[c]	NA	140[c]	NA	NA	ND	ND	25[c]	ND	NA	97[c]	ND	53[c]	ND
1997	FWBZ Well M05-04	No SWBZ Well Installed	FWBZ Well M05-07	No Deeper FWBZ Wells Installed		SWBZ Well D05-02	FWBZ Well M05-10	FWBZ Wells M05-03, M05HW-01, M10-01	FWBZ Wells M05-08, M12-01 and M12-03	No SWBZ Well Installed	FWBZ Wells M05-01, M05-05, M05-09, M05-11, M05-12 and M05BS-01	SWBZ Well D05-01	FWBZ Wells M05-02 and M05-06	SWBZ Well D05-03
benzene	ND	NA	0.6	NA	NA	0.6	ND	6[c]	ND	NA	3[c]	ND	2[c]	ND
1,1-dichloroethane	5	NA	78[c]	NA	NA	ND	330[c]	52[c]	ND	NA	4	ND	ND	ND
1,1-dichloroethene	2	NA	2	NA	NA	ND	140[c]	22[c]	ND	NA	ND	ND	ND	ND
cis-1,2-dichloroethene	ND	NA	3	NA	NA	ND	3	32[c]	ND	NA	2	ND	6	ND
trans-1,2-dichloroethene	ND	NA	1	NA	NA	ND	ND	5	ND	NA	19[c]	ND	2	ND
tetrachloroethene	ND	NA	ND	NA	NA	ND	ND	ND	1	NA	ND	ND	2	ND
1,1,1-trichloroethane	1	NA	8	NA	NA	ND	12	7	ND	NA	ND	ND	ND	ND
trichloroethene	8[c]	NA	18[c]	NA	NA	ND	5	8[c]	ND	NA	1	ND	7[c]	ND
vinyl chloride	2[c]	NA	4[c]	NA	NA	ND	9[c]	44[c]	ND	NA	1,600[c]	ND	86[c]	ND
1998	FWBZ Well M05-04	No SWBZ Well Installed	FWBZ Well M05-07	No Deeper FWBZ Wells Installed		SWBZ Well D05-02	FWBZ Well M05-10	FWBZ Wells M05-03, M05HW-01, M10-01	FWBZ Wells M05-08, M12-01 and M12-03	No SWBZ Well Installed	FWBZ Wells M05-01, M05-05, M05-09, M05-11, M05-12 and M05BS-01	SWBZ Well D05-01	FWBZ Wells M05-02 and M05-06	SWBZ Well D05-03
benzene	ND	NA	0.6	NA	NA	ND	ND	1	ND	NA	2[c]	ND	1	ND
1,1-dichloroethane	22[c]	NA	32[c]	NA	NA	ND	230[c]	230[c]	ND	NA	67[c]	ND	ND	ND
1,2-dichloroethane	ND	NA	ND	NA	NA	ND	0.6[c]	ND	ND	NA	ND	ND	ND	ND
1,1-dichloroethene	6	NA	ND	NA	NA	ND	100[c]	50[c]	ND	NA	9[c]	ND	ND	ND
cis-1,2-dichloroethene	13[c]	NA	2	NA	NA	ND	2	98[c]	6	NA	52[c]	ND	3	ND
trans-1,2-dichloroethene	ND	NA	ND	NA	NA	ND	ND	4	ND	NA	10	ND	4	ND
tetrachloroethene	ND	NA	ND	NA	NA	ND	ND	3	2	NA	1	ND	2	ND
1,1,1-trichloroethane	11	NA	5	NA	NA	ND	24	ND	ND	NA	ND	ND	ND	ND
trichloroethene	50[c]	NA	10[c]	NA	NA	ND	3	16[c]	ND	NA	13[c]	ND	3	ND
vinyl chloride	4[c]	NA	4[c]	NA	NA	0.5	8[c]	76[c]	1	NA	420[c]	ND	100[c]	ND

Table A1-4 (continued)

YEAR/VOC	PLUME AREA SOUTHEAST OF BUILDING 5		PLUME 5-1 AREA EAST OF BUILDING 5				BUILDING 5 PLATING SHOP AREA	SOUTH OF BUILDING 5	EASTERN PERIMETER OF EA 1		NORTHERN PERIMETER OF EA 1		WESTERN PERIMETER OF EA 1	
2001	FWBZ Well M05-04, MLS-1, and MLS-7	No SWBZ Well Installed	FWBZ Wells M05-07, MRW-1, MRW-2, MRW-3, and MRW-4	No Deeper FWBZ Wells Installed		SWBZ Well D05-02	FWBZ Well M05-10	FWBZ Wells M05-03, M05HW-01, and M10-01	FWBZ Wells M05-08, M12-01 and M12-03	No SWBZ Well Installed	FWBZ Wells M05-01, M05-05, M05-09, M05-11, M05-12 and M05BS-01	SWBZ Well D05-01	FWBZ Wells M05-02 and M05-06	SWBZ Well D05-03
benzene	ND	NA	**20[c]**	NA	NA	ND	ND	0.3	ND	NA	**2[c]**	ND	ND	ND
1,1-dichloroethane	**78[c]**	NA	**54,200[c]**	NA	NA	ND	**63[c]**	**12[c]**	2	NA	**10[c]**	ND	1	ND
1,2-dichloroethane	**7**	NA	**210[c]**	NA	NA	ND	ND	ND	ND	NA	0.3	ND	ND	ND
1,1-dichloroethene	**98[c]**	NA	**7,350[c]**	NA	NA	ND	3.1	1	ND	NA	ND	ND	ND	ND
1,2-dichloroethene	**18[c]**	NA	**11[c]**	NA	NA	ND	2	**20[c]**	ND	NA	5	ND	6	ND
cis-1,2-dichloroethene	**16[c]**	NA	**48,200[c]**	NA	NA	ND	1	ND	ND	NA	ND	ND	ND	ND
trans-1,2-dichloroethene	ND	NA	**950[c]**	NA	NA	ND	ND	ND	ND	NA	ND	ND	ND	ND
tetrachloroethene	2.1	NA	**230[c]**	NA	NA	ND	ND	3	2	NA	ND	ND	0.9	ND
1,1,1-trichloroethane	27	NA	**39,000[c]**	NA	NA	ND	0.4	0.4	ND	NA	ND	ND	ND	ND
trichloroethene	**150[c]**	NA	**14,600[c]**	NA	NA	ND	3.3	**16[c]**	0.4	NA	0.7	ND	3	ND
vinyl chloride	**5.1[c]**	NA	**11,400[c]**	NA	NA	0.5	**2[c]**	**7**	ND	NA	**83[c]**	ND	**3[c]**	**1[c]**
2002	No FWBZ Wells Sampled	No SWBZ Well Installed	FWBZ Wells P-5-1-MWS1 through MWS5[e]	FWBZ Wells P-5-1-MWI1 through MWI5[e]	BSU Wells P-5-1-MWD1 through MWD5[e]	No SWBZ Wells Sampled	FWBZ Well M05-10	No FWBZ Wells Sampled	FWBZ Wells M05-08	No SWBZ Well Installed	FWBZ Wells M05-01, M05-05, and M05-09	SWBZ Well D05-01	FWBZ Wells M05-02 and M05-06	SWBZ Well D05-03
benzene	NA	NA	**110[c]**	**70[c]**	**7.7[c]**	NA	ND	NA	ND	NA	0.6	ND	ND	ND
1,1-dichloroethane	NA	NA	**20,000[c]**	**1,200[c]**	**1,000[c]**	NA	**55[c]**	NA	ND	NA	2.3	ND	ND	ND
1,2-dichloroethane	NA	NA	**2.7[c]**	ND	ND	NA	ND	NA	ND	NA	0.1	ND	ND	ND
1,1-dichloroethene	NA	NA	**25,000[c]**	**14[c]**	**25[c]**	NA	1.9	NA	ND	NA	ND	ND	ND	ND
cis-1,2-dichloroethene	NA	NA	**10,000[c]**	**64[c]**	**130[c]**	NA	1.3	NA	ND	NA	2.5	ND	ND	ND
trans-1,2-dichloroethene	NA	NA	**740[c]**	8.3	0.4	NA	ND	NA	ND	NA	3	ND	ND	ND
tetrachloroethene	NA	NA	**2,800[c]**	ND	**12[c]**	NA	ND	NA	ND	NA	0.1	ND	0.3	ND
1,1,1-trichloroethane	NA	NA	**220,000[c]**	5.1	19	NA	3	NA	ND	NA	ND	ND	ND	ND
trichloroethene	NA	NA	**16,000[c]**	**10[c]**	**19[c]**	NA	1.9	NA	ND	NA	0.7	ND	ND	ND
vinyl chloride	NA	NA	**1,700[c]**	**82[c]**	**51[c]**	NA	**0.6[c]**	NA	ND	NA	**7.6[c]**	ND	**0.7[c]**	**0.7[c]**

Table A1-4 (continued)

YEAR/VOC	PLUME AREA SOUTHEAST OF BUILDING 5		PLUME 5-1 AREA EAST OF BUILDING 5				BUILDING 5 PLATING SHOP AREA	SOUTH OF BUILDING 5	EASTERN PERIMETER OF EA 1		NORTHERN PERIMETER OF EA 1		WESTERN PERIMETER OF EA 1	
2003	No FWBZ Wells Sampled	No SWBZ Well Installed	FWBZ Wells 1MW6S, 1MW7S, P-5-1-MWS1 through MWS5	FWBZ Wells P-5-1-MWI1 through MWI5	BSU Wells P-5-1-MWD1 through MWD5	No SWBZ Wells Sampled	FWBZ Wells 2MW8S, 3MW10S, M05-10	No FWBZ Wells Sampled	FWBZ Wells M05-08	No SWBZ Well Installed	FWBZ Wells M05-01, M05-05, and M05-09	SWBZ Well D05-01	FWBZ Wells M05-02 and M05-06	SWBZ Well D05-03
benzene	NA	NA	**28**[c]	ND	ND	NA	0.46	NA	ND	NA	ND	ND	0.26	ND
1,1-dichloroethane	NA	NA	**27,000**[c]	**592**[c]	**5.1**[c]	NA	**20,000**[c]	NA	1.2	NA	1.1	ND	**5.1**[c]	ND
1,2-dichloroethane	NA	NA	ND	**0.8**[c]	ND	NA	ND	NA	ND	NA	ND	ND	ND	ND
1,1-dichloroethene	NA	NA	**23,000**[c]	**557**[c]	**11**[c]	NA	**9,600**[c]	NA	2.3	NA	ND	ND	ND	ND
cis-1,2-dichloroethene	NA	NA	**5,520**[c]	**34**[c]	1	NA	**25**[c]	NA	ND	NA	1.7	ND	**22**[c]	ND
trans-1,2-dichloroethene	NA	NA	**130**[c]	5.1	ND	NA	5.4	NA	ND	NA	1.5	ND	1.1	ND
tetrachloroethene	NA	NA	**97**[c]	4.2	ND	NA	**12**[c]	NA	ND	NA	0.26	ND	1.7	ND
1,1,1-trichloroethane	NA	NA	**400,000**[c]	6.1	17	NA	**360,000**[c]	NA	34	NA	ND	ND	ND	ND
trichloroethene	NA	NA	**16,000**[c]	**175**[c]	**9.8**[c]	NA	**240**[c]	NA	ND	NA	0.81	ND	**6.5**[c]	ND
vinyl chloride	NA	NA	**1,400**[c]	**21**[c]	**1**[c]	NA	**110**[c]	NA	ND	NA	ND	ND	ND	ND
2004	No FWBZ Wells Sampled	SWBZ Well D05-08	FWBZ Wells 1MW6S, 1MW7S, P-5-1-MWS1 through MWS5	FWBZ Wells P-5-1-MWI1 through MWI5	BSU Wells P-5-1-MWD1 through MWD5	SWBZ Well D05-05 and D05-06	FWBZ Well 2MW8S	No FWBZ Wells Sampled	FWBZ Wells M05-08	SWBZ Well D05-07	FWBZ Wells M05-01, M05-05, and M05-09	SWBZ Wells D05-01and D05-04	FWBZ Wells M05-02 and M05-06	SWBZ Well D05-03
benzene	NA	ND	ND	ND	ND	ND	**3**[c]	NA	ND	ND	ND	ND	0.2	ND
1,1-dichloroethane	NA	ND	**48,800**[c]	**257**[c]	0.5	ND	**17,000**[c]	NA	ND	ND	ND	ND	3.8	ND
1,2-dichloroethane	NA	ND	**0.9**[c]	**0.7**[c]	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND
1,1-dichloroethene	NA	ND	**15,100**[c]	ND	ND	ND	**3,900**[c]	NA	ND	ND	ND	ND	ND	ND
cis-1,2-dichloroethene	NA	ND	**13,700**[c]	2.1	0.5	ND	**200**[c]	NA	ND	ND	0.4	ND	**11**[c]	ND
trans-1,2-dichloroethene	NA	ND	**300**[c]	ND	ND	ND	5.9	NA	ND	ND	ND	ND	0.1	ND
tetrachloroethene	NA	ND	**26**[c]	ND	ND	ND	4	NA	ND	ND	ND	ND	1.3	ND
1,1,1-trichloroethane	NA	ND	**5,220**[c]	ND	ND	ND	**110,000**[c]	NA	ND	ND	ND	ND	ND	ND
trichloroethene	NA	ND	**1,570**[c]	ND	ND	ND	**130**[c]	NA	ND	ND	0.4	ND	4.5	ND
vinyl chloride	NA	ND	**8,140**[c]	**10**[c]	**8.5**[c]	ND	**170**[c]	NA	ND	ND	ND	ND	0.1	0.1

Notes:
[a] ten VOCs were reported at concentrations exceeding MCLs in more than one sample
[b] maximum concentration reported for the year for all wells within the given area
[c] concentrations exceeding MCLs are shown in bold type
[d] concentrations compared to MCL for cis-1,2-dichloroethene
[e] P-5-1-MWS wells screened at 9 to 15 feet bgs, P-5-1-MWI wells screened at 18 to 22 feet bgs, P-5-1-MWD wells screened at 25 to 30 feet bgs

Table A1-4 (continued)

Acronyms/Abbreviations:
- bgs – below ground surface
- BSU – Bay Sediment Unit, semiconfining unit
- EA – evaluation area
- FWBZ – first water-bearing zone, wells generally screened at depths between 5 and 17 feet bgs
- MCL – maximum contaminant level
- NA – not applicable, no sampling conducted
- ND – not detected, concentrations below reporting limit
- SWBZ – second water-bearing zone, wells screened at depths of 67 to 70 feet bgs
- VOC – volatile organic compound

Table A1-5
Discrete Groundwater Samples: Volatile Organic Compounds
Exceeding Comparison Criteria

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
Upper FWBZ					
EA 2	045-003-010	11 to 12	1,2-dichloroethene (total)	240	6[b]
EA 2	045-003-010	11 to 12	vinyl chloride	79	0.5
EA 2	045-003-011	10 to 11	1,2-dichloroethene (total)	270	6
EA 2	045-003-011	10 to 11	vinyl chloride	6	0.5
Upper FWBZ					
EA 3	05GB003	5 to 6	1,1-dichloroethane	12	5
EA 3	3MW10S	NA	1,1-dichloroethane	4,530	5
EA 3	3MW10S	NA	1,1-dichloroethene	140	6
EA 3	3MW10S	NA	vinyl chloride	65	0.5
EA 3	4MW12S	NA	1,1-dichloroethane	1,000	5
EA 3	4MW12S	NA	1,1-dichloroethene	70	6
EA 3	4MW12S	NA	vinyl chloride	24	0.5
EA 3	5-3-ADD1	10 to 13	1,1-dichloroethane	15,000	5
EA 3	5-3-ADD1	10 to 13	1,1-dichloroethene	460	6
EA 3	5-3-ADD1	10 to 13	vinyl chloride	370	0.5
EA 3	5-3-ADD1	13.5 to 16.5	1,1-dichloroethane	6,200	5
EA 3	5-3-ADD1	6 to 9	1,1-dichloroethane	1,500	5
EA 3	5-3-ADD101	10 to 13	1,1-dichloroethane	1,800	5
EA 3	5-3-ADD101	6 to 9	1,1-dichloroethane	1,800	5
EA 3	5-3-ADD106	9 to 12	1,1-dichloroethane	6,700	5
EA 3	5-3-ADD106	6 to 8.5	1,1-dichloroethane	3,700	5
EA 3	5-3-ADD107	9 to 12	1,1-dichloroethane	1,000	5
EA 3	5-3-ADD107	13 to 16	1,1-dichloroethane	560	5
EA 3	5-3-ADD11	6 to 9	1,1-dichloroethane	670	5
EA 3	5-3-ADD11	6 to 9	1,1-dichloroethene	81	6
EA 3	5-3-ADD11	10 to 13	1,1-dichloroethane	39,000	5
EA 3	5-3-ADD11	10 to 13	vinyl chloride	4,600	0.5
EA 3	5-3-ADD11	14 to 17	1,1-dichloroethane	18,000	5
EA 3	5-3-ADD11	14 to 17	vinyl chloride	1,100	0.5
EA 3	5-3-ADD12	6 to 9	1,1-dichloroethane	130	5
EA 3	5-3-ADD12	10 to 13	1,1-dichloroethane	18,000	5
EA 3	5-3-ADD12	10 to 13	1,1-dichloroethene	1,500	6
EA 3	5-3-ADD12	14 to 17	1,1-dichloroethane	480	5
EA 3	5-3-ADD13	10 to 13	1,1-dichloroethane	4,900	5
EA 3	5-3-ADD13	10 to 13	1,1-dichloroethene	850	6
EA 3	5-3-ADD13	14 to 17	1,1-dichloroethane	4,000	5

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 3	5-3-ADD13	14 to 17	1,1-dichloroethene	310	6
EA 3	5-3-ADD14	10 to 13	1,1-dichloroethane	66,000	5
EA 3	5-3-ADD14	10 to 13	1,1-dichloroethene	3,600	6
EA 3	5-3-ADD14	10 to 13	vinyl chloride	4,400	0.5
EA 3	5-3-ADD14	14 to 17.5	1,1-dichloroethane	2,700	5
EA 3	5-3-ADD14	14 to 17.5	vinyl chloride	510	0.5
EA 3	5-3-ADD15	6 to 9	1,1-dichloroethane	78	5
EA 3	5-3-ADD15	10 to 13	1,1,1-trichloroethane	600	200
EA 3	5-3-ADD15	10 to 13	1,1-dichloroethane	66,000	5
EA 3	5-3-ADD15	10 to 13	1,1-dichloroethene	2,500	6
EA 3	5-3-ADD15	10 to 13	1,2-dichloroethane	130	0.5
EA 3	5-3-ADD15	10 to 13	trichloroethene	100	5
EA 3	5-3-ADD15	10 to 13	vinyl chloride	950	0.5
EA 3	5-3-ADD15	14 to 17.5	1,1-dichloroethane	2,900	5
EA 3	5-3-ADD16	10 to 13	1,1,1-trichloroethane	870	200
EA 3	5-3-ADD16	10 to 13	1,1-dichloroethane	41,000	5
EA 3	5-3-ADD16	10 to 13	1,1-dichloroethene	3,200	6
EA 3	5-3-ADD16	10 to 13	vinyl chloride	350	0.5
EA 3	5-3-ADD16	14 to 17	1,1-dichloroethane	13,000	5
EA 3	5-3-ADD17	10 to 13	1,1-dichloroethane	2,500	5
EA 3	5-3-ADD17	10 to 13	1,1-dichloroethene	700	6
EA 3	5-3-ADD17	14 to 17	1,1-dichloroethane	310	5
EA 3	5-3-ADD18	10 to 13	1,1-dichloroethane	95,000	5
EA 3	5-3-ADD18	14 to 17	1,1-dichloroethane	9,500	5
EA 3	5-3-ADD19	6 to 9	1,1,1-trichloroethane	1,200	200
EA 3	5-3-ADD19	6 to 9	1,1-dichloroethane	2,500	5
EA 3	5-3-ADD19	6 to 9	1,1-dichloroethene	330	6
EA 3	5-3-ADD19	10 to 13	1,1,1-trichloroethane	550	200
EA 3	5-3-ADD19	10 to 13	1,1-dichloroethane	4,900	5
EA 3	5-3-ADD19	15 to 19	1,1-dichloroethane	490	5
EA 3	5-3-ADD2	10 to 13	1,1-dichloroethane	240	5
EA 3	5-3-ADD2	14 to 17	1,1-dichloroethane	19,000	5
EA 3	5-3-ADD2	14 to 17	1,1-dichloroethene	800	6
EA 3	5-3-ADD2	6 to 9	1,1-dichloroethane	280	5
EA 3	5-3-ADD20	6 to 9	1,1-dichloroethane	57	5
EA 3	5-3-ADD20	10 to 13	1,1-dichloroethane	13,000	5
EA 3	5-3-ADD20	14 to 17	1,1-dichloroethane	3300	5
EA 3	5-3-ADD21	10 to 13	1,1-dichloroethane	410	5
EA 3	5-3-ADD21	14 to 17	1,1-dichloroethane	270	5

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 3	5-3-ADD22	5 to 9	1,1,1-trichloroethane	30,000	200
EA 3	5-3-ADD22	5 to 9	1,1-dichloroethane	72,000	5
EA 3	5-3-ADD22	10 to 13	1,1,1-trichloroethane	19,000	200
EA 3	5-3-ADD22	10 to 13	1,1-dichloroethane	2,100	5
EA 3	5-3-ADD23	6 to 9	1,1-dichloroethane	150	5
EA 3	5-3-ADD23	10 to 13	1,1-dichloroethane	73,000	5
EA 3	5-3-ADD23	10 to 13	1,1-dichloroethene	8,200	6
EA 3	5-3-ADD23	14 to 17	1,1-dichloroethane	1,000	5
EA 3	5-3-ADD24	6 to 9	1,1-dichloroethane	42	5
EA 3	5-3-ADD24	10 to 13	1,1-dichloroethane	130	5
EA 3	5-3-ADD24	10 to 13	cis-1,2-dichloroethene	11	6
EA 3	5-3-ADD26	5 to 9	1,1,1-trichloroethane	57,000	200
EA 3	5-3-ADD26	5 to 9	1,1-dichloroethane	36,000	5
EA 3	5-3-ADD26	10 to 13	1,1,1-trichloroethane	18,000	200
EA 3	5-3-ADD26	10 to 13	1,1-dichloroethane	2,600	5
EA 3	5-3-ADD27	5 to 9	1,1-dichloroethane	290	5
EA 3	5-3-ADD27	10 to 13	1,1-dichloroethane	280	5
EA 3	5-3-ADD29	14.5 to 18	1,1-dichloroethane	3,100	5
EA 3	5-3-ADD3	6 to 9	1,1-dichloroethane	120	5
EA 3	5-3-ADD3	6 to 9	1,1-dichloroethene	32	6
EA 3	5-3-ADD3	10.5 to 13.5	1,1-dichloroethane	7,800	5
EA 3	5-3-ADD3	10.5 to 13.5	1,1-dichloroethene	260	6
EA 3	5-3-ADD3	10.5 to 13.5	vinyl chloride	450	0.5
EA 3	5-3-ADD3	14.5 to 17.5	1,1-dichloroethane	3,300	5
EA 3	5-3-ADD3	14.5 to 17.5	vinyl chloride	180	0.5
EA 3	5-3-ADD30	10.5 to 13.5	1,1-dichloroethane	12,000	5
EA 3	5-3-ADD30	10.5 to 13.5	1,1-dichloroethene	630	6
EA 3	5-3-ADD30	10.5 to 13.5	vinyl chloride	260	0.5
EA 3	5-3-ADD30	14.5 to 17.5	1,1-dichloroethane	8,700	5
EA 3	5-3-ADD31	10 to 13	1,1-dichloroethane	23,000	5
EA 3	5-3-ADD31	10 to 13	1,1-dichloroethene	1,100	6
EA 3	5-3-ADD31	14 to 17.5	1,1-dichloroethane	2,400	5
EA 3	5-3-ADD32	10 to 13	1,1-dichloroethane	18,000	5
EA 3	5-3-ADD32	10 to 13	1,1-dichloroethene	1,400	6
EA 3	5-3-ADD32	10 to 13	vinyl chloride	1,000	0.5
EA 3	5-3-ADD32	14 to 17	1,1-dichloroethane	490	5
EA 3	5-3-ADD33	6 to 9	1,1-dichloroethane	240	5
EA 3	5-3-ADD33	10 to 13	1,1-dichloroethane	27,000	5
EA 3	5-3-ADD33	10 to 13	1,1-dichloroethene	1,400	6

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 3	5-3-ADD33	10 to 13	vinyl chloride	780	0.5
EA 3	5-3-ADD33	14 to 17	1,1-dichloroethane	3,200	5
EA 3	5-3-ADD34	6 to 9	1,1-dichloroethane	2,000	5
EA 3	5-3-ADD34	6 to 9	1,1-dichloroethene	220	6
EA 3	5-3-ADD34	10 to 13	1,1-dichloroethane	61,000	5
EA 3	5-3-ADD34	10 to 13	1,1-dichloroethene	3,200	6
EA 3	5-3-ADD34	14 to 17	1,1-dichloroethane	9,000	5
EA 3	5-3-ADD35	7 to 10	1,1-dichloroethane	1,100	5
EA 3	5-3-ADD35	11 to 14	1,1,1-trichloroethane	1,100	200
EA 3	5-3-ADD35	11 to 14	1,1-dichloroethane	41,000	5
EA 3	5-3-ADD35	11 to 14	1,1-dichloroethene	2,700	6
EA 3	5-3-ADD35	11 to 14	vinyl chloride	1,100	0.5
EA 3	5-3-ADD35	15 to 18	1,1-dichloroethane	250	5
EA 3	5-3-ADD36	6 to 9	1,1-dichloroethane	560	5
EA 3	5-3-ADD36	10 to 13	1,1,1-trichloroethane	2,700	200
EA 3	5-3-ADD36	10 to 13	1,1-dichloroethane	14,000	5
EA 3	5-3-ADD36	10 to 13	1,1-dichloroethene	900	6
EA 3	5-3-ADD36	10 to 13	vinyl chloride	440	0.5
EA 3	5-3-ADD36	14 to 17	1,1-dichloroethane	350	5
EA 3	5-3-ADD37	6 to 9	1,1-dichloroethane	300	5
EA 3	5-3-ADD37	10 to 13.5	1,1,1-trichloroethane	2,900	200
EA 3	5-3-ADD37	10 to 13.5	1,1-dichloroethane	16,000	5
EA 3	5-3-ADD37	10 to 13.5	1,1-dichloroethene	1,300	6
EA 3	5-3-ADD37	10 to 13.5	vinyl chloride	540	0.5
EA 3	5-3-ADD39	5 to 9	1,1,1-trichloroethane	1,000	200
EA 3	5-3-ADD39	5 to 9	1,1-dichloroethane	9,200	5
EA 3	5-3-ADD39	5 to 9	1,1-dichloroethene	560	6
EA 3	5-3-ADD39	10 to 13	1,1-dichloroethane	800	5
EA 3	5-3-ADD39	13.5 to 16.5	1,1,1-trichloroethane	370	200
EA 3	5-3-ADD39	13.5 to 16.5	1,1-dichloroethane	2,700	5
EA 3	5-3-ADD4	6 to 9	1,1-dichloroethane	430	5
EA 3	5-3-ADD4	6 to 9	1,1-dichloroethene	61	6
EA 3	5-3-ADD4	10 to 13	1,1-dichloroethane	37,000	5
EA 3	5-3-ADD4	10 to 13	vinyl chloride	4,500	0.5
EA 3	5-3-ADD4	13.5 to 16.5	1,1-dichloroethane	10,000	5
EA 3	5-3-ADD4	13.5 to 16.5	vinyl chloride	830	0.5
EA 3	5-3-ADD40	6.5 to 10.5	1,1,1-trichloroethane	230,000	200
EA 3	5-3-ADD40	6.5 to 10.5	1,1-dichloroethane	82,000	5
EA 3	5-3-ADD40	11.5 to 14.5	1,1,1-trichloroethane	1,300	200

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 3	5-3-ADD40	15 to 18	1,1,1-trichloroethane	1,500	200
EA 3	5-3-ADD41	6.5 to 10.5	1,1-dichloroethane	200	5
EA 3	5-3-ADD43	6 to 9	1,1-dichloroethane	240	5
EA 3	5-3-ADD43	10 to 13	1,1-dichloroethane	2,800	5
EA 3	5-3-ADD43	10 to 13	1,1-dichloroethene	480	6
EA 3	5-3-ADD43	14 to 17	1,1-dichloroethane	1,200	5
EA 3	5-3-ADD44	6 to 9	1,1-dichloroethane	970	5
EA 3	5-3-ADD44	10 to 13	1,1-dichloroethane	18,000	5
EA 3	5-3-ADD44	13.5 to 16.5	1,1-dichloroethane	1,100	5
EA 3	5-3-ADD45	6 to 9	1,1-dichloroethane	1,500	5
EA 3	5-3-ADD45	10 to 13	1,1-dichloroethane	41,000	5
EA 3	5-3-ADD45	13.5 to 16.5	1,1-dichloroethane	4,100	5
EA 3	5-3-ADD46	10 to 13	1,1-dichloroethane	57,000	5
EA 3	5-3-ADD46	14 to 17	1,1-dichloroethane	6,400	5
EA 3	5-3-ADD47	10 to 13	1,1-dichloroethane	31,000	5
EA 3	5-3-ADD47	14 to 17	1,1-dichloroethane	27,000	5
EA 3	5-3-ADD48	10 to 13	1,1-dichloroethane	26,000	5
EA 3	5-3-ADD48	14 to 17	1,1-dichloroethane	6,400	5
EA 3	5-3-ADD49	11 to 14	1,1-dichloroethane	8,400	5
EA 3	5-3-ADD49	14.5 to 17.5	1,1-dichloroethane	7,800	5
EA 3	5-3-ADD5	10 to 13	1,1-dichloroethane	720	5
EA 3	5-3-ADD50	10 to 13	1,1-dichloroethane	1,700	5
EA 3	5-3-ADD50	14.5 to 17.5	1,1-dichloroethane	1,400	5
EA 3	5-3-ADD51	10 to 13	1,1-dichloroethane	290	5
EA 3	5-3-ADD51	14 to 17	1,1-dichloroethane	1,800	5
EA 3	5-3-ADD56	6.5 to 10.5	1,1-dichloroethane	480	5
EA 3	5-3-ADD6	6 to 9	1,1-dichloroethane	84	5
EA 3	5-3-ADD6	6 to 9	1,1-dichloroethene	14	6
EA 3	5-3-ADD6	10.5 to 13.5	1,1-dichloroethane	17,000	5
EA 3	5-3-ADD6	10.5 to 13.5	1,1-dichloroethene	670	6
EA 3	5-3-ADD6	14.5 to 17.5	1,1-dichloroethane	12,000	5
EA 3	5-3-ADD63	10 to 13	1,1-dichloroethane	320	5
EA 3	5-3-ADD7	6 to 9	1,1-dichloroethane	43	5
EA 3	5-3-ADD7	6 to 9	1,1-dichloroethene	8.1	6
EA 3	5-3-ADD7	10.5 to 13.5	1,1-dichloroethane	1,200	5
EA 3	5-3-ADD7	10.5 to 13.5	1,1-dichloroethene	55	6
EA 3	5-3-ADD7	14.5 to 17.5	1,1-dichloroethane	2,400	5
EA 3	5-3-ADD71	9.5 to 12.5	1,1-dichloroethane	2,100	5
EA 3	5-3-ADD72	6 to 9	1,1-dichloroethane	1,100	5

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 3	5-3-ADD72	6 to 9	1,1-dichloroethene	160	6
EA 3	5-3-ADD72	9.5 to 12.5	1,1-dichloroethane	9,200	5
EA 3	5-3-ADD72	9.5 to 12.5	1,1-dichloroethene	1,200	6
EA 3	5-3-ADD72	9.5 to 12.5	vinyl chloride	170	0.5
EA 3	5-3-ADD72	13 to 16	1,1-dichloroethane	1,100	5
EA 3	5-3-ADD74	11 to 14	1,1-dichloroethane	1,800	5
EA 3	5-3-ADD74	15 to 18	1,1-dichloroethane	650	5
EA 3	5-3-ADD75	10 to 13	1,1-dichloroethane	34,000	5
EA 3	5-3-ADD75	14 to 17	1,1-dichloroethane	8,400	5
EA 3	5-3-ADD76	5 to 9	1,1-dichloroethane	1,300	5
EA 3	5-3-ADD76	10 to 13	1,1-dichloroethane	30,000	5
EA 3	5-3-ADD76	13.5 to 16.5	1,1-dichloroethane	9,100	5
EA 3	5-3-ADD8	6 to 9	1,1-dichloroethane	18	5
EA 3	5-3-ADD8	11 to 14	1,1-dichloroethane	260	5
EA 3	5-3-ADD8	11 to 14	1,1-dichloroethene	8.7	6
EA 3	5-3-ADD8	11 to 14	cis-1,2-dichloroethene	18	6
EA 3	5-3-ADD80	9 to 12	1,1-dichloroethane	13,000	5
EA 3	5-3-ADD80	9 to 12	1,1-dichloroethene	650	6
EA 3	5-3-ADD80	12.5 to 15.5	1,1-dichloroethane	3,400	5
EA 3	5-3-ADD81	10 to 13	1,1-dichloroethane	7,500	5
EA 3	5-3-ADD81	10 to 13	1,1-dichloroethene	390	6
EA 3	5-3-ADD81	13.5 to 16.5	1,1-dichloroethane	4,500	5
EA 3	5-3-ADD82	10 to 13	1,1-dichloroethane	9,000	5
EA 3	5-3-ADD82	10 to 13	1,1-dichloroethene	260	6
EA 3	5-3-ADD82	14 to 17	1,1-dichloroethane	3,800	5
EA 3	5-3-ADD83	10 to 13.5	1,1-dichloroethane	4,700	5
EA 3	5-3-ADD83	10 to 13.5	1,1-dichloroethene	170	6
EA 3	5-3-ADD83	14 to 17	1,1-dichloroethane	3,200	5
EA 3	5-3-ADD87	9 to 12	1,1-dichloroethane	290	5
EA 3	5-3-ADD87	12.5 to 15.5	1,1,1-trichloroethane	340	200
EA 3	5-3-ADD87	12.5 to 15.5	1,1-dichloroethane	3,300	5
EA 3	5-3-ADD89	10 to 13	1,1-dichloroethane	34,000	5
EA 3	5-3-ADD89	13 to 16	1,1-dichloroethane	2,300	5
EA 3	5-3-ADD89	6 to 9	1,1-dichloroethane	6,700	5
EA 3	5-3-ADD9	6 to 9	1,1-dichloroethane	10	5
EA 3	5-3-ADD9	10.5 to 13.5	1,1-dichloroethane	510	5
EA 3	5-3-ADD9	10.5 to 13.5	1,1-dichloroethene	17	6
EA 3	5-3-ADD9	10.5 to 13.5	cis-1,2-dichloroethene	25	6
EA 3	5-3-ADD9	14.5 to 17.5	1,1-dichloroethane	230	5

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 3	5-3-ADD91	9 to 12	1,1-dichloroethane	9,400	5
EA 3	5-3-ADD93	9 to 12	1,1-dichloroethane	8,900	5
EA 3	5-3-ADD93	9 to 12	1,1-dichloroethene	350	6
EA 3	5-3-ADD93	13 to 16	1,1-dichloroethane	1,400	5
EA 3	5-3-ADD94	9 to 12	1,1-dichloroethane	10,000	5
EA 3	5-3-ADD94	9 to 12	1,1-dichloroethene	310	6
EA 3	5-3-ADD95	9 to 12.5	1,1-dichloroethane	15,000	5
EA 3	5-3-ADD95	9 to 12.5	1,1-dichloroethene	760	6
EA 3	5-3-ADD95	9 to 12.5	vinyl chloride	420	0.5
EA 3	5-3-ADD95	13 to 16	1,1-dichloroethane	3,000	5
EA 3	5-3-ADD98	9 to 12	1,1-dichloroethane	13,000	5
EA 3	5-3-ADD98	13 to 16	1,1-dichloroethane	820	5
EA 3	5-3-ADD98	5 to 8.5	1,1-dichloroethane	9,800	5
EA 3	5MW15S	NA	1,1-dichloroethane	13,600	5
EA 3	5MW15S	NA	1,1-dichloroethene	779	6
EA 3	5MW15S	NA	trichloroethene	21	5
EA 3	5MW15S	NA	vinyl chloride	220	0.5
EA 3	6MW16S	NA	1,1-dichloroethane	11,200	5
EA 3	6MW16S	NA	1,1-dichloroethene	480	6
EA 3	6MW16S	NA	vinyl chloride	390	0.5
EA 3	B05PS-01	0 to 0	1,1,1-trichloroethane	430	200
EA 3	B05PS-01	0 to 0	1,1-dichloroethane	400	5
EA 3	B05PS-02	6 to 6	1,1,1-trichloroethane	3,900	200
EA 3	B05PS-02	6 to 6	1,1-dichloroethane	170	5
EA 3	B05PS-02	6 to 6	1,1-dichloroethene	91	6
EA 3	B05PS-03	6.5 to 6.5	1,1,1-trichloroethane	5,200	200
EA 3	B05PS-03	6.5 to 6.5	1,1-dichloroethane	140	5
EA 3	B05PS-03	6.5 to 6.5	1,1-dichloroethene	110	6
EA 3	B05PS-04	5 to 5.5	1,1,1-trichloroethane	790,000	200
EA 3	B05PS-04	5 to 5.5	1,1-dichloroethane	13,000	5
EA 3	B05PS-04	5 to 5.5	1,1-dichloroethene	9,200	6
EA 3	B05PS-05	6.5 to 6.5	1,1-dichloroethane	56	5
EA 3	B05PS-05	6.5 to 6.5	1,1-dichloroethene	6.6	6
EA 3	B05PS-05	6.5 to 6.5	vinyl chloride	5.9	0.5
EA 3	B05PS-06	3.5 to 3.5	1,1,1-trichloroethane	1,000	200
EA 3	B05PS-07	3.5 to 3.5	1,1,1-trichloroethane	990	200
EA 3	B05PS-08	0 to 0	1,1,1-trichloroethane	1,300	200
EA 3	B05PS-08	0 to 0	1,1-dichloroethane	35	5
EA 3	B05PS-08	3.5 to 3.5	1,1,1-trichloroethane	8,800	200

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 3	B05PS-10	3.5 to 3.5	1,1,1-trichloroethane	750	200
EA 3	S05-2A-B	10 to 10	1,1-dichloroethane	2,600	5
EA 3	S05-2A-B	10 to 10	1,1-dichloroethene	130	6
EA 3	S05-2A-B	10 to 10	1,2-dichloroethane	14	0.5
EA 3	S05-2A-B	10 to 10	cis-1,2-dichloroethene	7.2	6
EA 3	S05-2A-B	10 to 10	trichloroethene	19	5
EA 3	S05-2A-B	10 to 10	vinyl chloride	41	0.5
EA 3	S05-2A-B	7.5 to 7.5	1,1-dichloroethane	1,400	5
EA 3	S05-2A-B	7.5 to 7.5	1,1-dichloroethene	170	6
EA 3	S05-2A-B	7.5 to 7.5	1,2-dichloroethane	4.9	0.5
EA 3	S05-2A-B	7.5 to 7.5	cis-1,2-dichloroethene	7.1	6
EA 3	S05-2A-B	7.5 to 7.5	trichloroethene	19	5
EA 3	S05-2A-B	7.5 to 7.5	vinyl chloride	23	0.5
EA 3	S05-3A-D	12.5 to 12.5	1,1-dichloroethane	18	5
EA 3	S05-3A-D	12.5 to 12.5	vinyl chloride	0.63	0.5
EA 3	S05-3A-D	9 to 9	1,1-dichloroethane	750	5
EA 3	S05-3A-D	9 to 9	1,1-dichloroethene	160	6
EA 3	S05-3A-D	9 to 9	1,2-dichloroethane	6.3	0.5
EA 3	S05-3A-D	9 to 9	carbon tetrachloride	1.4	0.5
EA 3	S05-3A-D	9 to 9	vinyl chloride	3.8	0.5
EA 3	S05-3A-E	10 to 10	1,1-dichloroethane	18	5
EA 3	S05-3A-E	10 to 10	vinyl chloride	1.2	0.5
EA 3	S05-3A-E	13 to 13	1,1-dichloroethane	43	5
EA 3	S05-3A-E	13 to 13	cis-1,2-dichloroethene	19	6
EA 3	S05-3A-E	13 to 13	trichloroethene	6.9	5
EA 3	S05-3A-E	13 to 13	vinyl chloride	3	0.5
EA 3	S05-4-2	9.5 to 11.5	1,2-dichloroethane	0.6	0.5
EA 3	S05-4-2	9.5 to 11.5	trichloroethene	10	5
EA 3	S05-4-2	9.5 to 11.5	trichloroethene	9.5	5
EA 3	S05-4-2	11.5 to 13.5	1,2-dichloroethane	1.3	0.5
EA 3	S05-4-2	11.5 to 13.5	benzene	1.3	1
EA 3	S05-4-3	5.5 to 7.5	1,1-dichloroethane	6.2	5
EA 3	S05-4-3	9.5 to 11.5	1,1-dichloroethane	6	5
EA 3	S05-4-3	9.5 to 11.5	1,1-dichloroethane	5.2	5
EA 3	S05-4-3	9.5 to 11.5	1,2-dichloroethane	0.6	0.5
EA 3	S05-4-3	9.5 to 11.5	1,2-dichloroethane	0.6	0.5
EA 3	S05-4-3	9.5 to 11.5	1,2-dichloroethene (total)	46	6
EA 3	S05-4-3	9.5 to 11.5	cis-1,2-dichloroethene	21	6
EA 3	S05-4-3	9.5 to 11.5	trichloroethene	8	5

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 3	S05-4-3	9.5 to 11.5	trichloroethene	7.3	5
EA 3	S05-4-3	11.5 to 13.5	1,2-dichloroethane	0.9	0.5
EA 3	S05-4-3	11.5 to 13.5	benzene	2.4	1
EA 3	S05-4-3	11.5 to 13.5	trans-1,2-dichloroethene	11	10
EA 3	S05-4-3	11.5 to 13.5	vinyl chloride	3.1	0.5
EA 3	S05-4-3	13.5 to 15.5	1,2-dichloroethane	1.2	0.5
EA 3	S05-4-3	13.5 to 15.5	benzene	3	1
EA 3	S05-4-3	13.5 to 15.5	vinyl chloride	1.5	0.5
EA 3	S05-4-4	7.5 to 9.5	1,1-dichloroethane	51	5
EA 3	S05-4-4	7.5 to 9.5	vinyl chloride	1	0.5
EA 3	S05-4-4	5.5 to 7.5	1,1-dichloroethane	180	5
EA 3	S05-4-4	5.5 to 7.5	1,1-dichloroethene	10	6
EA 3	S05-4-4	5.5 to 7.5	1,2-dichloroethane	0.6	0.5
EA 3	S05-4-4	9.5 to 11.5	1,1-dichloroethane	210	5
EA 3	S05-4-4	9.5 to 11.5	1,1-dichloroethene	8.5	6
EA 3	S05-4-4	9.5 to 11.5	cis-1,2-dichloroethene	16	6
EA 3	S05-4-4	9.5 to 11.5	trichloroethene	8.4	5
EA 3	S05-4-4	9.5 to 11.5	vinyl chloride	4.4	0.5
EA 3	S05-4-4	13.5 to 15.5	1,2-dichloroethane	0.7	0.5
EA 3	S05-4-4	13.5 to 15.5	benzene	3.4	1
EA 3	S05-4-4	11.5 to 13.5	1,1-dichloroethane	240	5
EA 3	S05-4-4	11.5 to 13.5	1,1-dichloroethene	11	6
EA 3	S05-4-4	11.5 to 13.5	cis-1,2-dichloroethene	21	6
EA 3	S05-4-4	11.5 to 13.5	trichloroethene	11	5
EA 3	S05-4-4	11.5 to 13.5	vinyl chloride	7.3	0.5
EA 3	S05-4-5	11.5 to 13.5	1,1-dichloroethane	34,000	5
EA 3	S05-4-5	11.5 to 13.5	1,1-dichloroethane	40,000	5
EA 3	S05-4-5	11.5 to 13.5	1,1-dichloroethene	1,400	6
EA 3	S05-4-5	11.5 to 13.5	1,1-dichloroethene	2,000	6
EA 3	S05-4-5	11.5 to 13.5	1,2-dichloroethane	24	0.5
EA 3	S05-4-5	11.5 to 13.5	benzene	1.1	1
EA 3	S05-4-5	11.5 to 13.5	cis-1,2-dichloroethene	62	6
EA 3	S05-4-5	11.5 to 13.5	trichloroethene	42	5
EA 3	S05-4-5	11.5 to 13.5	vinyl chloride	230	0.5
EA 3	S05-4-5	7.5 to 9.5	1,1-dichloroethane	4,400	5
EA 3	S05-4-5	7.5 to 9.5	1,1-dichloroethene	370	6
EA 3	S05-4-5	7.5 to 9.5	vinyl chloride	200	0.5
EA 3	S05-4-6	5.5 to 7.5	1,1-dichloroethane	13	5
EA 3	S05-4-6	7.5 to 9.5	1,1-dichloroethane	12	5

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 3	S05-4-6	9.5 to 11.5	1,1-dichloroethane	13	5
EA 3	S05-4-6	9.5 to 11.5	1,1-dichloroethane	13	5
EA 3	S05-4-6	9.5 to 11.5	1,2-dichloroethene (total)	11	6
EA 3	S05-4-6	11.5 to 13.5	1,1-dichloroethane	21	5
EA 3	S05-4-6	11.5 to 13.5	cis-1,2-dichloroethene	22	6
EA 3	S05-4-6	11.5 to 13.5	vinyl chloride	1.2	0.5
EA 3	S05-4A-A	10 to 10	1,1-dichloroethane	1,100	5
EA 3	S05-4A-A	10 to 10	1,1-dichloroethene	63	6
EA 3	S05-4A-A	10 to 10	vinyl chloride	2.6	0.5
EA 3	S05-4A-A	12 to 12	cis-1,2-dichloroethene	26	6
EA 3	S05-4A-A	12 to 12	trichloroethene	10	5
EA 3	S05-4A-A	12 to 12	vinyl chloride	0.68	0.5
EA 3	S05-4A-A	8 to 8	1,1,1-trichloroethane	1,900	200
EA 3	S05-4A-A	8 to 8	1,1-dichloroethane	5,900	5
EA 3	S05-4A-A	8 to 8	1,1-dichloroethene	2,100	6
EA 3	S05-4A-A	8 to 8	1,2-dichloroethane	9.5	0.5
EA 3	S05-4A-A	8 to 8	carbon tetrachloride	210	0.5
EA 3	S05-4A-A	8 to 8	trichloroethene	7.7	5
EA 3	S05-4A-A	8 to 8	vinyl chloride	7.2	0.5
EA 3	S05-4B-A	10 to 10	1,1-dichloroethane	11	5
EA 3	S05-4B-A	10 to 10	1,1-dichloroethene	12	6
EA 3	S05-4B-A	10 to 10	carbon tetrachloride	0.75	0.5
EA 3	S05-4B-A	10 to 10	cis-1,2-dichloroethene	14	6
EA 3	S05-4B-A	10 to 10	trichloroethene	12	5
EA 3	S05-4B-A	12 to 12	1,1-dichloroethane	29	5
EA 3	S05-4B-A	12 to 12	1,1-dichloroethene	22	6
EA 3	S05-4B-A	12 to 12	1,2-dichloroethane	0.57	0.5
EA 3	S05-4B-A	12 to 12	cis-1,2-dichloroethene	50	6
EA 3	S05-4B-A	12 to 12	trans-1,2-dichloroethene	12	10
EA 3	S05-4B-A	12 to 12	vinyl chloride	2.4	0.5
EA 3	S05-4B-A	7 to 7	1,1,1-trichloroethane	260	200
EA 3	S05-4B-A	7 to 7	1,1-dichloroethane	27	5
EA 3	S05-4B-A	7 to 7	1,1-dichloroethene	25	6
EA 3	S05-4B-A	7 to 7	1,2-dichloroethane	1	0.5
EA 3	S05-4B-A	7 to 7	carbon tetrachloride	37	0.5
EA 3	S05-4B-A	7 to 7	trichloroethene	13	5
EA 3	S05-4B-B	10 to 10	1,1-dichloroethane	410	5
EA 3	S05-4B-B	10 to 10	1,1-dichloroethene	110	6
EA 3	S05-4B-B	10 to 10	cis-1,2-dichloroethene	43	6

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 3	S05-4B-B	10 to 10	vinyl chloride	9.4	0.5
EA 3	S05-4B-B	13.5 to 13.5	1,1-dichloroethane	240	5
EA 3	S05-4B-B	13.5 to 13.5	1,2-dichloroethane	2.9	0.5
EA 3	S05-4B-B	13.5 to 13.5	benzene	2.4	1
EA 3	S05-4B-B	13.5 to 13.5	trans-1,2-dichloroethene	17	10
EA 3	S05-4B-B	13.5 to 13.5	vinyl chloride	8	0.5
EA 3	S05-4B-B	8 to 8	1,1-dichloroethane	41	5
EA 3	S05-4B-B	8 to 8	1,1-dichloroethene	20	6
EA 3	S05-4B-B	8 to 8	cis-1,2-dichloroethene	6.5	6
EA 3	S05-5-3	5.5 to 7.5	1,1-dichloroethane	7.3	5
EA 3	S05-5-3	7.5 to 9.5	1,1-dichloroethane	13	5
EA 3	S05-5-3	9.5 to 11.5	1,1-dichloroethane	190	5
EA 3	S05-5-3	9.5 to 11.5	1,2-dichloroethane	2.6	0.5
EA 3	S05-5-3	9.5 to 11.5	benzene	2.5	1
EA 3	S05-5-3	9.5 to 11.5	vinyl chloride	0.8	0.5
EA 3	S05-5-3	11.5 to 13.5	1,1-dichloroethane	7	5
EA 3	S05-5-3	11.5 to 13.5	1,1-dichloroethane	8.1	5
EA 3	S05-5-3	11.5 to 13.5	1,2-dichloroethene (total)	1,100	6
EA 3	S05-5-3	11.5 to 13.5	benzene	10	1
EA 3	S05-5-3	11.5 to 13.5	benzene	9.8	1
EA 3	S05-5-3	11.5 to 13.5	cis-1,2-dichloroethene	820	6
EA 3	S05-5-3	11.5 to 13.5	vinyl chloride	170	0.5
EA 3	S05-5-3	11.5 to 13.5	vinyl chloride	190	0.5
EA 3	S05-5-3	13.5 to 15.5	benzene	3.8	1
EA 3	S05-5-3	13.5 to 15.5	trans-1,2-dichloroethene	62	10
EA 3	S05-5-3	13.5 to 15.5	vinyl chloride	20	0.5
EA 3	S05-5-4	5.5 to 7.5	1,1-dichloroethane	850	5
EA 3	S05-5-4	5.5 to 7.5	1,1-dichloroethene	46	6
EA 3	S05-5-4	5.5 to 7.5	1,2-dichloroethane	4.5	0.5
EA 3	S05-5-4	5.5 to 7.5	trichloroethene	8.1	5
EA 3	S05-5-4	5.5 to 7.5	vinyl chloride	1.8	0.5
EA 3	S05-5-4	7.5 to 9.5	1,1-dichloroethane	2,600	5
EA 3	S05-5-4	7.5 to 9.5	1,1-dichloroethene	150	6
EA 3	S05-5-4	7.5 to 9.5	1,2-dichloroethane	26	0.5
EA 3	S05-5-4	7.5 to 9.5	cis-1,2-dichloroethene	10	6
EA 3	S05-5-4	7.5 to 9.5	trichloroethene	27	5
EA 3	S05-5-4	7.5 to 9.5	vinyl chloride	39	0.5
EA 3	S05-5-4	9.5 to 11.5	1,1-dichloroethane	2,400	5

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 3	S05-5-4	9.5 to 11.5	1,1-dichloroethene	57	6
EA 3	S05-5-4	9.5 to 11.5	1,2-dichloroethane	16	0.5
EA 3	S05-5-4	9.5 to 11.5	cis-1,2-dichloroethene	7.6	6
EA 3	S05-5-4	9.5 to 11.5	trichloroethene	7.8	5
EA 3	S05-5-4	9.5 to 11.5	vinyl chloride	21	0.5
EA 3	S05-5-4	13.5 to 15.5	benzene	1.5	1
EA 3	S05-5-5	9.5 to 11.5	1,2-dichloroethane	0.9	0.5
EA 3	S05-5-5	9.5 to 11.5	1,2-dichloroethane	0.6	0.5
EA 3	S05-5-5	11.5 to 13.5	1,2-dichloroethane	0.7	0.5
EA 3	S05-5-5	11.5 to 13.5	benzene	2.3	1
EA 3	S05-5B-A	12 to 12	1,1-dichloroethane	22	5
EA 3	S05-5B-A	12 to 12	1,1-dichloroethene	97	6
EA 3	S05-5B-A	12 to 12	trichloroethene	7.9	5
EA 3	S05-5B-A	15 to 15	1,1,1-trichloroethane	620	200
EA 3	S05-5B-A	15 to 15	1,1-dichloroethane	510	5
EA 3	S05-5B-A	15 to 15	1,1-dichloroethene	1,500	6
EA 3	S05-5B-A	15 to 15	1,2-dichloroethane	3.1	0.5
EA 3	S05-5B-A	15 to 15	carbon tetrachloride	100	0.5
EA 3	S05-5B-A	15 to 15	cis-1,2-dichloroethene	120	6
EA 3	S05-5B-A	15 to 15	tetrachloroethene	5.1	5
EA 3	S05-5B-A	15 to 15	trans-1,2-dichloroethene	17	10
EA 3	S05-5B-A	15 to 15	trichloroethene	70	5
EA 3	S05-5B-A	15 to 15	vinyl chloride	150	0.5
EA 3	S05-5B-B	13.5 to 13.5	vinyl chloride	1.2	0.5
EA 3	S05-5B-B	7 to 7	1,1-dichloroethene	12	6
EA 3	S05-5B-B	7 to 7	vinyl chloride	0.56	0.5
EA 3	S05-DGS-DP06	7 to 7	1,1-dichloroethane	84	5
EA 3	S05-DGS-DP06	7 to 7	1,2-dichloroethane	0.6	0.5
EA 3	S05-DGS-DP06	7 to 7	1,2-dichloroethene (total)	120	6
EA 3	S05-DGS-DP06	7 to 7	trichloroethene	73	5
EA 3	S05-DGS-DP06	7 to 7	vinyl chloride	1	0.5
EA 3	S05-DGS-DP11	9 to 9	1,1,1-trichloroethane	28,000	200
EA 3	S05-DGS-DP11	9 to 9	1,1-dichloroethane	7,400	5
EA 3	S05-DGS-DP11	9 to 9	1,1-dichloroethene	11,000	6
EA 3	S05-DGS-DP11	9 to 9	1,2-dichloroethane	420	0.5
EA 3	S05-DGS-DP11	9 to 9	1,2-dichloroethene (total)	320	6
EA 3	S05-DGS-DP11	9 to 9	trichloroethene	140	5
EA 3	S05-DGS-DP11	9 to 9	vinyl chloride	400	0.5
EA 3	S05-DGS-DP12	9 to 9	1,1-dichloroethane	9	5
EA 3	S05-DGS-DP12	9 to 9	1,1-dichloroethene	8	6

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 3	S05-DGS-DP12	9 to 9	1,2-dichloroethene (total)	18	6
EA 3	S05-DGS-DP12	9 to 9	trichloroethene	11	5
EA 3	S05-DGS-DP14	14 to 14	1,1,1-trichloroethane	250	200
EA 3	S05-DGS-DP14	14 to 14	1,1-dichloroethane	17,000	5
EA 3	S05-DGS-DP14	14 to 14	1,1-dichloroethene	690	6
EA 3	S05-DGS-DP14	14 to 14	1,2-dichloroethane	15	0.5
EA 3	S05-DGS-DP14	14 to 14	1,2-dichloroethene (total)	8	6
EA 3	S05-DGS-DP14	14 to 14	trichloroethene	12	5
EA 3	S05-DGS-DP14	14 to 14	vinyl chloride	88	0.5
EA 3	S05-DGS-DP15	14 to 14	1,1-dichloroethane	11	5
EA 3	S05-DGS-DP15	14 to 14	1,2-dichloroethene (total)	8	6
EA 3	S05-DGS-DP15	14 to 14	vinyl chloride	2	0.5
EA 3	S05-DGS-DP16	14 to 14	1,1-dichloroethane	11,000	5
EA 3	S05-DGS-DP16	14 to 14	1,1-dichloroethene	530	6
EA 3	S05-DGS-DP16	14 to 14	1,2-dichloroethane	6	0.5
EA 3	S05-DGS-DP16	14 to 14	1,2-dichloroethene (total)	14	6
EA 3	S05-DGS-DP16	14 to 14	trichloroethene	10	5
EA 3	S05-DGS-DP16	14 to 14	vinyl chloride	100	0.5
EA 3	S05-DGS-DP23	6 to 8	1,1-dichloroethane	33	5
EA 3	S05-DGS-DP23	6 to 8	vinyl chloride	0.6	0.5
EA 3	S05-DGS-DP23	11 to 13	1,1-dichloroethane	490	5
EA 3	S05-DGS-DP23	11 to 13	1,1-dichloroethene	8.6	6
EA 3	S05-DGS-DP23	11 to 13	vinyl chloride	6.5	0.5
EA 3	S05-DGS-DP24	6 to 8	1,1-dichloroethane	7.4	5
EA 3	S05-DGS-DP24	6 to 8	1,1-dichloroethane	9	5
EA 3	S05-DGS-DP24	11 to 13	1,1-dichloroethane	6.8	5
EA 3	S05-DGS-DP38	8 to 8	1,1-dichloroethane	24	5
EA 3	S05-DGS-DP38	8 to 8	cis-1,2-dichloroethene	6.1	6
EA 3	S05-DGS-DP38	12 to 12	benzene	2.2	1
EA 3	S05-DGS-DP38	12 to 12	vinyl chloride	2.1	0.5
EA 3	S05-DGS-DP40	10 to 12	1,1-dichloroethane	6.4	5
EA 3	S05-DGS-DP40	10 to 12	benzene	1.3	1
EA 3	S05-DGS-DP40	10 to 12	cis-1,2-dichloroethene	15	6
EA 3	S05-DGS-DP40	15 to 17	benzene	6.5	1
EA 3	S05-DGS-DP42	8 to 10	1,1-dichloroethane	21	5
EA 3	S05-DGS-DP42	8 to 10	cis-1,2-dichloroethene	6.9	6
EA 3	S05-DGS-DP42	12 to 14	1,1-dichloroethane	19	5
EA 3	S05-DGS-DP42	12 to 14	benzene	1.1	1
EA 3	S05-DGS-DP42	12 to 14	cis-1,2-dichloroethene	29	6

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 3	S05-DGS-DP42	12 to 14	vinyl chloride	20	0.5
EA 3	S05-DGS-DP49	8 to 10	1,1-dichloroethane	31	5
EA 3	S05-DGS-DP49	8 to 10	1,1-dichloroethene	7	6
EA 3	S05-DGS-DP49	12 to 14	1,1-dichloroethane	18	5
EA 3	S05-DGS-DP49	12 to 14	benzene	5	1
EA 3	S05-DGS-DP49	12 to 14	vinyl chloride	22	0.5
Lower FWBZ					
EA 3	5-3-ADD106	18 to 21	cis-1,2-dichloroethene	470	6
EA 3	5-3-ADD106	23 to 26	cis-1,2-dichloroethene	380	6
EA 3	5-3-ADD107	18 to 21	cis-1,2-dichloroethene	310	6
EA 3	5-3-ADD107	23 to 26	cis-1,2-dichloroethene	10,000	6
EA 3	5-3-ADD14	20 to 24	1,1-dichloroethane	470	5
EA 3	5-3-ADD14	20 to 24	vinyl chloride	160	0.5
EA 3	5-3-ADD15	20 to 24	1,1-dichloroethane	630	5
EA 3	5-3-ADD17	21 to 25	1,1-dichloroethane	230	5
EA 3	5-3-ADD18	19.5 to 23.5	1,1-dichloroethane	540	5
EA 3	5-3-ADD18	19.5 to 23.5	vinyl chloride	42	0.5
EA 3	5-3-ADD19	19 to 22	1,1,1-trichloroethane	580	200
EA 3	5-3-ADD19	19 to 22	1,1-dichloroethane	1,500	5
EA 3	5-3-ADD19	24 to 27	1,1,1-trichloroethane	260	200
EA 3	5-3-ADD19	24 to 27	1,1-dichloroethane	300	5
EA 3	5-3-ADD20	20 to 24	1,1-dichloroethane	3400	5
EA 3	5-3-ADD21	21 to 25	1,1-dichloroethane	1,800	5
EA 3	5-3-ADD22	17 to 21	1,1-dichloroethane	23,000	5
EA 3	5-3-ADD22	23 to 26	1,1,1-trichloroethane	23,000	200
EA 3	5-3-ADD22	23 to 26	1,1-dichloroethane	1,900	5
EA 3	5-3-ADD23	20 to 24	1,1-dichloroethane	120	5
EA 3	5-3-ADD24	20 to 24	1,1-dichloroethane	4,100	5
EA 3	5-3-ADD24	25 to 29	1,1-dichloroethane	2,300	5
EA 3	5-3-ADD24	31 to 35	1,1-dichloroethane	260	5
EA 3	5-3-ADD26	17 to 21	1,1,1-trichloroethane	52,000	200
EA 3	5-3-ADD26	17 to 21	1,1-dichloroethane	13,000	5
EA 3	5-3-ADD26	23 to 26	1,1,1-trichloroethane	350,000	200
EA 3	5-3-ADD26	23 to 26	1,1-dichloroethane	23,000	5
EA 3	5-3-ADD26	28 to 31	1,1,1-trichloroethane	250	200
EA 3	5-3-ADD27	18 to 22	1,1,1-trichloroethane	1,600,000	200
EA 3	5-3-ADD27	18 to 22	1,1-dichloroethane	110,000	5
EA 3	5-3-ADD27	23 to 26	1,1-dichloroethane	6,700	5

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 3	5-3-ADD28	21 to 25	1,1-dichloroethane	230	5
EA 3	5-3-ADD3	20 to 24	1,1-dichloroethane	38	5
EA 3	5-3-ADD32	20 to 24	1,1-dichloroethane	750	5
EA 3	5-3-ADD32	26 to 30	1,1-dichloroethane	330	5
EA 3	5-3-ADD34	21 to 25	1,1-dichloroethane	320	5
EA 3	5-3-ADD35	25 to 29	1,1-dichloroethane	470	5
EA 3	5-3-ADD4	19.5 to 23.5	1,1-dichloroethane	24	5
EA 3	5-3-ADD40	19 to 22.5	1,1,1-trichloroethane	890	200
EA 3	5-3-ADD40	19 to 22.5	1,1-dichloroethane	220	5
EA 3	5-3-ADD40	24 to 28	1,1,1-trichloroethane	4,000	200
EA 3	5-3-ADD40	24 to 28	1,1-dichloroethane	3,000	5
EA 3	5-3-ADD40	30 to 34	1,1,1-trichloroethane	230	200
EA 3	5-3-ADD41	24 to 28	1,1-dichloroethane	290	5
EA 3	5-3-ADD48	24 to 28	1,1-dichloroethane	270	5
EA 3	5-3-ADD50	19 to 23	1,1-dichloroethane	770	5
EA 3	5-3-ADD56	19 to 22.5	1,1-dichloroethane	1,800	5
EA 3	5-3-ADD56	24 to 28	1,1-dichloroethane	1,800	5
EA 3	5-3-ADD57	27 to 30	1,1,1-trichloroethane	530	200
EA 3	5-3-ADD57	27 to 30	cis-1,2-dichloroethene	390	6
EA 3	5-3-ADD57	27 to 30	trichloroethene	8,000	5
EA 3	5-3-ADD63	26 to 30	1,1-dichloroethane	310	5
EA 3	B05PS-01	18 to 18	1,1,1-trichloroethane	720	200
EA 3	B05PS-01	18 to 18	1,1-dichloroethane	480	5
EA 3	S05-3A-D	20 to 20	1,2-dichloroethane	1.7	0.5
EA 3	S05-3A-D	20 to 20	benzene	6.3	1
EA 3	S05-4-4	15.5 to 20	1,1-dichloroethane	6.7	5
EA 3	S05-5-3	15.5 to 20	cis-1,2-dichloroethene	64	6
EA 3	S05-5-3	15.5 to 20	tetrachloroethene	72	5
EA 3	S05-5-3	15.5 to 20	trichloroethene	77	5
EA 3	S05-5-3	15.5 to 20	vinyl chloride	11	0.5
EA 3	S05-5-3	20 to 25	1,2-dichloroethene (total)	17	6
EA 3	S05-5-3	20 to 25	cis-1,2-dichloroethene	17	6
EA 3	S05-5-3	20 to 25	tetrachloroethene	8	5
EA 3	S05-5-3	20 to 25	tetrachloroethene	14	5
EA 3	S05-5-3	20 to 25	trichloroethene	10	5
EA 3	S05-5-3	20 to 25	trichloroethene	13	5
EA 3	S05-5-3	20 to 25	vinyl chloride	2	0.5
EA 3	S05-5-3	20 to 25	vinyl chloride	2.2	0.5

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
Upper FWBZ					
EA 4	S05-2A-C	10 to 10	1,1-dichloroethane	330	5
EA 4	S05-2A-C	10 to 10	1,1-dichloroethene	34	6
EA 4	S05-2A-C	10 to 10	1,2-dichloroethane	3.7	0.5
EA 4	S05-2A-C	10 to 10	cis-1,2-dichloroethene	11	6
EA 4	S05-2A-C	10 to 10	trichloroethene	16	5
EA 4	S05-2A-C	10 to 10	vinyl chloride	4.2	0.5
EA 4	S05-2B-A	15 to 15	1,1-dichloroethane	250	5
EA 4	S05-2B-A	15 to 15	1,1-dichloroethene	350	6
EA 4	S05-2B-A	15 to 15	1,2-dichloroethane	6.7	0.5
EA 4	S05-2B-A	15 to 15	benzene	22	1
EA 4	S05-2B-A	15 to 15	cis-1,2-dichloroethene	3,200	6
EA 4	S05-2B-A	15 to 15	trans-1,2-dichloroethene	220	10
EA 4	S05-2B-A	15 to 15	trichloroethene	90	5
EA 4	S05-2B-A	15 to 15	vinyl chloride	5,500	0.5
EA 4	S05-2B-A	8 to 8	1,1-dichloroethane	10	5
EA 4	S05-6-3	11.5 to 13.5	1,2-dichloroethane	0.8	0.5
EA 4	S05-6-3	11.5 to 13.5	benzene	1.4	1
EA 4	S05-6-3	13.5 to 15.5	1,2-dichloroethane	0.7	0.5
EA 4	S05-6-3	13.5 to 15.5	benzene	1.9	1
EA 4	S05-6-4	7.5 to 9.5	vinyl chloride	1.9	0.5
EA 4	S05-DGS-DP21	11 to 13	benzene	2	1
EA 4	S05-DGS-DP22	11 to 13	vinyl chloride	8.4	0.5
EA 4	S05-DGS-DP22	11 to 13	vinyl chloride	16	0.5
EA 4	S05-DGS-DP22	16 to 18	benzene	4.2	1
EA 4	S05-DGS-DP22	16 to 18	vinyl chloride	1.4	0.5
EA 4	S05-DGS-DP35	8 to 8	vinyl chloride	22	0.5
EA 4	S05-DGS-DP35	12 to 12	benzene	4.4	1
EA 4	S05-DGS-DP35	12 to 12	vinyl chloride	2.5	0.5
EA 4	S05-DGS-DP35	16 to 16	benzene	5.8	1
EA 4	S05-DGS-DP35	16 to 16	vinyl chloride	2	0.5
EA 4	S05-DGS-DP36	8 to 10	vinyl chloride	0.6	0.5
EA 4	S05-DGS-DP36	12 to 14	benzene	3.4	1
EA 4	S05-DGS-DP36	16 to 18	benzene	2.1	1
EA 4	S05-DGS-DP37	12 to 12	benzene	4	1
EA 4	SHP-S05-12	8 to 8	1,1-dichloroethane	7	5
EA 4	SHP-S05-12	8 to 8	1,2-dichloroethene (total)	34	6

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
Upper FWBZ					
EA 5	057-001	NA	1,1-dichloroethane	34	5
EA 5	057-006-014	7 to 8	1,1-dichloroethane	80	5
EA 5	057-006-014	7 to 8	1,1-dichloroethene	19	6
EA 5	057-006-014	7 to 8	1,2-dichloroethane	0.7	0.5
EA 5	057-006-014	7 to 8	1,2-dichloroethene (total)	780	6
EA 5	057-006-014	7 to 8	trichloroethene	6	5
EA 5	057-006-014	7 to 8	vinyl chloride	580	0.5
EA 5	057-006-015	7 to 8	1,1-dichloroethane	680	5
EA 5	057-006-015	7 to 8	1,1-dichloroethene	280	6
EA 5	057-006-015	7 to 8	vinyl chloride	11	0.5
EA 5	057-006-016	9 to 10	1,1,1-trichloroethane	4,700	200
EA 5	057-006-016	9 to 10	1,1-dichloroethane	1,300	5
EA 5	057-006-016	9 to 10	1,1-dichloroethene	290	6
EA 5	057-006-016	9 to 10	carbon tetrachloride	130	0.5
EA 5	057-006-016	9 to 10	trichloroethene	10	5
EA 5	057-006-016	9 to 10	vinyl chloride	1	0.5
EA 5	057-008	5 to 12	1,1-dichloroethane	26	5
EA 5	057-008	5 to 12	dichloroethene	2,200	6
EA 5	400-001	10 to 10	1,1-dichloroethane	16	5
EA 5	B05WT-01	10.5 to 10.5	1,1-dichloroethane	180	5
EA 5	B05WT-01	10.5 to 10.5	1,2-dichloroethene (total)	120	6
EA 5	B05WT-01	10.5 to 10.5	vinyl chloride	62	0.5
EA 5	B05WT-02	0 to 0	1,1-dichloroethane	24	5
EA 5	B05WT-02	0 to 0	1,2-dichloroethene (total)	62	6
EA 5	B05WT-02	0 to 0	methylene chloride	25	5
EA 5	B05WT-02	0 to 0	vinyl chloride	40	0.5
EA 5	CA05-04	NA	1,2,4-trimethylbenzene	98	5
EA 5	S05-2-1	11.5 to 13.5	1,1-dichloroethane	6.9	5
EA 5	S05-2-1	5.5 to 7.5	1,1-dichloroethane	11	5
EA 5	S05-2-1	9.5 to 11.5	1,1-dichloroethane	36	5
EA 5	S05-2-1	9.5 to 11.5	cis-1,2-dichloroethene	17	6
EA 5	S05-2-1	9.5 to 11.5	vinyl chloride	3.8	0.5
EA 5	S05-2-2	5.5 to 7.5	1,1-dichloroethane	7.9	5
EA 5	S05-2-2	5.5 to 7.5	1,1-dichloroethene	13	6
EA 5	S05-2-2	5.5 to 7.5	trichloroethene	23	5
EA 5	S05-2-2	7.5 to 9.5	1,1-dichloroethane	13	5
EA 5	S05-2-2	7.5 to 9.5	1,1-dichloroethene	6.7	6
EA 5	S05-2-2	7.5 to 9.5	trichloroethene	15	5
EA 5	S05-2-2	9.5 to 11.5	1,1-dichloroethane	8.1	5
EA 5	S05-2-2	9.5 to 11.5	trichloroethene	7	5
EA 5	S05-2-2	9.5 to 11.5	vinyl chloride	0.8	0.5

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 5	S05-2-2	11.5 to 13.5	1,1-dichloroethane	7.5	5
EA 5	S05-2-2	13.5 to 15.5	benzene	2.5	1
EA 5	S05-2-3	7.5 to 9.5	1,1-dichloroethane	170	5
EA 5	S05-2-3	7.5 to 9.5	trans-1,2-dichloroethene	15	10
EA 5	S05-2-3	7.5 to 9.5	vinyl chloride	5.2	0.5
EA 5	S05-2-3	11.5 to 13.5	1,1-dichloroethane	290	5
EA 5	S05-2-3	11.5 to 13.5	cis-1,2-dichloroethene	42	6
EA 5	S05-2-3	11.5 to 13.5	vinyl chloride	93	0.5
EA 5	S05-2-3	5.5 to 7.5	1,1-dichloroethane	220	5
EA 5	S05-2-3	5.5 to 7.5	cis-1,2-dichloroethene	72	6
EA 5	S05-2-3	5.5 to 7.5	trans-1,2-dichloroethene	18	10
EA 5	S05-2-3	5.5 to 7.5	vinyl chloride	76	0.5
EA 5	S05-2-3	9.5 to 11.5	1,1-dichloroethane	310	5
EA 5	S05-2-3	9.5 to 11.5	benzene	3.8	1
EA 5	S05-2-3	9.5 to 11.5	cis-1,2-dichloroethene	33	6
EA 5	S05-2-3	9.5 to 11.5	vinyl chloride	81	0.5
EA 5	S05-2-4	9.5 to 11.5	1,1-dichloroethane	16	5
EA 5	S05-2-4	9.5 to 11.5	cis-1,2-dichloroethene	37	6
EA 5	S05-2-4	9.5 to 11.5	vinyl chloride	2.5	0.5
EA 5	S05-2-4	11.5 to 13.5	1,1-dichloroethane	78	5
EA 5	S05-2-4	11.5 to 13.5	cis-1,2-dichloroethene	38	6
EA 5	S05-2-4	11.5 to 13.5	vinyl chloride	5.5	0.5
EA 5	S05-2-4	13.5 to 15.5	1,1-dichloroethane	19	5
EA 5	S05-2-4	13.5 to 15.5	cis-1,2-dichloroethene	6.8	6
EA 5	S05-2-4	13.5 to 15.5	vinyl chloride	8.9	0.5
EA 5	S05-3-2	5.5 to 7.5	trichloroethene	5.8	5
EA 5	S05-3-2	7.5 to 9.5	1,1-dichloroethane	44	5
EA 5	S05-3-2	7.5 to 9.5	1,1-dichloroethene	32	6
EA 5	S05-3-2	7.5 to 9.5	tetrachloroethene	7.6	5
EA 5	S05-3-2	7.5 to 9.5	trichloroethene	24	5
EA 5	S05-3-2	11.5 to 13.5	1,1-dichloroethane	940	5
EA 5	S05-3-2	11.5 to 13.5	1,1-dichloroethene	62	6
EA 5	S05-3-2	11.5 to 13.5	benzene	1.9	1
EA 5	S05-3-2	11.5 to 13.5	cis-1,2-dichloroethene	130	6
EA 5	S05-3-2	11.5 to 13.5	trans-1,2-dichloroethene	37	10
EA 5	S05-3-2	11.5 to 13.5	trichloroethene	61	5
EA 5	S05-3-2	11.5 to 13.5	vinyl chloride	490	0.5
EA 5	S05-3-2	13.5 to 15.5	1,1-dichloroethane	670	5
EA 5	S05-3-2	13.5 to 15.5	benzene	3.7	1
EA 5	S05-3-2	13.5 to 15.5	trans-1,2-dichloroethene	11	10

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 5	S05-3-2	13.5 to 15.5	vinyl chloride	180	0.5
EA 5	S05-3-3	5.5 to 7.5	1,1-dichloroethane	67	5
EA 5	S05-3-3	5.5 to 7.5	1,2-dichloroethane	2.4	0.5
EA 5	S05-3-3	5.5 to 7.5	vinyl chloride	2.1	0.5
EA 5	S05-3-3	7.5 to 9.5	1,1-dichloroethane	130	5
EA 5	S05-3-3	7.5 to 9.5	vinyl chloride	2	0.5
EA 5	S05-3-3	9.5 to 11.5	1,1-dichloroethane	21	5
EA 5	S05-3-3	9.5 to 11.5	vinyl chloride	3.1	0.5
EA 5	S05-3-3	13.5 to 15.5	1,1-dichloroethane	13	5
EA 5	S05-3-3	13.5 to 15.5	1,2-dichloroethane	2.1	0.5
EA 5	S05-3-3	13.5 to 15.5	benzene	1.1	1
EA 5	S05-3-3	13.5 to 15.5	benzene	4.1	1
EA 5	S05-3-3	13.5 to 15.5	vinyl chloride	0.8	0.5
EA 5	S05-3-3	13.5 to 15.5	vinyl chloride	0.9	0.5
EA 5	S05-3-3	11.5 to 13.5	1,1-dichloroethane	220	5
EA 5	S05-3-3	11.5 to 13.5	1,1-dichloroethane	280	5
EA 5	S05-3-3	11.5 to 13.5	1,1-dichloroethene	26	6
EA 5	S05-3-3	11.5 to 13.5	1,1-dichloroethene	38	6
EA 5	S05-3-3	11.5 to 13.5	1,2-dichloroethane	0.8	0.5
EA 5	S05-3-3	11.5 to 13.5	1,2-dichloroethene (total)	43	6
EA 5	S05-3-3	11.5 to 13.5	cis-1,2-dichloroethene	38	6
EA 5	S05-3-3	11.5 to 13.5	trichloroethene	14	5
EA 5	S05-3-3	11.5 to 13.5	trichloroethene	20	5
EA 5	S05-3-3	11.5 to 13.5	vinyl chloride	79	0.5
EA 5	S05-3-3	11.5 to 13.5	vinyl chloride	69	0.5
EA 5	S05-3-4	13.5 to 15.5	1,1-dichloroethane	2,900	5
EA 5	S05-3-4	13.5 to 15.5	benzene	8.4	1
EA 5	S05-3-4	13.5 to 15.5	trans-1,2-dichloroethene	18	10
EA 5	S05-3-4	13.5 to 15.5	vinyl chloride	2.4	0.5
EA 5	S05-3-4	5.5 to 7.5	1,1-dichloroethane	100	5
EA 5	S05-3-4	5.5 to 7.5	cis-1,2-dichloroethene	28	6
EA 5	S05-3-4	5.5 to 7.5	vinyl chloride	4.5	0.5
EA 5	S05-3-4	7.5 to 9.5	1,1-dichloroethane	46	5
EA 5	S05-3-4	7.5 to 9.5	1,2-dichloroethane	0.7	0.5
EA 5	S05-3-4	7.5 to 9.5	benzene	2	1
EA 5	S05-3-4	7.5 to 9.5	cis-1,2-dichloroethene	28	6
EA 5	S05-3-4	7.5 to 9.5	vinyl chloride	12	0.5
EA 5	S05-3-4	11.5 to 13.5	1,1-dichloroethane	1,700	5
EA 5	S05-3-4	9.5 to 11.5	1,1-dichloroethane	8.8	5

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 5	S05-3-4	9.5 to 11.5	benzene	2.2	1
EA 5	S05-3-4	9.5 to 11.5	vinyl chloride	1.7	0.5
EA 5	S05-3-5	9.5 to 11.5	1,1-dichloroethane	100	5
EA 5	S05-3-5	9.5 to 11.5	1,2-dichloroethane	4.4	0.5
EA 5	S05-3-5	5.5 to 7.5	1,1-dichloroethane	15	5
EA 5	S05-3-5	5.5 to 7.5	cis-1,2-dichloroethene	9.7	6
EA 5	S05-3-5	7.5 to 9.5	1,1-dichloroethane	47	5
EA 5	S05-3-5	7.5 to 9.5	1,2-dichloroethane	1.9	0.5
EA 5	S05-3-5	7.5 to 9.5	vinyl chloride	0.7	0.5
EA 5	S05-3-5	11.5 to 13.5	1,2-dichloroethane	0.6	0.5
EA 5	S05-DGS-DP39	11 to 13	1,1-dichloroethane	8	5
EA 5	S05-DGS-DP39	11 to 13	1,2-dichloroethane	2	0.5
EA 5	S05-SB-1	10 to 10	1,1-dichloroethane	62	5
EA 5	S05-SB-1	10 to 10	1,1-dichloroethene	11	6
EA 5	S05-SB-1	10 to 10	vinyl chloride	10	0.5
EA 5	S05-SB-1	12 to 12	1,1-dichloroethane	330	5
EA 5	S05-SB-1	12 to 12	1,1-dichloroethene	78	6
EA 5	S05-SB-1	12 to 12	cis-1,2-dichloroethene	21	6
EA 5	S05-SB-1	12 to 12	trans-1,2-dichloroethene	12	10
EA 5	S05-SB-1	12 to 12	trichloroethene	21	5
EA 5	S05-SB-1	12 to 12	vinyl chloride	81	0.5
EA 5	S05-SB-1	7 to 7	1,1-dichloroethane	85	5
EA 5	S05-SB-1	7 to 7	1,1-dichloroethene	32	6
EA 5	S05-SB-1	7 to 7	1,2-dichloroethane	6.9	0.5
EA 5	S05-SB-1	7 to 7	trichloroethene	14	5
EA 5	S05-SB-1	7 to 7	vinyl chloride	21	0.5
EA 5	S05-SB-2	10 to 10	1,1-dichloroethane	65	5
EA 5	S05-SB-2	10 to 10	1,1-dichloroethene	6.5	6
EA 5	S05-SB-2	10 to 10	benzene	1.1	1
EA 5	S05-SB-2	10 to 10	cis-1,2-dichloroethene	32	6
EA 5	S05-SB-2	10 to 10	trichloroethene	26	5
EA 5	S05-SB-2	10 to 10	vinyl chloride	210	0.5
EA 5	S05-SB-2	12 to 12	1,1-dichloroethane	96	5
EA 5	S05-SB-2	12 to 12	1,1-dichloroethene	89	6
EA 5	S05-SB-2	12 to 12	benzene	3	1
EA 5	S05-SB-2	12 to 12	cis-1,2-dichloroethene	30	6
EA 5	S05-SB-2	12 to 12	trans-1,2-dichloroethene	26	10
EA 5	S05-SB-2	12 to 12	trichloroethene	14	5
EA 5	S05-SB-2	12 to 12	vinyl chloride	530	0.5

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 5	S05-SB-2	7 to 7	1,1-dichloroethane	6.2	5
EA 5	S05-SB-2	7 to 7	carbon tetrachloride	0.68	0.5
EA 5	S05-SB-2	7 to 7	tetrachloroethene	15	5
EA 5	S05-SB-2	7 to 7	trichloroethene	26	5
EA 5	S05-SB-2	7 to 7	vinyl chloride	1.7	0.5
Lower FWBZ					
EA 5	S05-3-3	15.5 to 20	1,1-dichloroethane	48	5
EA 5	S05-3-3	15.5 to 20	cis-1,2-dichloroethene	13	6
EA 5	S05-3-3	15.5 to 20	vinyl chloride	15	0.5
Upper FWBZ					
EA 6N	5-1-ADD10	6 to 9	1,1-dichloroethane	8.9	5
EA 6N	5-1-ADD10	11 to 14	1,1-dichloroethane	120	5
EA 6N	5-1-ADD12	6 to 9	1,1-dichloroethane	42	5
EA 6N	5-1-ADD12	6 to 9	cis-1,2-dichloroethene	79	6
EA 6N	5-1-ADD12	6 to 9	trichloroethene	99	5
EA 6N	5-1-ADD12	6 to 9	vinyl chloride	6.3	0.5
EA 6N	5-1-ADD12	10 to 13	1,1-dichloroethane	5,300	5
EA 6N	5-1-ADD12	10 to 13	cis-1,2-dichloroethene	2,600	6
EA 6N	5-1-ADD12	10 to 13	trichloroethene	1,600	5
EA 6N	5-1-ADD12	10 to 13	vinyl chloride	1,700	0.5
EA 6N	5-1-ADD12	15 to 18	1,1,1-trichloroethane	28,000	200
EA 6N	5-1-ADD12	15 to 18	1,1-dichloroethane	17,000	5
EA 6N	5-1-ADD12	15 to 18	cis-1,2-dichloroethene	230,000	6
EA 6N	5-1-ADD12	15 to 18	trichloroethene	320,000	5
EA 6N	5-1-ADD12	15 to 18	vinyl chloride	31,000	0.5
EA 6N	5-1-ADD13	6 to 9	1,1-dichloroethane	11	5
EA 6N	5-1-ADD13	6 to 9	trichloroethene	7.4	5
EA 6N	5-1-ADD13	11.5 to 14.5	1,1-dichloroethane	130	5
EA 6N	5-1-ADD13	11.5 to 14.5	cis-1,2-dichloroethene	10	6
EA 6N	5-1-ADD13	11.5 to 14.5	trichloroethene	11	5
EA 6N	5-1-ADD13	11.5 to 14.5	vinyl chloride	13	0.5
EA 6N	5-1-ADD13	17 to 20.5	1,1-dichloroethane	9.1	5
EA 6N	5-1-ADD14	11 to 14	1,1-dichloroethane	78	5
EA 6N	5-1-ADD14	11 to 14	vinyl chloride	22	0.5
EA 6N	5-1-ADD15	11 to 15	1,1-dichloroethane	6,300	5
EA 6N	5-1-ADD15	11 to 15	cis-1,2-dichloroethene	3,100	6
EA 6N	5-1-ADD15	11 to 15	trichloroethene	4,300	5
EA 6N	5-1-ADD15	11 to 15	vinyl chloride	570	0.5
EA 6N	5-1-ADD16	11 to 15	1,1,1-trichloroethane	7,600	200

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 6N	5-1-ADD16	11 to 15	1,1-dichloroethane	15,000	5
EA 6N	5-1-ADD16	11 to 15	1,1-dichloroethene	1,500	6
EA 6N	5-1-ADD16	11 to 15	trichloroethene	910	5
EA 6N	5-1-ADD16	11 to 15	vinyl chloride	960	0.5
EA 6N	5-1-ADD16	17 to 21	1,1-dichloroethane	440	5
EA 6N	5-1-ADD16	22 to 25	1,1-dichloroethane	170	5
EA 6N	5-1-ADD17	11 to 15	1,1-dichloroethane	150	5
EA 6N	5-1-ADD17	11 to 15	cis-1,2-dichloroethene	21	6
EA 6N	5-1-ADD17	11 to 15	vinyl chloride	7.1	0.5
EA 6N	5-1-ADD19	11 to 15	1,1-dichloroethane	2,100	5
EA 6N	5-1-ADD19	11 to 15	cis-1,2-dichloroethene	7,000	6
EA 6N	5-1-ADD19	11 to 15	trichloroethene	8,900	5
EA 6N	5-1-ADD19	11 to 15	vinyl chloride	2,600	0.5
EA 6N	5-1-ADD2	12 to 15	1,1-dichloroethane	360	5
EA 6N	5-1-ADD20	6 to 9	1,1,1-trichloroethane	650,000	200
EA 6N	5-1-ADD20	6 to 9	1,1-dichloroethane	55,000	5
EA 6N	5-1-ADD20	6 to 9	trichloroethene	52,000	5
EA 6N	5-1-ADD20	11 to 15	1,1,1-trichloroethane	2,500,000	200
EA 6N	5-1-ADD20	11 to 15	1,1-dichloroethane	280,000	5
EA 6N	5-1-ADD20	11 to 15	1,1-dichloroethene	89,000	6
EA 6N	5-1-ADD20	11 to 15	cis-1,2-dichloroethene	38,000	6
EA 6N	5-1-ADD20	11 to 15	trichloroethene	230,000	5
EA 6N	5-1-ADD20	15.5 to 19	1,1,1-trichloroethane	9,400	200
EA 6N	5-1-ADD20	15.5 to 19	1,1-dichloroethane	15,000	5
EA 6N	5-1-ADD20	15.5 to 19	1,1-dichloroethene	620	6
EA 6N	5-1-ADD20	15.5 to 19	cis-1,2-dichloroethene	2,800	6
EA 6N	5-1-ADD20	15.5 to 19	trichloroethene	780	5
EA 6N	5-1-ADD20	15.5 to 19	vinyl chloride	1,500	0.5
EA 6N	5-1-ADD21	10 to 13.5	vinyl chloride	7.6	0.5
EA 6N	5-1-ADD23	6 to 9	1,1-dichloroethane	210	5
EA 6N	5-1-ADD23	11 to 14	1,1-dichloroethane	230	5
EA 6N	5-1-ADD24	11 to 15	1,1-dichloroethane	46	5
EA 6N	5-1-ADD24	11 to 15	vinyl chloride	9.2	0.5
EA 6N	5-1-ADD26	11.5 to 15	1,1-dichloroethane	100	5
EA 6N	5-1-ADD27	11.5 to 15	1,1,1-trichloroethane	37,000	200
EA 6N	5-1-ADD27	11.5 to 15	1,1-dichloroethane	7,500	5
EA 6N	5-1-ADD3	12 to 15	1,1-dichloroethane	320	5
EA 6N	5-1-ADD3	12 to 15	1,1-dichloroethene	8.3	6
EA 6N	5-1-ADD3	12 to 15	trichloroethene	7.8	5

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 6N	5-1-ADD3	12 to 15	vinyl chloride	19	0.5
EA 6N	5-1-ADD30	11 to 14	1,1-dichloroethane	590	5
EA 6N	5-1-ADD30	11 to 14	vinyl chloride	620	0.5
EA 6N	5-1-ADD31	12 to 16	1,1,1-trichloroethane	70,000	200
EA 6N	5-1-ADD31	12 to 16	1,1-dichloroethane	35,000	5
EA 6N	5-1-ADD31	12 to 16	cis-1,2-dichloroethene	4,000	6
EA 6N	5-1-ADD31	12 to 16	trichloroethene	16,000	5
EA 6N	5-1-ADD36	6 to 10	1,1-dichloroethane	600	5
EA 6N	5-1-ADD36	12 to 15	1,1,1-trichloroethane	25,000	200
EA 6N	5-1-ADD36	12 to 15	1,1-dichloroethane	67,000	5
EA 6N	5-1-ADD36	12 to 15	1,1-dichloroethene	12,000	6
EA 6N	5-1-ADD36	12 to 15	cis-1,2-dichloroethene	3,200	6
EA 6N	5-1-ADD36	12 to 15	trichloroethene	2,400	5
EA 6N	5-1-ADD36	12 to 15	vinyl chloride	4,500	0.5
EA 6N	5-1-ADD37	12 to 15	1,1-dichloroethane	390	5
EA 6N	5-1-ADD37	12 to 15	cis-1,2-dichloroethene	260	6
EA 6N	5-1-ADD37	12 to 15	vinyl chloride	260	0.5
EA 6N	5-1-ADD38	12 to 16	1,1-dichloroethane	2,100	5
EA 6N	5-1-ADD38	12 to 16	vinyl chloride	440	0.5
EA 6N	5-1-ADD4	6 to 9	cis-1,2-dichloroethene	32	6
EA 6N	5-1-ADD4	12 to 15	1,1-dichloroethane	51	5
EA 6N	5-1-ADD5	12 to 15	1,1-dichloroethane	19,000	5
EA 6N	5-1-ADD5	12 to 15	1,1-dichloroethene	1,300	6
EA 6N	5-1-ADD5	12 to 15	cis-1,2-dichloroethene	10,000	6
EA 6N	5-1-ADD5	12 to 15	trichloroethene	2,400	5
EA 6N	5-1-ADD5	12 to 15	vinyl chloride	10,000	0.5
EA 6N	5-1-ADD6	6 to 10	1,1-dichloroethane	8.1	5
EA 6N	5-1-ADD6	6 to 10	trichloroethene	11	5
EA 6N	5-1-ADD6	12 to 15	1,1-dichloroethane	9,700	5
EA 6N	5-1-ADD6	12 to 15	vinyl chloride	3,400	0.5
EA 6N	5-1-ADD7	6 to 9	cis-1,2-dichloroethene	15	6
EA 6N	5-1-ADD7	6 to 9	vinyl chloride	7.6	0.5
EA 6N	5-1-ADD7	11.5 to 15	1,1-dichloroethane	94	5
EA 6N	5-1-ADD7	11.5 to 15	vinyl chloride	17	0.5
EA 6N	5-1-ADD9	6 to 9	1,1-dichloroethane	310	5
EA 6N	5-1-ADD9	6 to 9	trichloroethene	79	5
EA 6N	5-1-ADD9	6 to 9	vinyl chloride	7.3	0.5
EA 6N	5-1-ADD9	11 to 14	1,1,1-trichloroethane	140,000	200
EA 6N	5-1-ADD9	11 to 14	1,1-dichloroethane	52,000	5

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 6N	5-1-ADD9	11 to 14	1,1-dichloroethene	14,000	6
EA 6N	5-1-ADD9	11 to 14	cis-1,2-dichloroethene	38,000	6
EA 6N	5-1-ADD9	11 to 14	trichloroethene	40,000	5
EA 6N	5-1-ADD9	11 to 14	vinyl chloride	8,500	0.5
EA 6N	5-1-ADD9	16 to 19	1,1,1-trichloroethane	30,000	200
EA 6N	5-1-ADD9	16 to 19	trichloroethene	12,000	5
EA 6N	B05-11	0 to 0	1,1-dichloroethane	53	5
EA 6N	CA05-01	to	1,1-dichloroethane	26	5
EA 6N	CA05-01	to	vinyl chloride	5.2	0.5
EA 6N	CA05-02	to	trichloroethene	15	5
EA 6N	CA05-02	to	vinyl chloride	0.7	0.5
EA 6N	NAS05-01-W-07	7 to 7	benzene	7	1
EA 6N	S05-2A-A	10 to 10	1,1-dichloroethane	6.2	5
EA 6N	S05-2A-A	10 to 10	1,1-dichloroethene	11	6
EA 6N	S05-2A-A	10 to 10	cis-1,2-dichloroethene	21	6
EA 6N	S05-2A-A	10 to 10	trichloroethene	56	5
EA 6N	S05-2A-A	10 to 10	vinyl chloride	6.4	0.5
EA 6N	S05-2A-A	13.5 to 13.5	1,1,1-trichloroethane	2,100	200
EA 6N	S05-2A-A	13.5 to 13.5	1,1-dichloroethane	29,000	5
EA 6N	S05-2A-A	13.5 to 13.5	1,1-dichloroethene	14,000	6
EA 6N	S05-2A-A	13.5 to 13.5	1,2-dichloroethane	12	0.5
EA 6N	S05-2A-A	13.5 to 13.5	benzene	6.4	1
EA 6N	S05-2A-A	13.5 to 13.5	carbon tetrachloride	320	0.5
EA 6N	S05-2A-A	13.5 to 13.5	cis-1,2-dichloroethene	4,600	6
EA 6N	S05-2A-A	13.5 to 13.5	tetrachloroethene	40	5
EA 6N	S05-2A-A	13.5 to 13.5	trans-1,2-dichloroethene	150	10
EA 6N	S05-2A-A	13.5 to 13.5	trichloroethene	1,700	5
EA 6N	S05-2A-A	13.5 to 13.5	vinyl chloride	2,600	0.5
EA 6N	S05-2A-A	7.5 to 7.5	cis-1,2-dichloroethene	69	6
EA 6N	S05-2A-A	7.5 to 7.5	trichloroethene	95	5
EA 6N	S05-2B-B	10 to 10	cis-1,2-dichloroethene	6.1	6
EA 6N	S05-2B-B	10 to 10	trichloroethene	14	5
EA 6N	S05-2B-B	14 to 14	1,1-dichloroethane	130	5
EA 6N	S05-2B-B	14 to 14	1,2-dichloroethane	9.4	0.5
EA 6N	S05-2B-B	14 to 14	benzene	22	1
EA 6N	S05-2B-B	14 to 14	trans-1,2-dichloroethene	110	10
EA 6N	S05-3A-A	10 to 10	1,1-dichloroethane	250	5
EA 6N	S05-3A-A	10 to 10	1,1-dichloroethene	42	6
EA 6N	S05-3A-A	10 to 10	carbon tetrachloride	1.3	0.5

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 6N	S05-3A-A	10 to 10	cis-1,2-dichloroethene	19	6
EA 6N	S05-3A-A	10 to 10	trichloroethene	79	5
EA 6N	S05-3A-A	10 to 10	vinyl chloride	91	0.5
EA 6N	S05-3A-A	13.5 to 13.5	1,1-dichloroethane	350	5
EA 6N	S05-3A-A	13.5 to 13.5	1,1-dichloroethene	19	6
EA 6N	S05-3A-A	13.5 to 13.5	1,2-dichloroethane	1.8	0.5
EA 6N	S05-3A-A	13.5 to 13.5	benzene	1.5	1
EA 6N	S05-3A-A	13.5 to 13.5	carbon tetrachloride	0.53	0.5
EA 6N	S05-3A-A	13.5 to 13.5	cis-1,2-dichloroethene	15	6
EA 6N	S05-3A-A	13.5 to 13.5	trichloroethene	41	5
EA 6N	S05-3A-A	13.5 to 13.5	vinyl chloride	14	0.5
EA 6N	S05-3A-A	8 to 8	1,1-dichloroethane	56	5
EA 6N	S05-3A-A	8 to 8	vinyl chloride	6	0.5
EA 6N	S05-3A-B	12 to 12	1,1-dichloroethane	100	5
EA 6N	S05-3A-B	12 to 12	1,1-dichloroethene	28	6
EA 6N	S05-3A-B	12 to 12	cis-1,2-dichloroethene	11	6
EA 6N	S05-3A-B	12 to 12	trichloroethene	20	5
EA 6N	S05-3A-B	12 to 12	vinyl chloride	8.9	0.5
EA 6N	S05-3A-B	14 to 14	1,1-dichloroethane	15,000	5
EA 6N	S05-3A-B	14 to 14	1,1-dichloroethene	96	6
EA 6N	S05-3A-B	14 to 14	1,2-dichloroethane	7	0.5
EA 6N	S05-3A-B	14 to 14	benzene	14	1
EA 6N	S05-3A-B	14 to 14	carbon tetrachloride	3.5	0.5
EA 6N	S05-3A-B	14 to 14	cis-1,2-dichloroethene	34	6
EA 6N	S05-3A-B	14 to 14	tetrachloroethene	6.5	5
EA 6N	S05-3A-B	14 to 14	trans-1,2-dichloroethene	71	10
EA 6N	S05-3A-B	14 to 14	trichloroethene	53	5
EA 6N	S05-3A-B	14 to 14	vinyl chloride	2,000	0.5
EA 6N	S05-3A-B	8 to 8	1,1-dichloroethane	7.2	5
EA 6N	S05-3A-B	8 to 8	cis-1,2-dichloroethene	13	6
EA 6N	S05-3A-B	8 to 8	vinyl chloride	0.66	0.5
EA 6N	S05-3B-A	12 to 12	1,1-dichloroethane	58	5
EA 6N	S05-3B-A	12 to 12	1,1-dichloroethene	17	6
EA 6N	S05-3B-A	12 to 12	cis-1,2-dichloroethene	41	6
EA 6N	S05-3B-A	12 to 12	trichloroethene	12	5
EA 6N	S05-3B-A	12 to 12	vinyl chloride	12	0.5
EA 6N	S05-3B-A	14 to 14	1,1-dichloroethane	18	5
EA 6N	S05-3B-A	14 to 14	1,2-dichloroethane	2	0.5
EA 6N	S05-3B-A	14 to 14	benzene	2.2	1

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 6N	S05-3B-A	14 to 14	vinyl chloride	1.2	0.5
EA 6N	S05-3B-A	7 to 7	1,1-dichloroethane	10	5
EA 6N	S05-3B-A	7 to 7	cis-1,2-dichloroethene	7	6
EA 6N	S05-3B-A	7 to 7	vinyl chloride	6.9	0.5
EA 6N	S05-3B-A	9 to 9	1,1-dichloroethane	12	5
EA 6N	S05-3B-A	9 to 9	cis-1,2-dichloroethene	21	6
EA 6N	S05-3B-A	9 to 9	trichloroethene	34	5
EA 6N	S05-3B-A	9 to 9	vinyl chloride	39	0.5
EA 6N	S05-3B-B	14 to 14	1,2-dichloroethane	0.59	0.5
EA 6N	S05-3B-B	14 to 14	benzene	2.4	1
EA 6N	S05-3B-B	14 to 14	vinyl chloride	0.71	0.5
EA 6N	S05-3B-B	8 to 8	1,1-dichloroethane	8.8	5
EA 6N	S05-3B-B	9.5 to 9.5	1,1-dichloroethane	5.1	5
EA 6N	S05-3B-B	9.5 to 9.5	vinyl chloride	2.2	0.5
EA 6N	S05-5-2	11.5 to 13.5	1,1-dichloroethane	34	5
EA 6N	S05-5-2	11.5 to 13.5	1,2-dichloroethane	2.7	0.5
EA 6N	S05-5-2	11.5 to 13.5	benzene	1.6	1
EA 6N	S05-5-2	11.5 to 13.5	vinyl chloride	3.6	0.5
EA 6N	S05-5-2	13.5 to 15.5	1,1-dichloroethane	15	5
EA 6N	S05-5-2	13.5 to 15.5	cis-1,2-dichloroethene	9.8	6
EA 6N	S05-5-2	13.5 to 15.5	trichloroethene	18	5
EA 6N	S05-5-2	13.5 to 15.5	vinyl chloride	1	0.5
EA 6N	S05-6-2	11.5 to 13.5	1,1-dichloroethane	170	5
EA 6N	S05-6-2	11.5 to 13.5	cis-1,2-dichloroethene	15	6
EA 6N	S05-6-2	11.5 to 13.5	trichloroethene	7	5
EA 6N	S05-6-2	11.5 to 13.5	vinyl chloride	18	0.5
EA 6N	S05-6-2	15.5 to 20	1,1-dichloroethane	820	5
EA 6N	S05-6-2	15.5 to 20	1,2-dichloroethane	0.8	0.5
EA 6N	S05-6-2	15.5 to 20	benzene	30	1
EA 6N	S05-6-2	15.5 to 20	vinyl chloride	4	0.5
EA 6N	S05-DGS-DP01	10 to 10	1,1,1-trichloroethane	760	200
EA 6N	S05-DGS-DP01	10 to 10	1,1-dichloroethane	3,900	5
EA 6N	S05-DGS-DP01	10 to 10	1,1-dichloroethene	310	6
EA 6N	S05-DGS-DP01	10 to 10	1,2-dichloroethene (total)	930	6
EA 6N	S05-DGS-DP01	10 to 10	benzene	2	1
EA 6N	S05-DGS-DP01	10 to 10	tetrachloroethene	24	5
EA 6N	S05-DGS-DP01	10 to 10	trichloroethene	1,700	5
EA 6N	S05-DGS-DP01	10 to 10	vinyl chloride	540	0.5

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
Lower FWBZ					
EA 6N	5-1-ADD12	20 to 24	1,1,1-trichloroethane	15,000	200
EA 6N	5-1-ADD12	20 to 24	cis-1,2-dichloroethene	46,000	6
EA 6N	5-1-ADD12	20 to 24	trichloroethene	180,000	5
EA 6N	5-1-ADD12	20 to 24	vinyl chloride	11,000	0.5
EA 6N	5-1-ADD12	26 to 29	1,1,1-trichloroethane	11,000	200
EA 6N	5-1-ADD12	26 to 29	1,1-dichloroethane	2,700	5
EA 6N	5-1-ADD12	26 to 29	1,1-dichloroethene	420	6
EA 6N	5-1-ADD12	26 to 29	cis-1,2-dichloroethene	17,000	6
EA 6N	5-1-ADD12	26 to 29	trans-1,2-dichloroethene	350	10
EA 6N	5-1-ADD12	26 to 29	trichloroethene	33,000	5
EA 6N	5-1-ADD12	26 to 29	vinyl chloride	1,100	0.5
EA 6N	5-1-ADD15	17 to 21	1,1-dichloroethane	190	5
EA 6N	5-1-ADD15	17 to 21	cis-1,2-dichloroethene	10	6
EA 6N	5-1-ADD15	17 to 21	trichloroethene	11	5
EA 6N	5-1-ADD15	22 to 25	1,1-dichloroethane	400	5
EA 6N	5-1-ADD15	22 to 25	cis-1,2-dichloroethene	180	6
EA 6N	5-1-ADD15	22 to 25	trichloroethene	240	5
EA 6N	5-1-ADD15	22 to 25	vinyl chloride	130	0.5
EA 6N	5-1-ADD20	26 to 30	1,1,1-trichloroethane	11,000	200
EA 6N	5-1-ADD20	26 to 30	1,1-dichloroethane	7,500	5
EA 6N	5-1-ADD20	26 to 30	1,1-dichloroethene	1,700	6
EA 6N	5-1-ADD20	26 to 30	cis-1,2-dichloroethene	2,200	6
EA 6N	5-1-ADD20	26 to 30	trans-1,2-dichloroethene	280	10
EA 6N	5-1-ADD20	26 to 30	trichloroethene	3,200	5
EA 6N	5-1-ADD20	26 to 30	vinyl chloride	290	0.5
EA 6N	5-1-ADD24	17 to 21	1,1-dichloroethane	19	5
EA 6N	5-1-ADD24	26 to 30	trichloroethene	470	5
EA 6N	5-1-ADD27	17 to 21	1,1,1-trichloroethane	1,800	200
EA 6N	5-1-ADD27	17 to 21	1,1-dichloroethane	4,200	5
EA 6N	5-1-ADD27	17 to 21	1,1-dichloroethene	100	6
EA 6N	5-1-ADD27	17 to 21	trichloroethene	170	5
EA 6N	5-1-ADD27	22 to 25	1,1,1-trichloroethane	530	200
EA 6N	5-1-ADD27	26 to 30	1,1,1-trichloroethane	5,000	200
EA 6N	5-1-ADD27	26 to 30	1,1-dichloroethane	2,000	5
EA 6N	5-1-ADD27	26 to 30	1,1-dichloroethene	370	6
EA 6N	5-1-ADD27	26 to 30	trichloroethene	380	5
EA 6N	5-1-ADD3	17 to 20	1,1-dichloroethane	8.3	5
EA 6N	5-1-ADD3	17 to 20	trichloroethene	10	5
EA 6N	5-1-ADD3	17 to 20	vinyl chloride	6.1	0.5

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 6N	5-1-ADD3	22 to 25	vinyl chloride	5.9	0.5
EA 6N	5-1-ADD31	18 to 21	1,1,1-trichloroethane	490	200
EA 6N	5-1-ADD31	18 to 21	1,1-dichloroethane	220	5
EA 6N	5-1-ADD31	26 to 30	1,1,1-trichloroethane	1,300	200
EA 6N	5-1-ADD36	17 to 20	1,1-dichloroethane	1,200	5
EA 6N	5-1-ADD5	17 to 21	1,1-dichloroethane	350	5
EA 6N	5-1-ADD5	22 to 25	1,1-dichloroethane	560	5
EA 6N	5-1-ADD6	17 to 20	1,1-dichloroethane	150	5
EA 6N	5-1-ADD6	17 to 20	vinyl chloride	31	0.5
EA 6N	5-1-ADD6	21 to 25	trichloroethene	91	5
EA 6N	5-1-ADD8	19 to 23	1,1,1-trichloroethane	1,000	200
EA 6N	5-1-ADD8	19 to 23	1,1-dichloroethane	270	5
EA 6N	5-1-ADD8	19 to 23	trichloroethene	560	5
EA 6N	5-1-ADD8	25 to 29	1,1,1-trichloroethane	1,400	200
EA 6N	5-1-ADD9	21 to 24	1,1,1-trichloroethane	120,000	200
EA 6N	5-1-ADD9	21 to 24	1,1-dichloroethane	7,400	5
EA 6N	5-1-ADD9	21 to 24	trichloroethene	40,000	5
EA 6N	5-1-ADD9	26 to 29	1,1,1-trichloroethane	1,600	200
EA 6N	5-1-ADD9	26 to 29	1,1-dichloroethene	270	6
EA 6N	5-1-ADD9	26 to 29	trichloroethene	670	5
BSU or SWBZ					
EA 6N	5-1-ADD12	31 to 34	1,1,1-trichloroethane	5,000	200
EA 6N	5-1-ADD12	31 to 34	1,1-dichloroethane	1,700	5
EA 6N	5-1-ADD12	31 to 34	cis-1,2-dichloroethene	24,000	6
EA 6N	5-1-ADD12	31 to 34	trichloroethene	11,000	5
EA 6N	5-1-ADD12	31 to 34	vinyl chloride	800	0.5
EA 6N	5-1-ADD12	36 to 39	trichloroethene	580,000	5
EA 6N	5-1-ADD12	45 to 48	1,1,1-trichloroethane	16,000	200
EA 6N	5-1-ADD12	45 to 48	1,1-dichloroethane	14,000	5
EA 6N	5-1-ADD12	45 to 48	1,1-dichloroethene	3,200	6
EA 6N	5-1-ADD12	45 to 48	cis-1,2-dichloroethene	85,000	6
EA 6N	5-1-ADD12	45 to 48	trans-1,2-dichloroethene	2,600	10
EA 6N	5-1-ADD12	45 to 48	trichloroethene	130,000	5
EA 6N	5-1-ADD12	45 to 48	vinyl chloride	7,000	0.5
EA 6N	5-1-ADD12	50 to 54	1,1,1-trichloroethane	1,000	200
EA 6N	5-1-ADD12	50 to 54	1,1-dichloroethane	490	5
EA 6N	5-1-ADD12	50 to 54	cis-1,2-dichloroethene	6,800	6
EA 6N	5-1-ADD12	50 to 54	trichloroethene	17,000	5
EA 6N	5-1-ADD12	50 to 54	vinyl chloride	470	0.5

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 6N	5-1-ADD12	56 to 60	1,1,1-trichloroethane	4,600	200
EA 6N	5-1-ADD12	56 to 60	1,1-dichloroethene	680	6
EA 6N	5-1-ADD12	56 to 60	cis-1,2-dichloroethene	2,900	6
EA 6N	5-1-ADD12	56 to 60	trichloroethene	10,000	5
EA 6N	5-1-ADD12	56 to 60	vinyl chloride	340	0.5
EA 6N	5-1-ADD15	32 to 36	trichloroethene	350	5
EA 6N	5-1-ADD19	32 to 36	cis-1,2-dichloroethene	520	6
EA 6N	5-1-ADD20	33 to 36	1,1,1-trichloroethane	2,000	200
EA 6N	5-1-ADD20	33 to 36	1,1-dichloroethane	300	5
EA 6N	5-1-ADD20	33 to 36	1,1-dichloroethene	210	6
EA 6N	5-1-ADD20	33 to 36	trichloroethene	240	5
EA 6N	5-1-ADD20	38 to 41	1,1,1-trichloroethane	830	200
EA 6N	5-1-ADD27	32 to 36	1,1,1-trichloroethane	460	200
EA 6N	5-1-ADD27	45 to 49	1,1,1-trichloroethane	13,000	200
EA 6N	5-1-ADD27	45 to 49	1,1-dichloroethane	730	5
EA 6N	5-1-ADD27	45 to 49	1,1-dichloroethene	380	6
EA 6N	5-1-ADD27	45 to 49	trichloroethene	790	5
EA 6N	5-1-ADD31	33 to 36	1,1,1-trichloroethane	340	200
EA 6N	5-1-ADD5	41 to 45	1,1-dichloroethane	230	5
EA 6N	5-1-ADD8	46 to 50	1,1,1-trichloroethane	1,700	200
EA 6N	5-1-ADD8	46 to 50	1,1-dichloroethane	690	5
EA 6N	5-1-ADD8	46 to 50	cis-1,2-dichloroethene	4,200	6
EA 6N	5-1-ADD8	46 to 50	trichloroethene	14,000	5
EA 6N	5-1-ADD8	46 to 50	vinyl chloride	510	0.5
EA 6N	5-1-ADD9	30 to 34	1,1,1-trichloroethane	940	200
EA 6N	5-1-ADD9	30 to 34	trichloroethene	220	5
EA 6N	5-1-ADD9	36 to 40	1,1,1-trichloroethane	30,000	200
EA 6N	5-1-ADD9	36 to 40	1,1-dichloroethane	110,000	5
EA 6N	5-1-ADD9	36 to 40	1,1-dichloroethene	370	6
EA 6N	5-1-ADD9	36 to 40	cis-1,2-dichloroethene	2,000	6
EA 6N	5-1-ADD9	36 to 40	tetrachloroethene	230	5
EA 6N	5-1-ADD9	36 to 40	trichloroethene	12,000	5
Upper FWBZ					
EA 6S	5-2-ADD10	10 to 14	1,1-dichloroethane	930	5
EA 6S	5-2-ADD10	21 to 24	1,1-dichloroethane	280	5
EA 6S	5-2-ADD13	11 to 14	1,1-dichloroethane	1,100	5
EA 6S	5-2-ADD2	6 to 9	1,1-dichloroethane	720	5
EA 6S	5-2-ADD2	6 to 9	1,1-dichloroethene	400	6
EA 6S	5-2-ADD2	10 to 14	1,1-dichloroethane	2,800	5

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 6S	5-2-ADD2	10 to 14	1,1-dichloroethene	270	6
EA 6S	5-2-ADD6	10 to 13	1,1-dichloroethane	1,200	5
EA 6S	5-2-ADD8	11 to 14	1,1-dichloroethane	2,900	5
EA 6S	5-4-ADD10	6 to 9	1,1-dichloroethane	370	5
EA 6S	5-4-ADD10	6 to 9	1,1-dichloroethene	270	6
EA 6S	5-4-ADD10	11 to 14	1,1-dichloroethane	450	5
EA 6S	5-4-ADD10	11 to 14	1,1-dichloroethene	180	6
EA 6S	5-4-ADD11	6 to 9	1,1-dichloroethane	470	5
EA 6S	5-4-ADD11	6 to 9	1,1-dichloroethene	390	6
EA 6S	5-4-ADD11	11 to 14	1,1-dichloroethane	1,700	5
EA 6S	5-4-ADD11	11 to 14	1,1-dichloroethene	250	6
EA 6S	5-4-ADD12	6 to 9	1,1-dichloroethane	1,400	5
EA 6S	5-4-ADD12	6 to 9	1,1-dichloroethene	240	6
EA 6S	5-4-ADD12	6 to 9	cis-1,2-dichloroethene	46	6
EA 6S	5-4-ADD2	6 to 9	1,1-dichloroethene	430	6
EA 6S	5-4-ADD20	6 to 9	1,1-dichloroethane	44	5
EA 6S	5-4-ADD20	6 to 9	1,1-dichloroethene	170	6
EA 6S	5-4-ADD20	6 to 9	trichloroethene	77	5
EA 6S	5-4-ADD20	11 to 14	1,1-dichloroethane	54	5
EA 6S	5-4-ADD20	11 to 14	1,1-dichloroethene	220	6
EA 6S	5-4-ADD20	11 to 14	cis-1,2-dichloroethene	190	6
EA 6S	5-4-ADD20	11 to 14	trans-1,2-dichloroethene	26	10
EA 6S	5-4-ADD20	11 to 14	trichloroethene	89	5
EA 6S	5-4-ADD21	6 to 9	1,1-dichloroethane	2,300	5
EA 6S	5-4-ADD21	6 to 9	1,1-dichloroethene	2,300	6
EA 6S	5-4-ADD21	11 to 14	1,1-dichloroethane	1,400	5
EA 6S	5-4-ADD21	11 to 14	1,1-dichloroethene	1,200	6
EA 6S	5-4-ADD21	11 to 14	vinyl chloride	350	0.5
EA 6S	5-4-ADD3	6 to 9	1,1-dichloroethene	570	6
EA 6S	5-4-ADD4	6 to 9	1,1-dichloroethane	260	5
EA 6S	5-4-ADD4	6 to 9	1,1-dichloroethene	480	6
EA 6S	5-4-ADD5	6 to 9	1,1-dichloroethane	410	5
EA 6S	5-4-ADD5	6 to 9	1,1-dichloroethene	1,500	6
EA 6S	5-4-ADD6	6 to 9	1,1-dichloroethene	550	6
EA 6S	5-4-ADD7	6 to 9	1,1,1-trichloroethane	330	200
EA 6S	5-4-ADD7	6 to 9	1,1-dichloroethane	470	5
EA 6S	5-4-ADD7	6 to 9	1,1-dichloroethene	1,300	6
EA 6S	5-4-ADD8	6 to 9	1,1-dichloroethane	340	5
EA 6S	5-4-ADD8	6 to 9	1,1-dichloroethene	450	6

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 6S	5-4-ADD8	11 to 14	1,1-dichloroethane	140	5
EA 6S	5-4-ADD8	11 to 14	1,1-dichloroethene	150	6
EA 6S	5-4-ADD9	6 to 9	1,1-dichloroethane	240	5
EA 6S	5-4-ADD9	6 to 9	1,1-dichloroethene	360	6
EA 6S	5-4-ADD9	11 to 14	1,1-dichloroethane	280	5
EA 6S	5-4-ADD9	11 to 14	1,1-dichloroethene	370	6
EA 6S	CA05-03	NA	1,1-dichloroethane	240	5
EA 6S	CA05-03	NA	1,1-dichloroethene	780	6
EA 6S	CA05-03	NA	1,2-dichloroethane	23	0.5
EA 6S	CA05-03	NA	cis-1,2-dichloroethene	22	6
EA 6S	CA05-03	NA	trichloroethene	79	5
EA 6S	CA05-03	NA	vinyl chloride	10	0.5
EA 6S	S05-3B-C	10 to 10	1,1-dichloroethane	170	5
EA 6S	S05-3B-C	10 to 10	1,1-dichloroethene	34	6
EA 6S	S05-3B-C	10 to 10	1,2-dichloroethane	0.6	0.5
EA 6S	S05-3B-C	10 to 10	carbon tetrachloride	22	0.5
EA 6S	S05-3B-C	10 to 10	cis-1,2-dichloroethene	180	6
EA 6S	S05-3B-C	10 to 10	tetrachloroethene	23	5
EA 6S	S05-3B-C	10 to 10	trichloroethene	320	5
EA 6S	S05-3B-C	10 to 10	vinyl chloride	0.85	0.5
EA 6S	S05-3B-C	12 to 12	1,1-dichloroethane	51	5
EA 6S	S05-3B-C	12 to 12	1,1-dichloroethene	21.9	6
EA 6S	S05-3B-C	12 to 12	1,2-dichloroethane	1.9	0.5
EA 6S	S05-3B-C	12 to 12	carbon tetrachloride	12	0.5
EA 6S	S05-3B-C	12 to 12	cis-1,2-dichloroethene	120	6
EA 6S	S05-3B-C	12 to 12	trans-1,2-dichloroethene	13	10
EA 6S	S05-3B-C	12 to 12	trichloroethene	50	5
EA 6S	S05-3B-C	12 to 12	vinyl chloride	12	0.5
EA 6S	S05-3B-D	10 to 10	1,1-dichloroethane	170	5
EA 6S	S05-3B-D	10 to 10	1,1-dichloroethene	113	6
EA 6S	S05-3B-D	10 to 10	1,2-dichloroethane	1.9	0.5
EA 6S	S05-3B-D	10 to 10	carbon tetrachloride	4.5	0.5
EA 6S	S05-3B-D	10 to 10	cis-1,2-dichloroethene	52	6
EA 6S	S05-3B-D	10 to 10	trans-1,2-dichloroethene	24	10
EA 6S	S05-3B-D	10 to 10	trichloroethene	130	5
EA 6S	S05-3B-D	10 to 10	vinyl chloride	46	0.5
EA 6S	S05-3B-D	13 to 13	1,1-dichloroethane	26	5
EA 6S	S05-3B-D	13 to 13	vinyl chloride	0.6	0.5
EA 6S	S05-4-1	7.5 to 9.5	1,1-dichloroethane	6.6	5

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 6S	S05-4-1	7.5 to 9.5	trichloroethene	10	5
EA 6S	S05-4-1	5.5 to 7.5	1,1-dichloroethane	11	5
EA 6S	S05-4-1	5.5 to 7.5	trichloroethene	7.4	5
EA 6S	S05-4-1	9.5 to 11.5	1,1-dichloroethane	13	5
EA 6S	S05-4B-C	10 to 10	1,1,1-trichloroethane	100,000	200
EA 6S	S05-4B-C	10 to 10	1,1-dichloroethane	8,200	5
EA 6S	S05-4B-C	10 to 10	1,1-dichloroethene	65,000	6
EA 6S	S05-4B-C	10 to 10	1,2-dichloroethane	570	0.5
EA 6S	S05-4B-C	10 to 10	carbon tetrachloride	4,600	0.5
EA 6S	S05-4B-C	10 to 10	cis-1,2-dichloroethene	48	6
EA 6S	S05-4B-C	10 to 10	tetrachloroethene	8.6	5
EA 6S	S05-4B-C	10 to 10	trichloroethene	160	5
EA 6S	S05-4B-C	10 to 10	vinyl chloride	270	0.5
EA 6S	S05-4B-C	12 to 12	1,1,1-trichloroethane	20,000	200
EA 6S	S05-4B-C	12 to 12	1,1-dichloroethane	24,000	5
EA 6S	S05-4B-C	12 to 12	1,1-dichloroethene	22,000	6
EA 6S	S05-4B-C	12 to 12	1,2-dichloroethane	550	0.5
EA 6S	S05-4B-C	12 to 12	carbon tetrachloride	2,500	0.5
EA 6S	S05-4B-C	12 to 12	cis-1,2-dichloroethene	250	6
EA 6S	S05-4B-C	12 to 12	toluene	370	150
EA 6S	S05-4B-C	12 to 12	trichloroethene	120	5
EA 6S	S05-4B-C	12 to 12	vinyl chloride	2,900	0.5
EA 6S	S05-4B-C	7 to 7	1,1,1-trichloroethane	370	200
EA 6S	S05-4B-C	7 to 7	1,1-dichloroethane	200	5
EA 6S	S05-4B-C	7 to 7	1,1-dichloroethene	170	6
EA 6S	S05-4B-C	7 to 7	1,2-dichloroethane	50	0.5
EA 6S	S05-4B-C	7 to 7	carbon tetrachloride	100	0.5
EA 6S	S05-4B-C	7 to 7	cis-1,2-dichloroethene	9.1	6
EA 6S	S05-4B-C	7 to 7	trichloroethene	68	5
EA 6S	S05-4B-C	7 to 7	vinyl chloride	1.3	0.5
EA 6S	S05-4B-D	10 to 10	1,1-dichloroethane	16	5
EA 6S	S05-4B-D	10 to 10	1,1-dichloroethene	27	6
EA 6S	S05-4B-D	10 to 10	cis-1,2-dichloroethene	50	6
EA 6S	S05-4B-D	10 to 10	trichloroethene	37	5
EA 6S	S05-4B-D	10 to 10	vinyl chloride	14	0.5
EA 6S	S05-4B-D	12 to 12	1,1-dichloroethane	37	5
EA 6S	S05-4B-D	12 to 12	1,1-dichloroethene	30	6
EA 6S	S05-4B-D	12 to 12	benzene	2.9	1
EA 6S	S05-4B-D	12 to 12	cis-1,2-dichloroethene	210	6

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
EA 6S	S05-4B-D	12 to 12	trans-1,2-dichloroethene	61	10
EA 6S	S05-4B-D	12 to 12	trichloroethene	13	5
EA 6S	S05-4B-D	12 to 12	vinyl chloride	47	0.5
EA 6S	S05-DGS-DP07	9 to 9	1,1-dichloroethane	290	5
EA 6S	S05-DGS-DP07	9 to 9	1,1-dichloroethene	670	6
EA 6S	S05-DGS-DP07	9 to 9	1,2-dichloroethane	13	0.5
EA 6S	S05-DGS-DP07	9 to 9	1,2-dichloroethene (total)	12	6
EA 6S	S05-DGS-DP07	9 to 9	benzene	7	1
EA 6S	S05-DGS-DP07	9 to 9	trichloroethene	13	5
EA 6S	S05-DGS-DP07	9 to 9	vinyl chloride	40	0.5
EA 6S	S05-DGS-DP08	9 to 9	1,1-dichloroethane	120	5
EA 6S	S05-DGS-DP08	9 to 9	1,1-dichloroethene	210	6
EA 6S	S05-DGS-DP08	9 to 9	1,2-dichloroethane	2	0.5
EA 6S	S05-DGS-DP08	9 to 9	1,2-dichloroethene (total)	24	6
EA 6S	S05-DGS-DP08	9 to 9	trichloroethene	34	5
EA 6S	S05-DGS-DP08	9 to 9	vinyl chloride	22	0.5
EA 6S	S05-DGS-DP10	9 to 9	1,1-dichloroethane	14	5
EA 6S	S05-DGS-DP10	9 to 9	1,1-dichloroethene	13	6
EA 6S	S05-DGS-DP10	9 to 9	trichloroethene	15	5
Lower FWBZ					
EA 6S	5-2-ADD13	21 to 24	1,1-dichloroethane	620	5
EA 6S	5-2-ADD5	21 to 24	1,1-dichloroethane	1,600	5
EA 6S	5-2-ADD8	21 to 24	1,1-dichloroethane	880	5
Upper FWBZ					
EPER	S05-1B/2B-A	11 to 11	1,1-dichloroethane	54	5
EPER	S05-1B/2B-A	11 to 11	vinyl chloride	11	0.5
EPER	S05-1B/2B-A	8 to 8	vinyl chloride	0.64	0.5
Upper FWBZ					
NPER	B05-12	0 to 0	1,1-dichloroethane	400	5
NPER	B05-12	0 to 0	1,1-dichloroethene	120	6
NPER	B05-12	0 to 0	1,2-dichloroethane	2	0.5
NPER	B05-12	0 to 0	1,2-dichloroethene (total)	420	6
NPER	B05-12	0 to 0	tetrachloroethene	14	5
NPER	B05-12	0 to 0	trichloroethene	460	5
NPER	B05-12	0 to 0	vinyl chloride	130	0.5
NPER	B05-12	NA	1,1-dichloroethane	270	5
NPER	B05-12	NA	1,1-dichloroethene	86	6
NPER	B05-12	NA	1,2-dichloroethane	3	0.5
NPER	B05-12	NA	1,2-dichloroethene (total)	230	6

Table A1-5 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
NPER	B05-12	to	tetrachloroethene	7	5
NPER	B05-12	to	trichloroethene	230	5
NPER	B05-12	to	vinyl chloride	59	0.5
NPER	S05-7-2	13.5 to 15.5	vinyl chloride	3	0.5
NPER	S05-7-3	13.5 to 15.5	benzene	1.4	1
NPER	S05-7-3	13.5 to 15.5	vinyl chloride	0.7	0.5
NPER	S05-DGS-DP41	8 to 10	cis-1,2-dichloroethene	60	6
NPER	S05-DGS-DP41	8 to 10	vinyl chloride	800	0.5
NPER	S05-DGS-DP41	12 to 14	trans-1,2-dichloroethene	18	10
NPER	S05-DGS-DP41	12 to 14	vinyl chloride	65	0.5
NPER	S05-DGS-DP43	9 to 9	cis-1,2-dichloroethene	70	6
NPER	S05-DGS-DP43	9 to 9	trichloroethene	20	5
NPER	S05-DGS-DP43	9 to 9	vinyl chloride	410	0.5
NPER	S05-DGS-DP43	12 to 12	benzene	3.1	1
NPER	S05-DGS-DP43	12 to 12	trans-1,2-dichloroethene	14	10
NPER	S05-DGS-DP43	12 to 12	vinyl chloride	14	0.5
NPER	S05-DGS-DP44	9 to 9	vinyl chloride	30	0.5
NPER	S05-DGS-DP44	12 to 12	benzene	2.7	1
NPER	S05-DGS-DP44	12 to 12	vinyl chloride	0.8	0.5
NPER	S05-DGS-DP45	8 to 10	cis-1,2-dichloroethene	23	6
NPER	S05-DGS-DP45	8 to 10	vinyl chloride	970	0.5
NPER	S05-DGS-DP45	12 to 14	benzene	2.8	1
NPER	S05-DGS-DP45	12 to 14	trans-1,2-dichloroethene	17	10
NPER	S05-DGS-DP45	12 to 14	vinyl chloride	80	0.5
NPER	S05-DGS-DP47	12 to 14	benzene	2	1
NPER	S05-DGS-DP48	8 to 10	vinyl chloride	2	0.5
NPER	S05-DGS-DP48	12 to 14	benzene	5	1
NPER	S05-DGS-DP48	12 to 14	vinyl chloride	2	0.5
NPER	SHP-S05-11	8 to 8	vinyl chloride	52	0.5
SWBZ					
NPER	HP-S05-03	58 to 58	vinyl chloride	1	0.5
Upper FWBZ					
IR Site 10	052-004-021	8.5 to 8.5	trichloroethene	9	5

Table A1-5 (continued)

Note:
* the lower of either federal or California MCL

Acronyms/Abbreviations:
bgs – below ground surface
BSU – Bay Sediment Unit
EA – evaluation area
EPER – eastern perimeter of Evaluation Area 1
FWBZ – first water-bearing zone
µg/L – micrograms per liter
MCL – maximum contaminant level
NA – not available
NPER – northern perimeter of Evaluation Area 1
SWBZ – second water-bearing zone
VOC – volatile organic compound

Table A1-6
Monitoring Well Groundwater Data: Maximum Concentrations of Petroleum Hydrocarbons[a]
(reported in micrograms per liter)

YEAR/ TPH Range	AREA SOUTHEAST OF BUILDING 5	PLUME 5-1 AREA EAST OF BUILDING 5		BUILDING 5 PLATING SHOP AREA	SOUTH OF BUILDING 5	EASTERN PERIMETER OF EA 1	NORTHERN PERIMETER OF EA 1		WESTERN PERIMETER OF EA 1		SOUTHERN IR SITE 10	EASTERN IR SITE 12	BUILDING 282
1994	FWBZ Well M05-04	FWBZ Well M05-07	SWBZ Well D05-02	FWBZ Well M05-10	FWBZ Wells M05-03, M05HW-01, M10-01	FWBZ Wells M05-08, M12-01 and M12-03	FWBZ Wells M05-01, M05-05, M05-09 and M05BS-01	SWBZ Well D05-01	FWBZ Wells M05-02 and M05-06	SWBZ Well D05-03	FWBZ Well M10-02	FWBZ Wells M12-02 and M12-04	No Wells Installed
motor oil	NA	NA	ND	NA	NA	120	ND	NA	NA	NA	NA	200	NA
1995	FWBZ Well M05-04	FWBZ Well M05-07	SWBZ Well D05-02	FWBZ Well M05-10	FWBZ Wells M05-03, M05HW-01, M10-01	FWBZ Wells M05-08, M12-01 and M12-03	FWBZ Wells M05-01, M05-05, M05-09 and M05BS-01	SWBZ Well D05-01	FWBZ Wells M05-02 and M05-06	SWBZ Well D05-03	FWBZ Well M10-02	FWBZ Wells M12-02 and M12-04	FWBZ Wells 282-MW1, 282-MW2, and 282-MW3
diesel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	310
1997	FWBZ Well M05-04	FWBZ Well M05-07	SWBZ Well D05-02	FWBZ Well M05-10	FWBZ Wells 400MJ-MW1, 400MJ-MW2, and 400MJ-MW3	FWBZ Wells M05-08, M12-01 and M12-03	FWBZ Wells M05-01, M05-05, M05-09 and M05BS-01	SWBZ Well D05-01	FWBZ Wells M05-02 and M05-06	SWBZ Well D05-03	FWBZ Well M10-02	FWBZ Wells M12-02 and M12-04	FWBZ Wells 282-MW1, 282-MW2, and 282-MW3
diesel	NA	NA	NA	NA	1,600[b]	NA	NA	NA	NA	NA	NA	NA	NA
1998	FWBZ Well M05-04	FWBZ Well M05-07	SWBZ Well D05-02	FWBZ Well M05-10	FWBZ Wells 400MJ-MW1, 400MJ-MW2, and 400MJ-MW3	FWBZ Wells M05-08, M12-01 and M12-03	FWBZ Wells M05-01, M05-05, M05-09 and M05BS-01	SWBZ Well D05-01	FWBZ Wells M05-02 and M05-06	SWBZ Well D05-03	FWBZ Well M10-02	FWBZ Wells M12-02 and M12-04	FWBZ Wells 282-MW1, 282-MW2, and 282-MW3
diesel	NA	NA	NA	NA	860[b]	NA	NA	NA	NA	NA	NA	NA	NA
JP-5	NA	NA	NA	NA	340	NA	NA	NA	NA	NA	NA	NA	NA
motor oil	NA	NA	NA	NA	800[b]	NA	NA	NA	NA	NA	NA	NA	NA
1999	FWBZ Well M05-04	FWBZ Well M05-07	SWBZ Well D05-02	FWBZ Well M05-10	FWBZ Wells 400MJ-MW1, 400MJ-MW2, and 400MJ-MW3	FWBZ Wells M05-08, M12-01 and M12-03	FWBZ Wells M05-01, M05-05, M05-09 and M05BS-01	SWBZ Well D05-01	FWBZ Wells M05-02 and M05-06	SWBZ Well D05-03	FWBZ Wells M10-02 and M10-03	FWBZ Wells M12-02 and M12-04	FWBZ Wells 282-MW1, 282-MW2, and 282-MW3
diesel	NA	NA	NA	NA	389	NA	NA	NA	NA	NA	NA	NA	NA
2001	FWBZ Well M05-04	FWBZ Well M05-07	SWBZ Well D05-02	FWBZ Well M05-10	FWBZ Wells M05-03, M05HW-01, M10-01	FWBZ Wells M05-08, M12-01 and M12-03	FWBZ Wells M05-01, M05-05, M05-09 and M05BS-01	SWBZ Well D05-01	FWBZ Wells M05-02 and M05-06	SWBZ Well D05-03	FWBZ Wells M10-02 and M10-03	FWBZ Wells M12-02 and M12-04	FWBZ Wells 282-MW1, 282-MW2, and 282-MW3
diesel	220	340	ND	210	340	ND	220	ND	200	200	220	240	NA
gasoline	ND	140	ND	50	486,000,000[b,c]	ND	030	ND	120	ND	30	ND	NA
motor oil	ND	ND	100	ND	ND	410	ND	100	ND	ND	ND	260	NA

Table A1-6 (continued)

YEAR ANALYTE (µg/L)	AREA SOUTHEAST OF BUILDING 5	PLUME 5-1 AREA EAST OF BUILDING 5		BUILDING 5 PLATING SHOP AREA	SOUTH OF BUILDING 5	EASTERN PERIMETER OF EA 1	NORTHERN PERIMETER OF EA 1		WESTERN PERIMETER OF EA 1		SOUTHERN IR SITE 10	EASTERN IR SITE 12	BUILDING 282
2002	FWBZ Well M05-04	FWBZ Wells 1MW6S, 1MW7S, P-5-1-MWS1 through MWS5	SWBZ Well D05-02	FWBZ Well M05-10	FWBZ Wells M05-03	FWBZ Well M05-08	FWBZ Wells M05-01, M05-05, and M05-09	SWBZ Well D05-01	FWBZ Wells M05-02 and M05-06	SWBZ Well D05-03	FWBZ Wells M10-02 and M10-03	FWBZ Wells M12-02 and M12-04	FWBZ Wells 282-MW1, 282-MW2, and 282-MW3
diesel	NA	NA	NA	NA	NA	ND	54	ND	ND	ND	NA	ND	NA
gasoline	NA	NA	NA	NA	NA	19	ND	ND	ND	ND	NA	ND	NA
motor oil	NA	NA	NA	NA	NA	ND	55	ND	ND	ND	NA	ND	NA
2003	FWBZ Well M05-04	FWBZ Wells 1MW6S, 1MW7S, P-5-1-MWS1 through MWS5	SWBZ Well D05-02	FWBZ Well 2MW8S and M05-10	FWBZ Wells M05-03	FWBZ Well M05-08	FWBZ Wells M05-01, M05-05, and M05-09	SWBZ Well D05-01	FWBZ Wells M05-02 and M05-06	SWBZ Well D05-03	FWBZ Wells M10-02 and M10-03	FWBZ Wells M12-02 and M12-04	FWBZ Wells 282-MW1, 282-MW2, and 282-MW3
diesel	NA	NA	NA	150	NA	NA	ND	ND	ND	ND	NA	ND	NA
gasoline	NA	NA	NA	**7,500**[b]	NA	NA	20	ND	ND	ND	NA	ND	NA
motor oil	NA	NA	NA	200	NA	NA	ND	ND	ND	140	NA	ND	NA
2004	FWBZ Well M05-04	FWBZ Wells 1MW6S, 1MW7S, P-5-1-MWS1 through MWS5	SWBZ Well D05-02	FWBZ Well 2MW8S	FWBZ Wells M05-03	FWBZ Well M05-08	FWBZ Wells M05-01, M05-05, and M05-09	SWBZ Well D05-01	FWBZ Wells M05-02 and M05-06	SWBZ Well D05-03	FWBZ Wells M10-02 and M10-03	FWBZ Wells M12-02 and M12-04	FWBZ Wells 282-MW1, 282-MW2, and 282-MW3
diesel	NA	NA	NA	23	NA	NA	ND	ND	ND	ND	NA	ND	NA
gasoline	NA	NA	NA	**35,000**[b]	NA	NA	ND	ND	ND	ND	NA	ND	NA
JP-5	NA	NA	NA	230	NA	NA	ND	ND	ND	ND	NA	ND	NA

Notes:
[a] maximum concentration reported for the year for all wells within the given area
[b] concentrations exceeding ESL are shown in bold type
[c] discussion of this gasoline result and subsequent floating product investigations is presented in Section A1.5.2.5

Acronyms/Abbreviations:
bgs – below ground surface
EA – evaluation area
ESL – (Regional Water Quality Control Board) environmental screening level
FWBZ – first water-bearing zone [wells generally screened between 5 and 17 feet bgs]
µg/L – micrograms per liter
NA – not applicable; no sampling conducted or no TPH analysis
ND – not detected; concentrations below reporting limit
SWBZ – second water-bearing zone [wells screened between 67 and 70 feet bgs]
TPH – total petroleum hydrocarbons

Table A1-7
Petroleum Hydrocarbons Exceeding Comparison Criteria in Discrete Groundwater Samples

Study Area	Station ID	Depth (feet bgs)	TPH Range	Petroleum Hydrocarbon Concentration (µg/L)	ESL Screening Criteria (µg/L)*
Evaluation Areas					
EA 5	CA05-04	NA	gasoline	2,600	500
EA 5	CA05-05	NA	diesel	6,400	640
EA 5	CA05-05	NA	motor oil	3,000	640
EA 5	057-001	5 to 12	diesel	1,300	640
EA 5	057-001	5 to 12	gasoline	3,700	500
EA 5	261-3L	NA	diesel	15,000	640
EA 5	261-3L	NA	gasoline	2,500	500
EA 5	261-3L	NA	jet fuel	14,000	640
EA 5	400-1-MOJ	NA	diesel	48,000	640
EA 5	400-1-MOJ	NA	gasoline	3,300	500
EA 5	400-16-MOJ	NA	diesel	4,200	640
EA 5	400-16-MOJ	NA	gasoline	1,400	500
EA 5	400-17-MOJ	NA	diesel	1,400	640
EA 5	400-17-MOJ	NA	motor oil	2,500	640
EA 5	400-2-MOJ	NA	diesel	740	640
EA 5	400-3-MOJ	NA	diesel	2,600	640
EA 6 (northern portion)	NAS05-01-W-07	7 to 7	diesel	864,000	640
EA 6 (southern portion)	CA05-03	NA	motor oil	670	640
Data Gap Areas					
Building 282	282-5-ERM	NA	gasoline	4,234	500
Building 6	6-L	7 to 7	diesel	1,200	640
Building 6	6-L	7 to 7	jet fuel	1,200	640
Building 6	6-L	7 to 7	motor oil	720	640
Building 400	400-11-MOJ	NA	diesel	1,000	640
Other Areas					
Eastern perimeter of EA 1	S05-DGS-VE02	5 to 6.5	diesel	670	640
IR Site 12	SB10-02	NA	motor oil	3,700	640
IR Site 12	SB10-03	NA	TPH components, total	1,500	640
IR Site 12	SB10-05	NA	TPH components, total	2,000	640
IR Site 12	SB10-01	NA	TPH components, total	14,000	640

Table A1-7 (continued)

Note:
* RWQCB 2005

Acronyms/Abbreviations:
AOC – area of concern
bgs – below ground surface
EA – evaluation area
ESL – environmental screening level
IR – Installation Restoration (Program)
µg/L – micrograms per liter
NA – not available
TPH – total petroleum hydrocarbons

Table A1-8
Semivolatile Organic Compounds in Groundwater
Exceeding Comparison Criteria

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (µg/L)	MCL* (µg/L)
Monitoring Well Samples					
EA 5	M05HW-01	5 to 15	1,4-dichlorobenzene	16	5
EA 5	M05HW-01	5 to 15	1,4-dichlorobenzene	11	5
EA 5	M05HW-01	5 to 15	1,4-dichlorobenzene	9	5
EA 5	M05HW-01	5 to 15	1,4-dichlorobenzene	8	5
EA 5	M05HW-01	5 to 15	1,4-dichlorobenzene	6.4	5
EA 5	M05-03	4 to 12	1,4-dichlorobenzene	11	5
EA 5	M05-03	4 to 12	bis(2-ethylhexyl)phthalate	5,900	4
EA 5	M05-03	4 to 12	bis(2-ethylhexyl)phthalate	3,000	4
EA 5	M05-03	4 to 12	bis(2-ethylhexyl)phthalate	1,000	4
EA 5	M05HW-01	5 to 15	bis(2-ethylhexyl)phthalate	11	4
Discrete Groundwater Samples					
EA 5	B05WT-02	10.5 to 10.5	1,4-dichlorobenzene	59	5
EA 6N	030-S05-011	7 to 7.5	benzo(a)pyrene	6	0.2
EA 6N	B05-11	0 to 0	bis(2-ethylhexyl)phthalate	590	4

Note:
* the lower of either federal or California MCL

Acronyms/Abbreviations:
bgs – below ground surface
EA – evaluation area
µg/L – micrograms per liter

Table A1-9
Monitoring Well Groundwater Data: Maximum Concentrations[a] of Metals Exceeding Comparison Criteria
(reported in micrograms per liter)

YEAR/Metal	AREA SOUTHEAST OF BUILDING 5		PLUME 5-1 AREA EAST OF BUILDING 5		BUILDING 5 PLATING SHOP AREA	SOUTH OF BUILDING 5	EASTERN PERIMETER OF EA 1		NORTHERN PERIMETER OF EA 1		WESTERN PERIMETER OF EA 1	
1991	**FWBZ Well M05-04**	**No SWBZ Well Installed**	**No FWBZ Well Installed**	**No SWBZ Well Installed**	**No FWBZ Well Installed**	**FWBZ Wells M05-03 and M10-01**	**FWBZ Wells M12-01 and M12-03**	**No SWBZ Well Installed**	**FWBZ Wells M05-01 and M05-05**	**No SWBZ Well Installed**	**FWBZ Well M05-02**	**No SWBZ Well Installed**
antimony	ND	NA	NA	NA	NA	ND	**26.3**[b]	NA	ND	NA	ND	NA
arsenic	8	NA	NA	NA	NA	**27.9**[b]	5.3	NA	**16.6**[b]	NA	5.1	NA
lead	3.1	NA	NA	NA	NA	ND	2.9	NA	2.9	NA	4.2	NA
nickel	ND	NA	NA	NA	NA	**222**[b]	ND	NA	ND	NA	ND	NA
1992	**FWBZ Well M05-04**	**No SWBZ Well Installed**	**No FWBZ Well Installed**	**No SWBZ Well Installed**	**No FWBZ Well Installed**	**FWBZ Well M05HW-01**	**FWBZ Wells M12-01 and M12-03**	**No SWBZ Well Installed**	**FWBZ Well M05BS-01**	**No SWBZ Well Installed**	**FWBZ Well M05-02**	**No SWBZ Well Installed**
arsenic	ND	NA	NA	NA	NA	4.6	NA	NA	9.8	NA	NA	NA
barium	ND	NA	NA	NA	NA	81.9	NA	NA	740	NA	NA	NA
nickel	ND	NA	NA	NA	NA	39.1	NA	NA	28.5	NA	NA	NA
1994	**FWBZ Well M05-04**	**No SWBZ Well Installed**	**FWBZ Well M05-07**	**SWBZ Well D05-02**	**FWBZ Well M05-10**	**FWBZ Wells M05-03, M05HW-01, M10-01**	**FWBZ Wells M05-08, M12-01 and M12-03**	**No SWBZ Well Installed**	**FWBZ Wells M05-01, M05-05, M05-09 and M05BS-01**	**SWBZ Well D05-01**	**FWBZ Wells M05-02 and M05-06**	**SWBZ Well D05-03**
aluminum	ND	NA	ND	ND	ND	ND	694	NA			ND	ND
antimony	ND	NA	ND	ND	2.8	ND	4.4	NA	**25.4**[b]	ND	3.2	ND
arsenic	**18.1**[b]	NA	**29.8**[b]	**9.1**[b]	**16.3**[b]	**69.1**[b]	**48.4**[b]	NA	**22.4**[b]	ND	6.5	3.1
barium	125	NA	165	58.2	45	240	235	NA	659	88.2	274	69
cadmium	ND	NA	0.95	1.7	ND	1.5	ND	NA	0.74	4	ND	2.1
chromium, total	ND	NA	ND	4.9	38.1	ND	ND	NA	ND	3.7	ND	4.7
lead	1.6	NA	1.4	12.8	ND	3.2	1.3	NA	8.2	ND	ND	ND
nickel	9	NA	20.2	20.2	ND	**182**[b]	10.9	NA	78.7	15.4	6	36.4
thallium	ND	NA	ND	ND	ND	ND	**20**[b]	NA	ND	ND	**20**[b]	ND
1995	**FWBZ Well M05-04**	**No SWBZ Well Installed**	**FWBZ Well M05-07**	**SWBZ Well D05-02**	**FWBZ Well M05-10**	**FWBZ Wells M05-03, M05HW-01, M10-01**	**FWBZ Wells M05-08, M12-01 and M12-03**	**No SWBZ Well Installed**	**FWBZ Wells M05-01, M05-05, M05-09 and M05BS-01**	**SWBZ Well D05-01**	**FWBZ Wells M05-02 and M05-06**	**SWBZ Well D05-03**
aluminum	ND	NA	ND	ND	ND	ND	136	NA	ND	ND	ND	ND
antimony	ND	NA	ND	ND	ND	ND	ND	NA	2.8	ND	ND	ND
arsenic	ND	NA	**18.3**[b]	ND	**14.2**[b]	**47.1**[b]	**44**[b]	NA	9.2	ND	5.7	ND
barium	54.4	NA	139	49.7	21.8	244	120	NA	1380	81.1	309	49.9
cadmium	ND	NA	ND	ND	ND	ND	ND	NA	ND	4.3	0.6	**31.2**[b]
chromium, total	ND	NA	ND	ND	**53.3**[b]	ND	ND	NA	3.1	ND	ND	ND
lead	ND	NA	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND
nickel	ND	NA	32	14.1	2.6	68.8	7.1	NA	71.4	11	4.8	28.7

Table A1-9 (continued)

YEAR/Metal	AREA SOUTHEAST OF BUILDING 5		PLUME 5-1 AREA EAST OF BUILDING 5		BUILDING 5 PLATING SHOP AREA	SOUTH OF BUILDING 5	EASTERN PERIMETER OF EA 1		NORTHERN PERIMETER OF EA 1		WESTERN PERIMETER OF EA 1	
1997	**FWBZ Well M05-04**	**No SWBZ Well Installed**	**FWBZ Well M05-07**	**SWBZ Well D05-02**	**FWBZ Well M05-10**	**FWBZ Wells M05-03, M05HW-01, M10-01**	**FWBZ Wells M05-08, M12-01 and M12-03**	**No SWBZ Well Installed**	**FWBZ Wells M05-01, M05-05, M05-09 and M05BS-01**	**SWBZ Well D05-01**	**FWBZ Wells M05-02 and M05-06**	**SWBZ Well D05-03**
arsenic	ND	NA	**18.3**[b]	ND	**18.7**[b]	**68.3**	**42.9**[b]	NA	**26**[b]	ND	5.3	ND
barium	142	NA	135	79.5	21.2	139	109	NA	**1,350**[b]	ND	238	ND
cadmium	ND	NA	ND	3.5	ND	1.2	ND	NA	0.76	ND	ND	ND
chromium, total	ND	NA	0.4	ND	3	ND	0.44	NA	1.5	ND	ND	ND
nickel	6.4	NA	13.5	15.5	1.6	31.2	4.7	NA	41.3	ND	2.3	ND
1998	**FWBZ Well M05-04**	**No SWBZ Well Installed**	**FWBZ Well M05-07**	**SWBZ Well D05-02**	**FWBZ Well M05-10**	**FWBZ Wells M05-03, M05HW-01, M10-01**	**FWBZ Wells M05-08, M12-01 and M12-03**	**No SWBZ Well Installed**	**FWBZ Wells M05-01, M05-05, M05-09 and M05BS-01**	**SWBZ Well D05-01**	**FWBZ Wells M05-02 and M05-06**	**SWBZ Well D05-03**
aluminum	ND	NA	115	ND	ND	275	205	NA	**6,640**[b]	ND	**1,410**[b]	ND
arsenic	5.1	NA	**18.3**[b]	2.5	**17.4**[b]	**58.4**	**45**[b]	NA	**15.2**[b]	ND	6.6	ND
barium	297	NA	316	317	387	856	354	NA	2120	ND	351	ND
cadmium	0.48	NA	0.54	**6.8**[b]	0.26	0.28	0.26	NA	1	ND	0.3	ND
chromium, total	ND	NA	0.49	ND	18.8	1.7	2.2	NA	3.7	ND	4.9	ND
lead	ND	NA	ND	ND	ND	ND	2.1	NA		ND		ND
nickel	10.6	NA	4.8	21.8	3.9	34.8	7.4	NA	55.5	ND	51.9	ND
thallium	ND	NA	ND	**8.4**[b]	ND	ND	ND	NA		ND		ND
2002	**FWBZ Well M05-04**	**No SWBZ Well Installed**	**FWBZ Wells 1MW6S, 1MW7S, P-5-1-MWS1 through MWS5**	**No SWBZ Wells**	**FWBZ Well M05-10**	**FWBZ Wells M05-03, M05HW-01, M10-01**	**FWBZ Wells M05-08, M12-01 and M12-03**	**No SWBZ Well Installed**	**FWBZ Wells M05-01, M05-05, M05-09 and M05BS-01**	**SWBZ Well D05-01**	**FWBZ Wells M05-02 and M05-06**	**SWBZ Well D05-03**
aluminum	NA	NA	NA	NA	35	NA	84	NA	190	4.6	ND	ND
antimony	NA	NA	NA	NA	0.16	NA	ND	NA	**27**[b]	0.12	ND	ND
arsenic	NA	NA	NA	NA	**16**[b]	NA	**33**[b]	NA	**24**[b]	8.6	7.9	ND
barium	NA	NA	NA	NA	18	NA	130	NA	420	61	83	180
cadmium	NA	NA	NA	NA	ND	NA	ND	NA	0.59	ND	ND	ND
chromium, total	NA	NA	NA	NA	28	NA	0.59	NA	3	9.3	0.74	0.88
lead	NA	NA	NA	NA	0.039	NA	1.2	NA	1.3	0.047	ND	ND
nickel	NA	NA	NA	NA	3.9	NA	4.2	NA	13	26	1.2	10
thallium	NA	NA	NA	NA	ND	NA	ND	NA	0.13	ND	ND	ND

Table A1-9 (continued)

YEAR/Metal	AREA SOUTHEAST OF BUILDING 5		PLUME 5-1 AREA EAST OF BUILDING 5		BUILDING 5 PLATING SHOP AREA	SOUTH OF BUILDING 5	EASTERN PERIMETER OF EA 1		NORTHERN PERIMETER OF EA 1		WESTERN PERIMETER OF EA 1	
2003	**FWBZ Well M05-04**	**No SWBZ Well Installed**	**FWBZ Wells 1MW6S, 1MW7S, P-5-1-MWS1 through MWS5**	**No SWBZ Wells**	**FWBZ Wells 2MW8S, 3MW10S, and M05-10**	**FWBZ Wells M05-03, M05HW-01, M10-01**	**FWBZ Wells M05-08, M12-01 and M12-03**	**No SWBZ Well Installed**	**FWBZ Wells M05-01, M05-05, M05-09 and M05BS-01**	**SWBZ Well D05-01**	**FWBZ Wells M05-02 and M05-06**	**SWBZ Well D05-03**
aluminum	NA	NA	NA	NA	66.3	NA	51.1	NA	28.4	8.1	ND	30.4
antimony	NA	NA	NA	NA	ND	NA	ND	NA	0.29	**22.9**[b]	ND	0.69
arsenic	NA	NA	NA	NA	**21.1**[b]	NA	**39.6**[b]	NA	**20.6**[b]	4.5	**12.8**[b]	0.67
barium	NA	NA	NA	NA	28	NA	163	NA	278	57.3	90	849
cadmium	NA	NA	NA	NA	3.22	NA	ND	NA	ND	ND	ND	ND
chromium, total	NA	NA	NA	NA	36.1	NA	ND	NA	2.9	ND	ND	0.98
chromium, hexavalent	NA	NA	NA	NA	**35**[b]	NA	ND	NA	ND	ND	ND	ND
nickel	NA	NA	NA	NA	19.3	NA	4.7	NA	14.1	13.9	1.3	13.9
2004	**FWBZ Well M05-04**	**SWBZ Well D05-08**	**FWBZ Wells 1MW6S, 1MW7S, P-5-1-MWS1 through MWS5**	**SWBZ Well D05-05 and D05-06**	**FWBZ Well 2MW8S**	**FWBZ Wells M05-03, M05HW-01, M10-01**	**FWBZ Wells M05-08, M12-01 and M12-03**	**SWBZ Well D05-07**	**FWBZ Wells M05-01, M05-05, M05-09 and M05BS-01**	**SWBZ Well D05-01 and D05-04**	**FWBZ Wells M05-02 and M05-06**	**SWBZ Well D05-03**
aluminum	NA	NA	NA	NA	10	NA	ND	NA	220	10	6.6	ND
antimony	NA	NA	NA	NA	0.1	NA	0.08	NA	0.35	0.4	ND	0.63
arsenic	NA	NA	NA	NA	**24.2**[b]	NA	**43**[b]	NA	**24**[b]	6.31	**14**[b]	ND
barium	NA	NA	NA	NA	42.3	NA	112	NA	340	57	64	160
cadmium	NA	NA	NA	NA	**5.35**[b]	NA	ND	NA	ND	0.67	ND	2.3
chromium, total	NA	NA	NA	NA	ND	NA	ND	NA	ND	2.9	ND	ND
chromium, hexavalent	NA	NA	NA	NA	ND	NA	ND	NA	ND	ND	ND	ND
lead	NA	NA	NA	NA	0.25	NA	0.4	NA	0.11	0.24	0.14	0.3
nickel	NA	NA	NA	NA	25.6	NA	1.4	NA	10	13	ND	27

Notes:
[a] maximum concentration reported for the year for all wells within the given area
[b] bold type indicates concentrations exceeding MCL

Acronyms/Abbreviations:
bgs – below ground surface
EA – evaluation area
FWBZ – first water-bearing zone, wells generally screened at depths between 5 and 17 feet bgs
MCL – maximum contaminant level
mg/L – milligrams per liter
NA – not applicable, no sampling conducted or no metals analysis
ND – not detected, concentrations below reporting limit
SWBZ – second water-bearing zone, wells screened at depths of 67 to 70 feet bgs

Table A1-10
Metals in Discrete Groundwater Samples Exceeding Comparison Criteria

Study Area	Station ID	Depth (feet bgs)	Analyte	Metal Concentration (µg/L)	MCL* (µg/L)
EA 3	05GB001	5 to 6	arsenic	20.7	10
EA 3	05GB003	5 to 6	arsenic	79	10
EA 3	5-3-ADD12	21 to 25	arsenic	74.7	10
EA 3	5-3-ADD12	21 to 25	barium	1,440	1,000
EA 3	5-3-ADD12	21 to 25	chromium, total	918	50
EA 3	5-3-ADD12	21 to 25	lead	116	15
EA 3	5-3-ADD12	21 to 25	nickel	819	100
EA 3	5-3-ADD27	NA	antimony	7.6	6
EA 3	5-3-ADD27	NA	arsenic	18	10
EA 3	5-3-ADD27	NA	chromium, total	110	50
EA 3	5-3-ADD27	NA	lead	46.4	15
EA 3	5-3-ADD27	NA	nickel	116	100
EA 3	B05PS-01	18 to 18	aluminum	1,470	1,000
EA 3	B05PS-01	18 to 18	chromium, hexavalent	1,020	2
EA 3	B05PS-01	0 to 0	aluminum	1,150	1,000
EA 3	B05PS-01	0 to 0	lead	156	15
EA 3	B05PS-02	6 to 6	aluminum	103,000	1,000
EA 3	B05PS-02	6 to 6	arsenic	25.7	10
EA 3	B05PS-02	6 to 6	barium	1,200	1,000
EA 3	B05PS-02	6 to 6	beryllium	5.8	4
EA 3	B05PS-02	6 to 6	cadmium	443	5
EA 3	B05PS-02	6 to 6	chromium, total	2,470	50
EA 3	B05PS-02	6 to 6	chromium, hexavalent	6,470	2
EA 3	B05PS-02	6 to 6	lead	63.4	15
EA 3	B05PS-02	6 to 6	nickel	325	100
EA 3	B05PS-03	6.5 to 6.5	aluminum	6,370	1,000
EA 3	B05PS-03	6.5 to 6.5	cadmium	24.5	5
EA 3	B05PS-03	6.5 to 6.5	chromium, total	111	50
EA 3	B05PS-03	6.5 to 6.5	chromium, hexavalent	7,010	2
EA 3	B05PS-04	5 to 5.5	aluminum	35,200	1,000
EA 3	B05PS-04	5 to 5.5	arsenic	39.2	10
EA 3	B05PS-04	5 to 5.5	cadmium	248	5
EA 3	B05PS-04	5 to 5.5	chromium, total	227	50
EA 3	B05PS-04	5 to 5.5	chromium, hexavalent	13,100	2
EA 3	B05PS-04	5 to 5.5	lead	19.5	15
EA 3	B05PS-04	5 to 5.5	nickel	116	100
EA 3	B05PS-05	6.5 to 6.5	aluminum	328,000	1,000

Table A1-10 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Metal Concentration (µg/L)	MCL* (µg/L)
EA 3	B05PS-05	6.5 to 6.5	arsenic	22.2	10
EA 3	B05PS-05	6.5 to 6.5	barium	2,820	1,000
EA 3	B05PS-05	6.5 to 6.5	beryllium	10.9	4
EA 3	B05PS-05	6.5 to 6.5	cadmium	983	5
EA 3	B05PS-05	6.5 to 6.5	chromium, total	10,700	50
EA 3	B05PS-05	6.5 to 6.5	lead	243	15
EA 3	B05PS-05	6.5 to 6.5	nickel	1,030	100
EA 3	S05-DGS-DP14	7 to 7	cadmium	7.8	5
EA 3	S05-DGS-DP14	7 to 7	chromium, total	138	50
EA 3	S05-DGS-DP17	5 to 7	cadmium	10.7	5
EA 3	S05-DGS-DP17	5 to 7	chromium, total	79.1	50
EA 3	S05-DGS-DP18	3 to 4	cadmium	189	5
EA 3	S05-DGS-DP19	8 to 8	cadmium	21	5
EA 3	S05-DGS-DP19	8 to 8	chromium, total	71.8	50
EA 3	S05-DGS-DP20	8 to 8	cadmium	14.7	5
EA 3	S05-DGS-DP20	8 to 8	chromium, total	109	50
EA 3	S05-EXC-GW-1	0 to 0	cadmium	13.8	5
EA 3	S05-EXC-GW-1	0 to 0	chromium, total	116	50
EA 3	S05-EXC-GW-1	0 to 0	chromium, hexavalent	97	2
EA 3	S05-EXC-GW-2	0 to 0	cadmium	224	5
EA 3	S05-EXC-GW-2	0 to 0	chromium, total	416	50
EA 4	SHP-S05-12	8 to 8	arsenic	17.5	10
EA 5	057-006-014	7 to 8	aluminum	200,000	1,000
EA 5	057-006-014	7 to 8	arsenic	73.5	10
EA 5	057-006-014	7 to 8	barium	1,980	1,000
EA 5	057-006-014	7 to 8	cadmium	5.1	5
EA 5	057-006-014	7 to 8	chromium, total	1,130	50
EA 5	057-006-014	7 to 8	lead	69.9 J	15
EA 5	057-006-014	7 to 8	nickel	1,090 J	100
EA 5	057-006-014	7 to 8	thallium	2.3 J	2
EA 5	057-006-015	7 to 8	aluminum	147,000	1,000
EA 5	057-006-015	7 to 8	arsenic	85.8	10
EA 5	057-006-015	7 to 8	barium	3,770	1,000
EA 5	057-006-015	7 to 8	cadmium	5.2	5
EA 5	057-006-015	7 to 8	chromium, total	1,110	50
EA 5	057-006-015	7 to 8	lead	69.4 J	15
EA 5	057-006-015	7 to 8	nickel	1,170 J	100
EA 5	057-006-016	9 to 10	aluminum	213,000	1,000
EA 5	057-006-016	9 to 10	arsenic	64.6	10

Table A1-10 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Metal Concentration (µg/L)	MCL* (µg/L)
EA 5	057-006-016	9 to 10	barium	2,840	1,000
EA 5	057-006-016	9 to 10	beryllium	7.7	4
EA 5	057-006-016	9 to 10	cadmium	5.6	5
EA 5	057-006-016	9 to 10	chromium, total	980	50
EA 5	057-006-016	9 to 10	lead	184 J	15
EA 5	057-006-016	9 to 10	nickel	645 J	100
EA 5	B05WT-01	10.5 to 10.5	arsenic	30.3	10
EA 5	B05WT-01	10.5 to 10.5	chromium, hexavalent	2,830	2
EA 5	B05WT-01	10.5 to 10.5	nickel	312	100
EA 5	B05WT-02	0 to 0	chromium, hexavalent	9,350	2
EA 5	B05WT-02	0 to 0	lead	4,420	15
EA 5	B05WT-02	0 to 0	nickel	483	100
EA 6N	5-1-ADD16	17 to 21	arsenic	27.2	10
EA 6N	5-1-ADD16	17 to 21	chromium, total	391	50
EA 6N	5-1-ADD16	17 to 21	lead	74.9	15
EA 6N	5-1-ADD16	17 to 21	nickel	307	100
EA 6N	5-1-ADD17	17 to 21	arsenic	41.2	10
EA 6N	5-1-ADD17	17 to 21	chromium, total	336	50
EA 6N	5-1-ADD17	17 to 21	lead	98.8	15
EA 6N	5-1-ADD17	17 to 21	nickel	270	100
EA 6N	5-1-ADD21	10 to 13.5	antimony	7	6
EA 6N	5-1-ADD21	10 to 13.5	arsenic	20.5	10
EA 6N	5-1-ADD21	10 to 13.5	barium	1,220	1,000
EA 6N	5-1-ADD21	10 to 13.5	chromium, total	480	50
EA 6N	5-1-ADD21	10 to 13.5	lead	62.6	15
EA 6N	5-1-ADD21	10 to 13.5	nickel	518	100
EA 6N	5-1-ADD21	15 to 19	chromium, total	134	50
EA 6N	5-1-ADD21	15 to 19	lead	26.9	15
EA 6N	5-1-ADD21	15 to 19	nickel	123	100
EA 6N	5-1-ADD24	11 to 15	arsenic	20	10
EA 6N	5-1-ADD24	11 to 15	barium	1,140	1,000
EA 6N	5-1-ADD24	11 to 15	chromium, total	330	50
EA 6N	5-1-ADD24	11 to 15	lead	51.5	15
EA 6N	5-1-ADD24	11 to 15	nickel	254	100
EA 6N	5-1-ADD24	17 to 21	arsenic	14.8	10
EA 6N	5-1-ADD24	17 to 21	chromium, total	166	50
EA 6N	5-1-ADD24	17 to 21	lead	43.7	15
EA 6N	5-1-ADD24	17 to 21	nickel	152	100
EA 6N	B05-11	0 to 0	arsenic	50.5	10

Table A1-10 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Metal Concentration (µg/L)	MCL* (µg/L)
EA 6S	5-2-ADD13	15.5 to 18.5	arsenic	13	10
EA 6S	5-2-ADD13	15.5 to 18.5	chromium, total	122	50
EA 6S	5-2-ADD13	15.5 to 18.5	lead	39.4	15
EA 6S	5-2-ADD13	15.5 to 18.5	nickel	131	100
EA 6S	5-2-ADD6	15 to 18	arsenic	26.1	10
EA 6S	5-2-ADD6	15 to 18	chromium, total	264	50
EA 6S	5-2-ADD6	15 to 18	lead	76.6	15
EA 6S	5-2-ADD6	15 to 18	nickel	209	100
EA 6S	5-4-ADD11	16 to 19	arsenic	33	10
EA 6S	5-4-ADD11	16 to 19	chromium, total	503	50
EA 6S	5-4-ADD11	16 to 19	lead	124	15
EA 6S	5-4-ADD11	16 to 19	nickel	485	100
EA 6S	5-4-ADD12	11 to 14	chromium, total	59.6	50
EA 6S	5-4-ADD12	11 to 14	nickel	149	100
EA 6S	5-4-ADD12	11 to 14	thallium	2.8	2
EA 6S	5-4-ADD20	16 to 19	arsenic	26.2	10
EA 6S	5-4-ADD20	16 to 19	chromium, total	338	50
EA 6S	5-4-ADD20	16 to 19	lead	72.3	15
EA 6S	5-4-ADD20	16 to 19	nickel	244	100
EA 6S	5-4-ADD6	11 to 14	arsenic	23.8	10
EA 6S	5-4-ADD6	11 to 14	barium	1,290	1,000
EA 6S	5-4-ADD6	11 to 14	chromium, total	304	50
EA 6S	5-4-ADD6	11 to 14	lead	33	15
EA 6S	5-4-ADD6	11 to 14	nickel	349	100
EA 6S	5-4-ADD7	11 to 14	arsenic	18.5	10
EA 6S	5-4-ADD7	11 to 14	barium	1,140	1,000
EA 6S	5-4-ADD7	11 to 14	chromium, total	122	50
EA 6S	5-4-ADD7	11 to 14	lead	22.6	15
EA 6S	5-4-ADD7	11 to 14	nickel	151	100
EA 6S	5-4-ADD8	16 to 19	arsenic	25.1	10
EA 6S	5-4-ADD8	16 to 19	chromium, total	226	50
EA 6S	5-4-ADD8	16 to 19	lead	87.8	15
EA 6S	5-4-ADD8	16 to 19	nickel	188	100
EA 6S	5-4-ADD9	11 to 14	arsenic	15.6	10
EA 6S	5-4-ADD9	11 to 14	chromium, total	79.4	50
EA 6S	5-4-ADD9	11 to 14	nickel	114	100
EA 6S	HP-S05-05	42 to 42	arsenic	14.1 J	10
EA 6S	HP-S05-05	42 to 42	cadmium	5.3 J	5

Table A1-10 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Metal Concentration (µg/L)	MCL* (µg/L)
NPER	B05-12	0 to 0	arsenic	17.8	10
NPER	DHP-S05-01	42.5 to 42.5	arsenic	14.8 J	10
NPER	DHP-S05-01	42.5 to 42.5	lead	154 J	15
NPER	HP-S05-02	65 to 65	lead	20.2	15
NPER	HP-S05-03	58 to 58	lead	27.8 J	15
Data Gap Areas					
Building 6	6-L	7 to 7	lead	100	15
Other Areas					
Other	030-S05-011	7 to 7.5	aluminum	247,000	1,000
Other	030-S05-011	7 to 7.5	antimony	24.2	6
Other	030-S05-011	7 to 7.5	arsenic	87.3	10
Other	030-S05-011	7 to 7.5	barium	5,600	1,000
Other	030-S05-011	7 to 7.5	cadmium	51.5	5
Other	030-S05-011	7 to 7.5	chromium, total	1,020	50
Other	030-S05-011	7 to 7.5	lead	2,760	15
Other	030-S05-011	7 to 7.5	mercury	6.8	2
Other	030-S05-011	7 to 7.5	nickel	1,220	100
Other	030-S05-011	7 to 7.5	thallium	13.4 J	2
Other	066-IWTP-005	16 to 20	arsenic	20.1 J	10
Other	066-IWTP-007	16 to 20	arsenic	18.7	10
WPER	HP-S05-06	43 to 43	arsenic	12.3	10

Note:
* the lower of either federal or California MCL

Acronyms/Abbreviations:
bgs – below ground surface
EA – evaluation area
µg/L – micrograms per liter
MCL – maximum contaminant level
NA – not available
NPER – northern perimeter of EA 1
WPER – western perimeter of EA 1

Review Qualifier:
J – estimated value

Table A1-11
Cyanide in Groundwater Samples Exceeding Comparison Criteria

Study Area	Station ID	Depth (feet bgs)	Cyanide Concentration (µg/L)	MCL* (µg/L)
Monitoring Well Samples				
EA 3	M05-10	5 to 15	521	150
Discrete Groundwater Samples				
EA 3	05GB003	5 to 6	3,520	150
EA 3	B05PS-01	18 to 18	342	150
EA 3	B05PS-02	6 to 6	3,610	150
EA 3	B05PS-03	6.5 to 6.5	1,140	150
EA 3	B05PS-04	5 to 5.5	4,550	150
EA 3	B05PS-05	6.5 to 6.5	4,550	150
EA 3	S05-DGS-DP14	7 to 7	170	150
EA 3	S05-DGS-DP20	8 to 8	480	150
EA 3	S05-DGS-DP63	8 to 8	1,090	150
EA 3	S05-DGS-DP66	8 to 8	465	150
EA 3	S05-EXC-GW-1	0 to 0	426	150
EA 3	S05-EXC-GW-2	0 to 0	1,390	150

Note:
* the lower of either federal or California MCL

Acronyms/Abbreviations:
bgs – below ground surface
EA – evaluation area
µg/L – micrograms per liter
MCL – maximum contaminant level

Review Qualifier:
J – estimated value

Table A1-12
Volatile Organic Compounds in Soil
Exceeding Comparison Criteria

Study Area	Station ID	Depth (feet bgs)	Analyte	Concentration (mg/kg)	Residential PRG* (mg/kg)
Evaluation Area					
EA 3	B05PS-08	22 to 22	1,1-dichloroethane	4.3	2.8
EA 5	054-SS-005	8.5 to 9.5	trichloroethene	0.13	0.053
EA 5	057-001-001	4 to 4.5	ethylbenzene	24	8.9
EA 5	057-001-001	4 to 4.5	trichloroethene	0.84	0.053
EA 5	057-001-002	4 to 4.5	ethylbenzene	25	8.9
EA 5	057-001-002	4 to 4.5	tetrachloroethene	11	1.5
EA 5	057-001-002	4 to 4.5	trichloroethene	3.3	0.053
EA 6N	B05-11	14 to 14.3	trichloroethene	2.2	0.053
EA 6S	030-MOD1-283	0 to 7.5	1,1-dichloroethane	20	2.8
EA 6S	030-MOD1-283	0 to 7.5	1,2-dichloroethene (total)	77	43
EA 6S	030-MOD1-283	0 to 7.5	tetrachloroethene	110	1.5
EA 6S	030-MOD1-283	0 to 7.5	trichloroethene	260	0.053
EA 6S	030-MOD1-284	0 to 7.5	1,1-dichloroethane	5.1	2.8
EA 6S	030-MOD1-284	0 to 7.5	tetrachloroethene	68	1.5
EA 6S	030-MOD1-284	0 to 7.5	trichloroethene	29	0.053
EA 6S	030-MOD1-285	0 to 5	tetrachloroethene	1.8	1.5
EA 6S	030-MOD1-285	0 to 5	trichloroethene	6.9	0.053
Data Gap Area					
Building 347	M05-02	14.5 to 15.3	vinyl chloride	0.08	0.079
West of Building 5	030-S05-009	7.5	benzene	1 J	0.6
Buildings 6 and 282	282-MW1	4.5 to 4.5	benzene	5	0.6
Buildings 6 and 282	282-MW2	5 to 5	benzene	6	0.6
Buildings 6 and 282	282-MW3	5 to 5	benzene	6	0.6

Note:
* U.S. EPA 2004

Table A1-12 (continued)

Acronyms/Abbreviations:
- bgs – below ground surface
- EA – evaluation area
- mg/kg – milligrams per kilogram
- PRG – preliminary remediation goal
- VOC – volatile organic compound

Review Qualifier:
- J – estimated value

Table A1-13
Petroleum Hydrocarbons in Soil Exceeding Comparison Criteria

Study Area	Station ID	Depth (feet bgs)	TPH Range	Petroleum Hydrocarbon Concentration (mg/kg)	ESL Residential Soil Screening Criteria (mg/kg)
EA 5	054-SS-005	8.5 to 9.5	diesel	730	500
EA 5	057-001-001	0 to 0.5	diesel	1,200	500
EA 5	CA05-07	4 to 4.7	diesel	1,200	500
EA 5	CA05-07	4 to 4.7	gasoline	230,000	100
EA 5	030-MOD1-181	0 to 4.5	diesel	5,500 J	500
EA 5	030-MOD1-181	0 to 4.5	gasoline	6,100 J	100
EA 5	030-MOD1-181	0 to 4.5	motor oil	2,000 J	500
EA 5	261-S7	2 to 2	motor oil	680	500
EA 5	261-S8	2 to 2	diesel	870	500
EA 5	261-S8	2 to 2	motor oil	1,100	500
EA 5	261-S9	2 to 2	diesel	15,000	500
EA 5	261-S9	2 to 2	jet fuel	14,000	500
EA 5	261-S9	2 to 2	motor oil	16,000	500
EA 5	400-E	4 to 4	diesel	7,000	500
EA 5	400-E	4 to 4	gasoline	140	100
EA 5	400-E	4 to 4	jet fuel	3,600	500
EA 5	400-E	4 to 4	motor oil	5,500	500
EA 5	400-N	4 to 4	diesel	9700	500
EA 5	400-N	4 to 4	gasoline	280	100
EA 5	400-N	4 to 4	jet fuel	5,200	500
EA 5	400-N	4 to 4	motor oil	6,600	500
EA 5	400-8-MOJ	6 to 6	diesel	2,200	500
EA 5	400-S	4 to 4	diesel	6,900	500
EA 5	400-S	4 to 4	gasoline	170	100
EA 5	400-S	4 to 4	jet fuel	3,500	500
EA 5	400-S	4 to 4	motor oil	5,300	500
EA 5	400-W	4 to 4	diesel	14,000	500
EA 5	400-W	4 to 4	gasoline	1,300	100
EA 5	400-W	4 to 4	jet fuel	8,500	500
EA 5	400-W	4 to 4	motor oil	9,400	500
EA 6N	NAS05-01-S-07-E	7 to 7	diesel	3,020	500
EA 6N	NAS05-01-S-07-E	7 to 7	gasoline	2,200	100
EA 6N	NAS05-01-S-07-W	7 to 7	diesel	4,800	500
EA 6N	NAS05-02-S-09-E	9 to 9	diesel	3,400	500
EA 6N	NAS05-02-S-09-E	9 to 9	gasoline	1,200	100

Table A1-13 (continued)

Study Area	Station ID	Depth (feet bgs)	TPH Range	Petroleum Hydrocarbon Concentration (mg/kg)	ESL Residential Soil Screening Criteria (mg/kg)
EA 6S	030-MOD1-283	0 to 7.5	diesel	8,900	500
EA 6S	030-MOD1-283	0 to 7.5	gasoline	11,000	100
EA 6S	030-MOD1-284	0 to 7.5	diesel	2,300	500
EA 6S	030-MOD1-284	0 to 7.5	gasoline	6,400	100
EA 6S	030-MOD1-285	0 to 5	diesel	22,000	500
EA 6S	030-MOD1-285	0 to 5	gasoline	2,700	100
EPER	M12-01	0 to 0.5	total recoverable petroleum hydrocarbons	2,390	500
EPER	M12-03	0 to 0.5	total recoverable petroleum hydrocarbons	730	500
IR Site 12	M12-02	0 to 0.5	total recoverable petroleum hydrocarbons	4,020	500
IR Site 12	M12-04	0 to 0.5	total recoverable petroleum hydrocarbons	10,700	500
IR Site 12	B12-05	0.5 to 1	total recoverable petroleum hydrocarbons	573	500
IR Site 12	B12-06	0.5 to 1	total recoverable petroleum hydrocarbons	1,540	500
IR Site 12	B12-07	0 to 0.5	total recoverable petroleum hydrocarbons	2,380	500
IR Site 12	B12-09	0.5 to 1	total recoverable petroleum hydrocarbons	1,750	500

Acronyms/Abbreviations:
- bgs – below ground surface
- EA – evaluation area
- EPER – eastern perimeter of Evaluation Area 1
- ESL – environmental screening level
- IR – Installation Restoration (Program)
- mg/kg – milligrams per kilogram
- TPH – total petroleum hydrocarbons

Review Qualifier:
- J – estimated value

Table A1-14
Benzo(a)pyrene Equivalents in Soil Exceeding
Alameda Point–Specific Residential Soil Screening Criterion

Study Area	Station ID	Depth (feet bgs)	B(a)P Equivalent Concentration (µg/kg)*
West of Building 5	030-S05-009	7.5	12,300
West of Building 5	C3S005B048	4 to 8	1,170
West of Building 5	C3S005B082	0.5 to 2	840
North of Building 2	C3S005B003	0 to 0.5	1,260
North of Building 2	C3S005B004	2 to 4	2,030

Note:
* values exceed the Alameda Point–specific B(a)P equivalent residential soil screening criterion of 620 µg/kg

Acronyms/Abbreviations:
B(a)P – benzo(a)pyrene
bgs – below ground surface
µg/kg – micrograms per kilogram

Table A1-15
Semivolatile Organic Compounds in Soil
Exceeding Comparison Criteria

Study Area	Station ID	Depth (feet bgs)	Analyte	SVOC Concentration (mg/kg)	Residential PRG* Screening Criteria (mg/kg)
EA 5	M05-03	14 to 15.5	bis(2-chloroethyl)ether	0.4 J	0.21
EA 6S	030-MOD1-284	0 to 7.5	bis(2-ethylhexyl)phthalate	44	35

Note:
* U.S. EPA 2004

Acronyms/Abbreviations:
bgs – below ground surface
EA – evaluation area
mg/kg – milligrams per kilogram
PRG – preliminary remediation goal
SVOC – semivolatile organic compound

Review Qualifier:
J – estimated value

Table A1-16
Pesticides and Polychlorinated Biphenyls in Soil Exceeding Comparison Criteria

Study Area	Station ID	Depth (feet bgs)	Analyte	Pesticide/PCB Concentration (µg/kg)	Residential Soil PRG* (µg/kg)
EBS Parcel 59	059-SS-002	10 to 10.5	Aroclor 1260	1,900	220

Note:
* U.S. EPA 2004

Acronyms/Abbreviations:
bgs – below ground surface
EBS – environmental baseline survey
µg/kg – micrograms per kilogram
PCB – polychlorinated biphenyl
PRG – preliminary remediation goal

Table A1-17
Metals in Soil Exceeding Comparison Criteria

Study Area	Station ID	Depth (feet bgs)	Analyte	Metal Concentration (mg/kg)	Background Concentration (mg/kg)	Residential Soil PRG[a] (mg/kg)
EA 3	054-002-011	0 to 0.5	lead	527 J	37.66	150[b]
EA 3	054-002-012	0 to 0.5	iron	37,100 J	22,280	23,000
EA 3	054-002-012	0 to 0.5	thallium	5.9	0.5	5.2
EA 3	054-002-012	0 to 0.5	vanadium	95.3	47.34	550
EA 3	054-002-014	0 to 0.5	iron	29,300	22,280	23,000
EA 3	054-002-014	0 to 0.5	vanadium	69.2	47.34	550
EA 3	054-002-014	0 to 0.5	vanadium	51.2	47.34	550
EA 3	054-003-020	0 to 0.5	iron	37,600 J	22,280	23,000
EA 3	054-003-020	0 to 0.5	vanadium	85.1	47.34	550
EA 3	054-003-022	0 to 0.5	iron	23,200	22,280	23,000
EA 3	054-004-027	0 to 0.5	iron	30,600	22,280	23,000
EA 3	05GB003	0.5 to 1	iron	30,000	22,280	23,000
EA 3	05GB003	0.5 to 1	vanadium	74.9	47.34	550
EA 3	B05PS-01[c]	4.5 to 5	cadmium	570	1.72	37
EA 3	B05PS-01	18 to 18.5	cadmium	133	1.72	37
EA 3	B05PS-01	18 to 18.5	chromium, total	850	54.84	210
EA 3	B05PS-03	1.5 to 2	cadmium	58.1	1.72	37
EA 3	B05PS-03	1.5 to 2	iron	34,600	22,280	23,000
EA 3	B05PS-03	1.5 to 2	vanadium	105	47.34	550
EA 3	B05PS-04	2.5 to 3	iron	31,500	22,280	23,000
EA 3	B05PS-04	2.5 to 3	vanadium	93.2	47.34	550
EA 3	B05PS-05	2.5 to 3	iron	23,800	22,280	23,000
EA 3	B05PS-05	2.5 to 3	vanadium	66.1	47.34	550
EA 3	B05PS-06	0.8 to 0.8	cadmium	44.4 J	1.72	37
EA 3	B05PS-08	0 to 0	cadmium	235	1.72	37
EA 3	B05PS-08	1.3 to 1.3	cadmium	80.3	1.72	37
EA 3	B05PS-08	1.3 to 1.3	cadmium	95.2	1.72	37
EA 3	B05PS-08	22 to 22	iron	35,400	22,280	23,000
EA 3	B05PS-08	22 to 22	vanadium	62.3	47.34	550
EA 3	B05PS-09	1.3 to 1.3	cadmium	452	1.72	37
EA 3	B05PS-09	2 to 2	cadmium	177	1.72	37
EA 3	B05PS-09	2 to 2	chromium, total	244	54.84	210
EA 3	B05PS-10	3 to 3	cadmium	38.6	1.72	37
EA 3	B05SP-01	0.5 to 1	cadmium	113	1.72	37
EA 3	C1	1.5 to 1.5	iron	40,700	22,280	23,000
EA 3	C1	1.5 to 1.5	vanadium	132	47.34	550
EA 3	C10	1.5 to 1.5	iron	26,100	22,280	23,000
EA 3	C10	1.5 to 1.5	vanadium	50.7	47.34	550
EA 3	C11	1.5 to 1.5	iron	30,600	22,280	23,000

Table A1-17 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Metal Concentration (mg/kg)	Background Concentration (mg/kg)	Residential Soil PRG[a] (mg/kg)
EA 3	C11	1.5 to 1.5	vanadium	76.7	47.34	550
EA 3	C12	1.5 to 1.5	iron	46,300	22,280	23,000
EA 3	C12	1.5 to 1.5	vanadium	125	47.34	550
EA 3	C2	1.5 to 1.5	chromium, total	373 J	54.84	210
EA 3	C4	1.5 to 1.5	cadmium	261	1.72	37
EA 3	C4	1.5 to 1.5	chromium, total	759 J	54.84	210
EA 3	C4	1.5 to 1.5	iron	26,700	22,280	23,000
EA 3	C4	1.5 to 1.5	vanadium	64.8	47.34	550
EA 3	C5	1.5 to 1.5	chromium, hexavalent	47.7 J	0	30
EA 3	C5	1.5 to 1.5	iron	44,100	22,280	23,000
EA 3	C5	1.5 to 1.5	vanadium	136	47.34	550
EA 3	C6	1.5 to 1.5	chromium, total	270 J	54.84	210
EA 3	C7	1.5 to 1.5	cadmium	186	1.72	37
EA 3	C7	1.5 to 1.5	chromium, total	305	54.84	210
EA 3	C7	1.5 to 1.5	iron	38,800	22,280	23,000
EA 3	C7	1.5 to 1.5	vanadium	115	47.34	550
EA 3	C8	1.5 to 1.5	iron	80,400	22,280	23,000
EA 3	C8	1.5 to 1.5	vanadium	131	48.34	550
EA 3	C9	1.5 to 1.5	chromium, total	339 J	54.84	210
EA 3	C9	1.5 to 1.5	iron	39,800	22,280	23,000
EA 3	C9	1.5 to 1.5	vanadium	104	47.34	550
EA 3	S05-DGS-DP17	5 to 5.5	cadmium	266	1.72	37
EA 3	S05-DGS-DP18	0.5 to 1	cadmium	147	1.72	37
EA 3	S05-DGS-DP55	8 to 8.5	cadmium	97	1.72	37
EA 3	S05-EXC-SW-B1	10 to 10	cadmium	39.9	1.72	37
EA 3	S05-EXC-SWE3	3.5 to 3.5	cadmium	38 J	1.72	37
EA 3	S05-EXC-X2Y2	7 to 7	chromium, total	295	54.84	210
EA 3	S05-EXC-X3Y2	7 to 7	chromium, total	220	54.84	210
EA 3	S05-EXC-X5Y2	7 to 7	cadmium	62.6 J	1.72	37
EA 3	S05-EXC-X5Y3	7 to 7	cadmium	83.8 J	1.72	37
EA 4	054-001-003	0 to 0.5	lead	1,770 J	37.66	150
EA 4	054-001-005	0 to 0.5	lead	251 J	37.66	150
EA 4	054-001-006	4 to 4.5	lead	361 J	37.66	150
EA 4	054-001-007	0 to 0.5	arsenic	329 J	9.14	0.39

Table A1-17 (continued)

Study Area	Station ID	Depth (feet bgs)	Analyte	Metal Concentration (mg/kg)	Background Concentration (mg/kg)	Residential Soil PRG[a] (mg/kg)
EA 4	054-001-007	0 to 0.5	thallium	335	0.5	5.2
EA 4	CPT-S05-12	0 to 0	lead	173	37.66	150
EA 4	CPT-S05-12	2.5 to 2.5	lead	161	37.66	150
EA 4	M05-11	1 to 2	vanadium	57.5	47.34	550
EA 4	M05-12	1 to 2	lead	190	37.66	150
EA 4	M05-12	2.5 to 3.5	lead	172	37.66	150
EA 4	M05-12	4.5 to 5.5	lead	185	37.66	150
EA 5	057-001-001	0 to 0.5	chromium, total	408 J	54.84	210
EA 5	057-001-003	0 to 0.5	chromium, total	876 J	54.84	210
EA 5	057-002-006	0 to 0.5	arsenic	12.6 J	9.14	0.39
EA 5	057-002-006	0 to 0.5	iron	26,700 J	22,280	23,000
EA 5	057-0043	3.5 to 4	vanadium	59.9	47.34	550
EA 5	261-S8	2 to 2	lead	170	37.66	150
EA 5	M05-03	14 to 15.5	iron	25,700 J	22,280	23,000
EA 5	M05-03	1 to 1.5	vanadium	56.3J	47.34	550
EA 5	M05-03	14 to 15.5	vanadium	64.8J	47.34	550
Data Gap Areas						
Building 6	068-001-002	6 to 6.5	thallium	5.5	0.5	5.2
Building 347	030-S05-005	0 to 5	iron	30,300	22,280	23,000
Building 347	030-S05-005	0 to 5	vanadium	49.2	47.34	550
Building 347	M05-02	14.5 to 15.3	iron	25,200 J	22,280	23,000
Building 347	M05-02	14.5 to 15.3	vanadium	56.8	47.34	550
Other Areas						
IR Site 12	B12-08	0.5 to 1	iron	26,900 J	22,280	23,000
IR Site 12	M12-02	9.5 to 11	iron	25,800 J	22,280	23,000
IR Site 12	M12-02	9.5 to 11	vanadium	53.4 J	47.34	550
IR Site 12	M12-03	0 to 0.5	iron	25,100	22,280	23,000
IR Site 12	M12-03	11 to 12.5	iron	33,800	22,280	23,000
IR Site 12	M12-03	0 to 0.5	vanadium	60.9	47.34	550
IR Site 12	M12-03	11 to 12.5	vanadium	73	47.34	550
IR Site 12	M12-04	9.5 to 11	iron	32,900	22,280	23,000
IR Site 12	M12-04	9.5 to 11	vanadium	69.1	47.34	550

Table A1-17 (continued)

Notes:
[a] U.S. EPA 2004
[b] California-modified PRG used
[c] shaded areas represent samples from locations that have been subsequently excavated

Acronyms/Abbreviations:
bgs – below ground surface
EA – evaluation area
mg/kg – milligrams per kilogram
NA – not applicable
PRG – preliminary remediation goal

Review Qualifier:
J – estimated value

Table A1-18
Numerical Comparison Criteria and Known Maximum Contaminant Levels for Decision Logic Figures A1-17 through A1-20

Decision Logic Steps	Action	Decision
Step 1	Evaluate analytical results for any results that exceed comparison criteria presented in Table A1-1 (organic analytes), Table A1-2 (inorganic analytes), and Table A1-3 (TPH).	If concentrations do not exceed comparison criteria, no further RI sampling activities will be conducted at this location as part of the Supplemental RI sampling at OU-2C.
		If concentrations exceed comparison criteria, proceed to Step 2.
Step 2a (Figure A1-17): Decision Logic for Installation of Permanent Monitoring Wells	Compare analytical results with identified potential source (e.g., previously identified VOC sources areas such as the former plating shop in Building 5 or the former dry cleaning operation at Building 2).	If analytes in discrete groundwater samples are the same as, or related to, analytes reported for an identified upgradient source, proceed with Step 3A of Decision Logic (Figure A1-17) to determine the need for a downgradient monitoring well.
		If analytes in discrete groundwater samples are not related to analytes reported for an identified upgradient source **or** if there is no identified upgradient source, proceed with Step 3B of Decision Logic (Figure A1-17) to determine the need for an upgradient monitoring well.
Step 2b (Figure A1-18): Decision Logic for Discrete Groundwater Step-Out Sampling	Review mapped location of soil boring and determine whether there are existing groundwater sampling data collected within 50 feet.	If soil samples contain analytes at a concentration exceeding comparison criteria from a location for which there are existing groundwater results within 50 feet for this analyte and the groundwater results indicate the same analytes as reported in soil, no further RI sampling activities will be conducted at this location as part of the Supplemental RI sampling at OU-2C.
		If soil samples contain an analyte at a concentration exceeding comparison criteria from a location for which there are no groundwater results within 50 feet for this analyte, additional sampling is needed. Proceed with Step 3 of Decision Logic (Figure A1-18).
Step 2c (Figure A1-19): Decision Logic for SWMU and Data Gap Step-Out Soil Sampling	Review mapped location of soil boring and determine whether there are other soil sampling data from borings within 50 feet.	If soil samples contain an analyte at a concentration exceeding comparison criteria from a location for which there are existing soil results within 50 feet for this analyte, no further RI sampling activities will be conducted at this location as part of the Supplemental RI sampling at OU-2C.
		If soil samples contain an analyte at a concentration exceeding comparison criteria from a location for which there are no soil results within 50 feet for this analyte, additional sampling is needed. Proceed with Step 3 of Decision Logic (Figure A1-19).
Step 2d (Figure A1-20): Decision Logic for SWMU and Data Gap Step-Out Discrete Groundwater Sampling	Review mapped location of discrete groundwater sampling boring and determine whether there are other groundwater data from borings or wells within 50 feet.	If discrete groundwater samples contain an analyte at a concentration exceeding a comparison criterion from a location for which there are existing groundwater results within 50 feet for this analyte, no further RI sampling activities will be conducted at this location as part of the Supplemental RI sampling at OU-2C.
		If discrete groundwater samples contain an analyte at a concentration exceeding a comparison criterion from a location for which there are no groundwater results within 50 feet for this analyte, additional sampling is needed. Proceed with Step 3 of Decision Logic (Figure A1-20).

Data for Decision Logic Step 2a Comparison

Area	VOLATILE ORGANIC COMPOUNDS			PETROLEUM HYDROCARBONS			SEMIVOLATILE ORGANIC COMPOUNDS			INORGANIC ANALTYES				
	Analytes Exceeding MCLs or PRGs	Groundwater Maximum (µg/L)	Soil Maximum (mg/kg)	Analytes Exceeding RWQCB ESLs	Groundwater Maximum (µg/L)	Soil Maximum (mg/kg)	Analytes Exceeding MCLs or PRGs	Groundwater Maximum (µg/L)	Soil Maximum (mg/kg)	Analytes Exceeding MCLs, PRGs, or Background Threshold	Exceeding MCLs: Groundwater Maximum (µg/L)	Exceeding Residential PRGs: Soil Maximum (mg/kg)	Exceeding Background Threshold: Groundwater Maximum (µg/L)	Exceeding Background Threshold: Soil Maximum (mg/kg)
Evaluation Area 2	1,2-dichloroethene (total)	270	NE	motor oil–range organics	NE	410	benzo(a)pyrene	NE	0.067	inorganic analytes	NE	NE	NE	NE
	vinyl chloride	79	NE	oil and grease	NE	625								
Evaluation Area 3 (includes SWMUs M-01, M-02, M-09, and NADEP GAPs 57 and 70)	benzene	10	NE	diesel-range organics	260	NE	SVOCs	NE	NE	aluminum	328,000	NE	328,000	29,000
	carbon tetrachloride	210	NE	gasoline-range organics	35,000	NE				antimony	7.6	NE	NE	10
	1,1-dichloroethane	110,000	4.3	JP-5-range organics	230	NE				arsenic	79	6.4	79	NE
	1,2-dichloroethane	420	NE	motor oil–range organics	200	NE				barium	2,820	NE	2,820	758
	1,1-dichloroethene	11,000	NE							beryllium	10.9	NE	10.9	NE
	1,2-dichloroethene (total)	1,100	NE							cadmium	983	570	NE	570
	cis-1,2-dichloroethene	10,000	NE							calcium	NE	NE	NE	39,000

Table A1-18 (continued)

Area	VOLATILE ORGANIC COMPOUNDS			PETROLEUM HYDROCARBONS			SEMIVOLATILE ORGANIC COMPOUNDS			INORGANIC ANALTYES				
	Analytes Exceeding MCLs or PRGs	Groundwater Maximum (µg/L)	Soil Maximum (mg/kg)	Analytes Exceeding RWQCB ESLs	Groundwater Maximum (µg/L)	Soil Maximum (mg/kg)	Analytes Exceeding MCLs or PRGs	Groundwater Maximum (µg/L)	Soil Maximum (mg/kg)	Analytes Exceeding MCLs, PRGs, or Background Threshold	Exceeding MCLs: Groundwater Maximum (µg/L)	Exceeding Residential PRGs: Soil Maximum (mg/kg)	Exceeding Background Threshold	
													Groundwater Maximum (µg/L)	Soil Maximum (mg/kg)
Evaluation Area 3 (cont.)	trans-1,2-dichloroethene	62	NE							chromium	10,700	850	10,700	850
	tetrachloroethene	72	NE							hexavalent chromium	13,100	47.7	NE	47.7
	1,1,1-trichloroethane	1,600,000	NE							cobalt	NE	NE	NE	551
	trichloroethene	8,000	NE							copper	NE	NE	1,310	138
	vinyl chloride	4,600	NE							iron	NE	80,400	330,000	80,400
										lead	243	527	243	527
										magnesium	NE	NE	NE	19,600
										manganese	NE	NE	24,500	942
										mercury	NE	NE	NE	18.9
										molybdenum	NE	NE	NE	11.3
										nickel	1,030	NE	NE	91.3
										potassium	NE	NE	NE	3640
										silver	NE	NE	NE	10.9
										sodium	NE	NE	NE	9,430
										thallium	NE	5.9	NE	5.9
										vanadium	NE	95.3	818	136
										zinc	NE	NE	1,730	699
Evaluation Area 4 (includes SWMUs NADEP GAP 02, 04, 31)	benzene	22	NE	diesel-range organics	280	NE	SVOCs	NE	NE	antimony	NE	NE	NE	20.7
	1,1-dichloroethane	330	NE	gasoline-range organics	110	NE				arsenic	17.5	329	NE	329
										beryllium	NE	NE	763	NE
	1,2-dichloroethane	6.7	NE	motor oil–range organics	NE	430				cadmium	NE	NE	NE	10.2
	1,1-dichloroethene	350	NE							calcium	NE	NE	NE	32,900
	1,2-dichloroethene (total)	34	NE							cobalt	NE	NE	NE	18.2
	cis-1,2-dichloroethene	3,200	NE							copper	NE	NE	NE	39.4
	trans-1,2-dichloroethene	220	NE							hexavalent chromium	NE	NE	NE	0.706
										iron	NE	NE	7.280	NE
	trichloroethene	90	NE							lead	NE	1,770	NE	1,770
	vinyl chloride	5,500	NE							manganese	NE	NE	8,600	395
										potassium	NE	NE	NE	1,830
										selenium	NE	NE	NE	320
										silver	NE	NE	NE	9.1
										sodium	NE	NE	NE	2,690
										thallium	NE	335	NE	335
										vanadium	NE	NE	29	NE
										zinc	NE	NE	610	NE

Table A1-18 (continued)

Area	VOLATILE ORGANIC COMPOUNDS			PETROLEUM HYDROCARBONS			SEMIVOLATILE ORGANIC COMPOUNDS			INORGANIC ANALTYES				
	Analytes Exceeding MCLs or PRGs	Groundwater Maximum (µg/L)	Soil Maximum (mg/kg)	Analytes Exceeding RWQCB ESLs	Groundwater Maximum (µg/L)	Soil Maximum (mg/kg)	Analytes Exceeding MCLs or PRGs	Groundwater Maximum (µg/L)	Soil Maximum (mg/kg)	Analytes Exceeding MCLs, PRGs, or Background Threshold	Exceeding MCLs: Groundwater Maximum (µg/L)	Exceeding Residential PRGs: Soil Maximum (mg/kg)	Exceeding Background Threshold: Groundwater Maximum (µg/L)	Exceeding Background Threshold: Soil Maximum (mg/kg)
Evaluation Area 5 (includes SWMUs OWS-005 and NADEP GAP 25, and Building 415)	benzene	8.4	NE	diesel-range organics	15,000	15,000	benzo(a)anthracene	NE	28	aluminum	213,000	NE	213,000	17,000
	carbon tetrachloride	130	NE	gasoline-range organics	486,000,000	230,000	benzo(b)fluoranthene	NE	25	antimony	NE	NE	NE	9.6
	1,1-dichloroethane	2,900	NE	jet fuel	14,000	14,000	benzo(k)fluoranthene	NE	15	arsenic	85.8	12.6	85.8	12.6
	1,2-dichloroethane	6.9	NE	motor oil–range organics	3,000	16,000	benzo(a)pyrene	NE	16	barium	3,770	NE	3,770	165
	dichloroethene	2,200	NE	oil and grease	NE	792	bis(2-chloroethyl)ether	NE	0.4	beryllium	7.7	NE	7.7	1.98
	1,1-dichloroethene	290	NE				bis(2-ethylhexyl)phthalate	5,900	NE	cadmium	5.6	NE	NE	11.1
	1,2-dichloroethene (total)	780	NE				chrysene	NE	22	calcium	NE	NE	NE	18,800
	cis-1,2-dichloroethene	130	NE				dibenzo(a,h)anthracene	NE	1.4	chromium	1,130	876	1,130	876
	trans-1,2-dichloroethene	37	NE				1,4-dichlorobenzene	59	NE	hexavalent chromium	9,350	NE	NE	0.962
	ethylbenzene	120	25				indeno(1,2,3-cd)pyrene	NE	2.7	cobalt	NE	NE	NE	77.6
	methylene chloride	25	NE				naphthalene	11,000	NE	copper	NE	NE	372	53
	tetrachloroethene	15	11							iron	NE	26,700	556,000	26,700
	toluene	240	NE							lead	4,420	170	4,420	170
	1,1,1-trichloroethane	4,700	NE							magnesium	NE	NE	NE	7,350
	trichloroethene	270	3.3							manganese	NE	NE	16,000	469
	1,2,4-trimethylbenzene	5,000	NE							nickel	1,170	NE	NE	70
	vinyl chloride	580	NE							potassium	NE	NE	NE	3,200
	xylene (total)	13,000	NE							sodium	NE	NE	NE	3,260
										thallium	2.3	NE	NE	5.1
										vanadium	NE	NE	1,330	64.8
										zinc	NE	NE	1,900	76.5
Evaluation Area 6 (Plume 5-1 area) (includes SWMU AOC 005)	benzene	110	NE	diesel-range organics	864,000	4,800	benzo(b)fluoranthene	NE	1.3	antimony	7	NE	NE	NE
	carbon tetrachloride	320	NE	gasoline-range organics	140	2,200	benzo(a)pyrene	NE	1.2	arsenic	50.5	2.3	50.5	NE
	1,4-dichlorobenzene	5.6	NE	motor oil–range organics	100	310	bis(2-ethylhexyl)phthalate	590	NE	barium	1,220	NE	1,220	NE
	1,1-dichloroethane	280,000	NE	oil and grease	NE	373	indeno(1,2,3-cd)pyrene	NE	0.67	cadmium	6.8	NE	NE	NE
	1,2-dichloroethane	210	NE							chromium	480	NE	480	NE
	1,1-dichloroethene	89,000	NE							cobalt	NE	NE	NE	47.8
	1,2-dichloroethene (total)	1,300	NE							copper	NE	NE	245	NE
	cis-1,2-dichloroethene	230,000	NE							iron	NE	NE	7,120	22,400
	trans-1,2-dichloroethene	2,600	NE							lead	98.8	NE	98.8	78.8
	methylene chloride	300	NE							manganese	NE	NE	9,840	NE
	tetrachloroethene	1,600	NE							nickel	518	NE	NE	NE
	toluene	900	NE							sodium	NE	NE	NE	1,810
	1,2,4-trichlorobenzene	17	NE							thallium	8.4	NE	NE	3.6
	1,1,1-trichloroethane	2,500,000	NE							vanadium	NE	NE	341	NE
	trichloroethene	580,000	2.2							zinc	NE	NE	383	NE
	1,2,4-trimethylbenzene	100	NE											
	vinyl chloride	31,000	NE											

Table A1-18 (continued)

Area	VOLATILE ORGANIC COMPOUNDS			PETROLEUM HYDROCARBONS			SEMIVOLATILE ORGANIC COMPOUNDS			INORGANIC ANALTYES				
	Analytes Exceeding MCLs or PRGs	Groundwater Maximum (µg/L)	Soil Maximum (mg/kg)	Analytes Exceeding RWQCB ESLs	Groundwater Maximum (µg/L)	Soil Maximum (mg/kg)	Analytes Exceeding MCLs or PRGs	Groundwater Maximum (µg/L)	Soil Maximum (mg/kg)	Analytes Exceeding MCLs, PRGs, or Background Threshold	Exceeding MCLs: Groundwater Maximum (µg/L)	Exceeding Residential PRGs: Soil Maximum (mg/kg)	Exceeding Background Threshold: Groundwater Maximum (µg/L)	Exceeding Background Threshold: Soil Maximum (mg/kg)
Evaluation Area 6 (Plumes 5-2 and 5-4 area) (includes SWMUs AST 005Gand NADEP GAP 20 and Buildings 34 and 500)	benzene	7	NE	diesel-range organics	220	22,000	benzo(a)pyrene	NE	0.21	arsenic	33	5.59	33	NE
	carbon tetrachloride	4,600	NE	gasoline-range organics	NE	11,000	bis(2-ethylhexyl)phthalate	NE	44	barium	1,290	NE	1,290	197
	1,1-dichloroethane	24,000	20	motor oil–range organics	670	NE				cadmium	5.3	NE	NE	15.2
	1,2-dichloroethane	570	NE							chromium	503	NE	503	58.2
	1,1-dichloroethene	65,000	NE							cobalt	NE	NE	NE	42.5
	1,2-dichloroethene (total)	580	77							copper	NE	NE	199	84.8
	cis-1,2-dichloroethene	250	NE							lead	124	NE	124	62.7
	trans-1,2-dichloroethene	61	NE							magnesium	NE	NE	NE	7,370
	methylene chloride	14	NE							manganese	NE	NE	31,500	NE
	tetrachloroethene	23	110							nickel	485	NE	NE	66
	toluene	370	NE							potassium	NE	NE	NE	1,760
	1,1,1-trichloroethane	100,000	NE							silver	NE	NE	NE	2.89
	trichloroethene	590	260							sodium	NE	NE	NE	3,300
	vinyl chloride	2,900	NE							thallium	2.8	NE	NE	NE
										vanadium	NE	NE	308	NE
										zinc	NE	NE	473	NE
Data Gap Buildings West of Building 5 (includes SWMU NADEP GAP 27 and Buildings 43, 44, 102, 347, 405, and 505)	benzene	4	NE	diesel-range organics	NE	26	benzo(a)anthracene	NE	13	aluminum	1,410	NE	1,410	15,400
	1,1-diclhloroethane	21	NE	gasoline-range organics	NE	0.55	benzo(a)pyrene	NE	9.1	arsenic	13	5.96	NE	NE
	1,2-dichloroethene (total)	71	NE	jet fuel	NE	13	benzo(b)fluoranthene	NE	17	barium	NE	NE	849	151
	cis-1,2-dichloroethene	22	NE	motor oil–range organics	NE	62	benzo(k)fluoranthene	NE	1.7	beryllium	NE	NE	2.6	NE
	trichloroethene	8.8	NE	oil and grease	NE	694	chrysene	NE	11	cadmium	31.2	NE	NE	
	vinyl chloride	100	0.08				dibenzo(a,h)anthracene	NE	0.68	chromium	NE	NE	NE	75.5
							indeno(1,2,3-cd)pyrene	NE	9.1	copper	NE	NE	NE	45.6
										iron	NE	30,300	11,800	30,300
										lead	NE	NE	NE	62.6
										manganese	NE	NE	9,060	NE
										nickel	NE	NE	NE	93
										potassium	NE	NE	NE	1,650
										thallium	20	NE	NE	3.6
										vanadium	NE	NE	NE	49.2
										zinc	NE	NE	140	81.2

Table A1-18 (continued)

Area	VOLATILE ORGANIC COMPOUNDS			PETROLEUM HYDROCARBONS			SEMIVOLATILE ORGANIC COMPOUNDS			INORGANIC ANALTYES				
	Analytes Exceeding MCLs or PRGs	Groundwater Maximum (µg/L)	Soil Maximum (mg/kg)	Analytes Exceeding RWQCB ESLs	Groundwater Maximum (µg/L)	Soil Maximum (mg/kg)	Analytes Exceeding MCLs or PRGs	Groundwater Maximum (µg/L)	Soil Maximum (mg/kg)	Analytes Exceeding MCLs, PRGs, or Background Threshold	Exceeding MCLs: Groundwater Maximum (µg/L)	Exceeding Residential PRGs: Soil Maximum (mg/kg)	Exceeding Background Threshold: Groundwater Maximum (µg/L)	Exceeding Background Threshold: Soil Maximum (mg/kg)
Data Gap Building 6 Area (includes SWMUs OWS 006 A and B, NAS GAP 01, and UST(R)-02, and Buildings 6 and 282)	benzene	NE	6	diesel-range organics	1,200	11	benzo(a)pyrene	NE	0.064	arsenic	NE	2.6	NE	NE
				gasoline-range organics	4,200	27				barium	NE	NE	NE	153
				jet fuel	1,200	2.3				chromium	NE	NE	NE	55.1
				motor oil–range organics	720	60				lead	100	NE	100	NE
				oil and grease	NE	883				nickel	NE	NE	NE	64
										potassium	NE	NE	NE	1,500
										sodium	NE	NE	NE	1,360
										thallium	NE	5.5	NE	5.5
Data Gap Building 400/ IR Site 10 (includes SWMU M-08)	1,1-dichloroethane	16		diesel-range organics	48,000	14,000				aluminum	11,300	NE	11,300	NE
	trichloroethene	9		gasoline-range organics	3,300	1,300				arsenic	12.6	2.98	NE	NE
				jet fuel	340	8,500				cadmium	6.9	NE	NE	NE
				motor oil–range organics	3,700	9,400				chromium	75.6	NE	75.6	NE
				oil and grease	NE	337				iron	NE	NE	13,500	NE
				other TPH components, total	14,000	16				lead	18.8	NE	18.8	NE
										manganese	NE	NE	15,600	NE
										nickel	268	NE	NE	NE
										vanadium	NE	NE	51	NE
										zinc	NE	NE	333	NE
IR Site 12 (includes SWMU OWS 010)	NE			diesel-range organics	240	NE	benzo(a)anthracene	NE	4.4	aluminum	NE	NE	NE	20,600
				motor oil–range organics	260	60	benzo(b)fluoranthene	NE	4.6	arsenic	NE	7.9	NE	NE
				other heavy TPH components	200	NE	benzo(k)fluoranthene	NE	4.3	barium	NE	NE	NE	143
				total recoverable petroleum hydrocarbons	NE	10,700	benzo(a)pyrene	NE	6.6	beryllium	NE	NE	2.8	2.29
							chrysene	NE	5.5	cadmium	5.6	NE	NE	NE
							dibenzo(a,h)anthracene	NE	0.32	chromium	NE	NE	NE	85.3
							indeno(1,2,3-cd)pyrene	NE	3.7	hexavalent chromium	20	NE	NE	NE
										cobalt	NE	NE	NE	62.1
										copper	NE	NE	NE	40.6
										iron	NE	32,900	28,300	32,900
										lead	20.6	NE	20.6	48.3
										magnesium	NE	NE	NE	9,700
										manganese	NE	NE	19,100	885
										mercury	NE	NE	NE	1.91
										nickel	NE	NE	NE	87.5
										potassium	NE	NE	NE	4,020

Table A1-18 (continued)

Area	VOLATILE ORGANIC COMPOUNDS			PETROLEUM HYDROCARBONS			SEMIVOLATILE ORGANIC COMPOUNDS			INORGANIC ANALTYES				
	Analytes Exceeding MCLs or PRGs	Groundwater Maximum (µg/L)	Soil Maximum (mg/kg)	Analytes Exceeding RWQCB ESLs	Groundwater Maximum (µg/L)	Soil Maximum (mg/kg)	Analytes Exceeding MCLs or PRGs	Groundwater Maximum (µg/L)	Soil Maximum (mg/kg)	Analytes Exceeding MCLs, PRGs, or Background Threshold	Exceeding MCLs: Groundwater Maximum (µg/L)	Exceeding Residential PRGs: Soil Maximum (mg/kg)	Exceeding Background Threshold	
													Groundwater Maximum (µg/L)	Soil Maximum (mg/kg)
IR Site 12 (includes SWMU OWS 010) (cont.)										silver	NE	NE	NE	5.17
										sodium	NE	NE	NE	2,830
										thallium	NE	NE	NE	0.53
										vanadium	NE	NE	NE	NE
										zinc	NE	NE	828	69.1

Acronyms/Abbreviations:
ESL – environmental screening level
IR – Installation Restoration (Program)
µg/L – micrograms per liter
MCL – maximum contaminant level
mg/kg – milligrams per kilogram
NE – no exceedance
OU – operable unit
PRG – preliminary remediation goal
RI – remedial investigation
RWQCB – Regional Water Quality Control Board
SVOC – semivolatile organic compound
SWMU – solid waste management unit
TPH – total petroleum hydrocarbons
U.S. EPA – United States Environmental Protection Agency
VOC – volatile organic compound

Table A1-19
Recommendations for SWMUs at OU-2C

SWMU	Location	Substances Stored at SWMU	Current Navy Sampling Recommendation
I. NFA – Navy and Agencies Concur			
AST 005A (IR Site 5)	East of Building 5	Water and glycol (8,000 gal)	NFA
AST 005B (IR Site 5)	East of Building 5	Water and glycol (8,000 gal)	NFA
AST 005C (IR Site 5)	East of Building 5	Water and glycol (8,000 gal)	NFA
AST 005D (IR Site 5)	East of Building 5	Liquid argon (5,000 gal)	NFA
AST 005E (IR Site 5)	West of Building 5	Liquid nitrogen (200 gal), installed 1973	NFA
AST 005F (IR Site 5)	West of Building 5	Liquid nitrogen (capacity unknown)	NFA
AST 010L (IR Site 12)	North of Building 10	Brine solution (8,800 gal)	NFA
AST 032 (IR Site 5)	Building 32, 2nd floor	Propane	NFA
AST 261 (IR Site 5)	South of Building 261	Liquid argon	NFA
AST 500 (IR Site 5)	NE of Building 500	Propane	NFA
NADEP GAP 22 (IR Site 5)	Building 5	Asbestos (55-gal drums)	NFA
NADEP GAP 24 (IR Site 5)	Building 5	Blasting grit (large bags)	NFA
NADEP GAP 26 (IR Site 5)	Building 5	Blasting grit (large bags)	NFA
NADEP GAP 27A (IR Site 5)	Building 5	Blasting grit (large bags)	NFA
NADEP GAP 29 (IR Site 5)	Building 5, 2nd floor	Aerosol paints	NFA
NADEP GAP 30 (IR Site 5)	Building 5, 2nd floor	Hydraulic oil and Freon 113	NFA
NADEP GAP 39 (IR Site 10)	Building 400, 2nd floor	Paints, lacquer, Freon, stripper sludge, zinc chromate primer, oils, PD-680, naphtha, thinners	NFA
NADEP GAP 42 (IR Site 10)	Building 400, 3rd floor	Batteries, beryllium, paint, oils, PCBs, mercury, oil solvents, Freon, radioactive waste	NFA

Table A1-19 (continued)

SWMU	Location	Substances Stored at SWMU	Current Navy Sampling Recommendation
II. Navy Recommends No Further Sampling			
AOC 261 (IR Site 5)	South of Building 261	UST 261-1, 2, and 3 (kerosene & stoddard solvent)	No. Area will undergo remediation. No additional sampling is necessary for characterization.
M-03 (IR Site 5)	Building 5	Portable 15 gal solvent distillation unit	No. Portable unit. No visible stains, no apparent sizable cracks, no floor drains.
M-04 (IR Site 5)	Building 5	Portable 15 gal solvent distillation unit	No. Portable unit. No visible stains, no apparent sizable cracks, no floor drains.
NADEP GAP 03 (IR Site 5)	Building 5 (northern section of building in shop 95723)	MEK, Freon, oil	No. No visible stains, no apparent sizable cracks, no floor drains.
NADEP GAP 05 (IR Site 5)	Building 5 (northern section of building; shop 95531)	Poly paint, thinner, aerosol paint	No. No visible stains, no apparent sizable cracks, no floor drains.
NADEP GAP 08 (IR Site 5)	Building 5 (northern section of building; shop 95832)	Hydraulic fluid, JP-5, engine oil	No. Secondary containment; oils only. No visible stains, no apparent sizable cracks, no floor drains.
NADEP GAP 10 (IR Site 5)	Building 5	Oil, MEK, PD-680	No. No visible stains, no apparent sizable cracks, no floor drains.
NADEP GAP 11 (IR Site 5)	North of Building 405	Various oils, Freon, JP-5, paint	No. Two samples located nearby with low concentrations; secondary containment; no visible stains, no apparent sizable cracks, no floor drains.
NADEP GAP 12 (IR Site 5)	Building 5	Paint, thinner, MEK	No. No visible stains, no apparent sizable cracks, no floor drains.
NADEP GAP 13 (IR Site 5)	Building 5	Primer, thinner, acetone (55-gal drums)	No. Secondary containment. No visible stains, no apparent sizable cracks, no floor drains.
NADEP GAP 14 (IR Site 5)	Building 5	Hydraulic fluid, JP-5, stripper, oil, fuel (55-gal drums)	No. Had secondary containment; mainly oils; nearby soil sample. Visible stains attributed to vehicle traffic, no apparent sizable cracks, no floor drains.

Table A1-19 (continued)

SWMU	Location	Substances Stored at SWMU	Current Navy Sampling Recommendation
II. Navy Recommends No Further Sampling (continued)			
NADEP GAP 16 (IR Site 5)	Building 5	Hydraulic oil, batteries, contaminated wash water	No. Had secondary containment; mainly oils; nearby soil sample. No visible stains, no apparent sizable cracks, no floor drains.
NADEP GAP 18 (IR Site 5)	Building 5	Coolant, heavy metal grindings (55- and 30-gal drums)	No. Metals (primary chemical of concern), including lead (as requested by the EPA), were part of analytical suite at nearby sample location. (Lead was reported at a concentration of 1.2 mg/kg in the nearby sample).
NADEP GAP 21 (IR Site 5)	Building 5	Lead dust	No. No visible stains, no apparent sizable cracks, no floor drains.
NADEP GAP 23 (IR Site 5)	Building 5	Ethyl acetate (55-gal drums)	No. No visible stains, no apparent sizable cracks, no floor drains.
NADEP GAP 36 (IR Site 10)	Building 400	Aerosol paint, mixed solvents	No. One nearby soil sample analyzed for VOCs. No visible stains, no apparent sizable cracks, no floor drains.
NADEP GAP 37 (IR Site 10)	Building 400	Aerosol paint, hydraulic and lube oils, 1,1,1-TCA and Freon	No. No visible stains, no apparent sizable cracks, no floor drains.
NADEP GAP 38 (IR Site 10)	Building 400	Primer, paints, thinner, alcohol, and MEK	No. No visible stains, no apparent sizable cracks, no floor drains.
NAS GAP 02 (IR Site 12)	South of Building 10	Waste oil (55-gal drums)	No. Secondary containment; groundwater has already been sampled. No visible stains.
NAS GAP 05 (IR Site 5)	Building 2	Perchloroethene and used dry cleaner filter elements	No. Soil sampling targeted for this SWMU; results were ND. Note: Although no additional samples will be collected to directly address this SWMU, several samples will be collected in the vicinity of this location as part of the characterization of a possible release from dry cleaning operations at Building 2.

Table A1-19 (continued)

SWMU	Location	Substances Stored at SWMU	Current Navy Sampling Recommendation
II. Navy Recommends No Further Sampling (continued)			
OWS 615 (IR Site 5)	West of Building 615	Runoff from RCRA hazardous waste storage unit	No. Soil sampling conducted at the location of the OWS. The associated RCRA unit (SWMU 615); received DTSC closure in July 2001.
SWMU 005 (IR Site 5)	Building 5	VV-L-800, rust remover, PD-680, Freon, and alkaline solvent	No. No visible stains, no apparent sizable cracks, no floor drains.
SWMU 614 (IR Site 5)	Building 614	Acids, bases, adhesives, paint	No. Soil sampling conducted at the location of the SWMU 614; recommended for no further action by DTSC.
SWMU 615 (IR Site 5)	Building 615	Acids, bases, adhesives, paint	No. Soil sampling conducted at the location of the SWMU 615; received DTSC closure in July 2001.
UST(R)-01 (IR Site 5)	West of Building 5	UST 5-1 waste oil	To be addressed with sampling at Building 347.
UST(R)-19 (IR Site 5)	South of Building 615	Four units associated with SWMU 615: Waste oil/waste diesel tank (UST 615-4 80-gal) and spill control tanks for SWMU 615 sprinklers (UST 615-1, 2) and OWS 615 (UST 615-3)	No. UST(R)-19, including UST 615-4 that was located about 70 feet east of Building 615, was closed. The closure letter from DTSC was dated July 27, 2001.
III. SWMUs Under TPH Program			
AOC 002 (IR Site 5)	East of Building 2	UST 2-1 diesel	Address under TPH Program.
AST 005H (IR Site 5)	Building 5	1010 oil (1,300 gal)	Address under TPH Program.
UST(R)-12 (IR Site 10)	Building 400	UST 400-1	Address under TPH Program.

Table A1-19 (continued)

SWMU	Location	Substances Stored at SWMU	Current Navy Sampling Recommendation
IV. Further Sampling – Navy and Agencies Concur			
AOC 005 (IR Site 5)	East of Building 5	UST 5-2 (JP-5) and UST 5-3 (waste oil and solvents)	Yes. Known contamination; no sidewall samples were collected. Need shallow confirmation samples to fully delineate the extent of contamination.
AST 005G (IR Site 5)	East of Building 5	Waste oil (40 gal)	Yes. Known contamination in groundwater; however, no soil sampling has been conducted. Area will undergo remediation for TPH in groundwater but requires soil characterization.
M-01 (IR Site 5)	Building 5	50 gal solvent distillation unit	Yes. No visible stains, no apparent sizable cracks, no floor drains. However, large unit and no groundwater sampling in this area.
M-02 (IR Site 5)	Building 5	50 gal solvent distillation unit	Yes. No visible stains, no apparent sizable cracks, no floor drains. However, large unit and no groundwater sampling in this area.
M-05 (IR Site 5)	Building 5	Portable 15 gal solvent distillation unit	Yes. Portable unit. No visible stains, no floor drains. However, cracks in concrete and expansion joint nearby.
M-08 (IR Site 10)	Building 400	Portable 15-gal solvent distillation unit	Yes. Portable unit. No visible stains, no apparent sizable cracks. However, floor drain nearby.
M-09 (IR Site 5)	Building 5	Coolant recovery system (4-500 gal tanks)	Yes. Need VOC analysis.
NADEP GAP 02 (IR Site 5)	Building 5 (northern section of Building in shop 95532)	Poly paint, thinner, naptha	Yes. No nearby soil sampling.
NADEP GAP 04 (IR Site 5)	Building 5 (northern section of building; shop 93532)	Battery acid, nickel-cadmium solution	Yes. Had secondary containment; nearby soil sample included metals analysis as well as VOCs and SVOCs. No visible stains, no apparent sizable cracks, no floor drains. Etched and cracked concrete noted during site inspection.

Table A1-19 (continued)

SWMU	Location	Substances Stored at SWMU	Current Navy Sampling Recommendation
IV. Further Sampling – Navy and Agencies Concur (continued)			
NADEP GAP 17 (IR Site 5)	Building 5	Coolant with nickel, chromium, cadmium, aluminum oxide, silicon carbide (55- and 30-gal drums)	Yes. No nearby samples.
NADEP GAP 20 (IR Site 5)	NW of Building 500	Lead-contaminated items	Yes. No visible stains, no apparent sizable cracks, no floor drains. Liquid wastes in secondary containment. Documentation of adequately maintained drums by the DTSC. However, no sampling for metals.
NADEP GAP 25 (IR Site 5)	Building 5	Ethyl acetate, aluminum oxide, blasting grit, 55-gal drums of unknown waste	Yes. Unknown wastes, no nearby soil samples.
NADEP GAP 27 (IR Site 5)	West of Building 5	Hydraulic oil (55-gal drums)	Yes. On asphalt; no nearby sampling. Sampling for PCBs recommended.
NADEP GAP 31 (IR Site 5)	Building 5	Various oils, solvents, paint (55- and 30-gal drums)	Yes. No visible stains, no floor drains. Cracks in concrete nearby. Sampling for PCBs recommended.
NADEP GAP 57 (IR Site 5)	Building 5	Plating and cadmium solutions	Yes. No nearby soil samples.
NADEP GAP 70 (IR Site 5)	Building 5	Cyanide, chromic acid plating solutions, sulfuric acid, nickel chloride	Yes. Limited analytical suite at previous sample. Additional analyses would include cyanide and hexavalent chromium.
NAS GAP 01 (IR Site 5)	South of Building 6	Oily liquids	Yes. No nearby soil samples; metals reported in groundwater above screening criteria.
OWS 005 (IR Site 5)	South of Building 5, associated with IWTP 5	Unfiltered waste	Yes. Samples collected within 20', however, location is above a storm sewer line and received unfiltered waste for several years.
OWS 006A (IR Site 5)	South of Building 6	Residue from steam cleaning bay	Yes. Collect soil and groundwater samples based on extensive waste chemicals, elevated VOCs in nearby samples, limited samples, and limited analyses.
OWS 006B (IR Site 5)	NW of Building 6	Unspecified	Yes. Collect soil and groundwater samples based on limited sampling in the vicinity of the OWS and elevated diesel in groundwater.

Table A1-19 (continued)

SWMU	Location	Substances Stored at SWMU	Current Navy Sampling Recommendation
IV. Further Sampling – Navy and Agencies Concur (continued)			
OWS 010 (IR Site 12)	Building 10	Unspecified	Yes. Collect soil and groundwater samples.
UST(R)-02 (IR Site 5)	Building 6	Texaco petroleum solvents	Yes. Collect groundwater samples to delineate groundwater plume.

Acronyms/Abbreviations:
- AOC – area of concern
- AST – aboveground storage tank
- CAA – corrective action area
- DTSC – (California Environmental Protection Agency) Department of Toxic Substances Control
- EBS – environmental baseline survey
- gal – gallon
- GAP – generator accumulation point
- IR – Installation Restoration (Program)
- IWTP – industrial wastewater treatment plant
- JP – jet propellant
- MCL – maximum contaminant level
- MEK – methyl ethyl ketone
- NADEP – Naval Aviation Depot
- NAS – Naval Air Station
- NFA – no further action
- OU – operable unit
- OWS – oil/water separator
- PAH – polynuclear aromatic hydrocarbon
- PCB – polychlorinated biphenyl
- PRG – preliminary remediation goal
- RCRA – Resource Conservation and Recovery Act
- RI – remedial investigation
- RWQCB – (California) Regional Water Quality Control Board
- SAP – sampling and analysis plan
- SVOC – semivolatile organic compound
- SWMU – solid waste management unit
- TPH – total petroleum hydrocarbons
- U.S. EPA – United States Environmental Protection Agency
- UST – underground storage tank
- UST(R) – underground storage tank, RCRA waste
- VOC – volatile organic compound

ATTACHMENT A – APPENDIX A2

ANALYTICAL RESULTS FROM PREVIOUS INVESTIGATIONS IS CONTAINED IN ELECTRONIC FORMAT AND IS TOO VOLUMINOUS TO PRINT

TO VIEW THE DATA, CONTACT:

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

TELEPHONE: (619) 532-3676

ATTACHMENT B

DATA MANAGEMENT PLAN

Department of the Navy
Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

Contract No. N68711-95-D-7526

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY

CLEAN 3

FINAL
DATA MANAGEMENT PLAN FOR SUPPLEMENTAL REMEDIAL INVESTIGATION SAMPLING AT OPERABLE UNIT 2C ALAMEDA POINT ALAMEDA, CALIFORNIA

CTO-0093/0203
May 2007

Prepared by:

BECHTEL ENVIRONMENTAL, INC.
1230 Columbia Street, Suite 400
San Diego, California 92101-8502

Signature: Eric Johansen Date: 4/27/07
Eric Johansen, CTO Leader

Signature: Toni Kuzmack Date: 4/26/07
Toni Kuzmack, Database/Laboratory Services Supervisor

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ACRONYMS/ABBREVIATIONS

BEIDMS	Bechtel Environmental Integrated Data Management System
CCS	contract compliance screening
CLEAN	Comprehensive Long-Term Environmental Action Navy
CTO	contract task order
DMP	data management plan
DQO	data quality objective
FS	feasibility study
GPS	global positioning system
NEDD	Naval Electronic Data Deliverable
OU	operable unit
PDCC	Program Document Control Center
PP	program procedure
QA	quality assurance
QC	quality control
RI	remedial investigation
SAP	sampling and analysis plan
SOP	standard operating procedure
TS	technical specification
U.S. EPA	United States Environmental Protection Agency

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Section 1
INTRODUCTION

This Data Management Plan (DMP) provides site-specific guidance related to the collection, maintenance, and use of data in support of the supplemental remedial investigation sampling to be conducted at Operable Unit (OU)-2C at Alameda Point, Alameda, California. This work is being conducted under the Comprehensive Long-Term Environmental Action Navy (CLEAN) 3 Program, Contract Task Order (CTO)-0093. Activities to occur at OU-2C are referred to as "the Project"; the entire CLEAN Program is referred to as "the Program."

This DMP is a companion document to the Bechtel National, Inc., Program DMP (BNI 1993). The Program DMP provides guidance for managing Program data so that they are controlled, documented, and retrievable in the format required by the end user. The intent of the Program DMP is to integrate the entire life cycle of environmental data, from planning data collection to archiving data elements, into a logical sequence that addresses all CLEAN data needs. Implementing this Project DMP will result in meeting the data maintenance and access requirements specified in the Program DMP. This DMP emphasizes managing, verifying, and validating data to satisfy the Program data quality objectives (DQOs).

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Section 2
DATA MANAGEMENT OVERVIEW

The Program data management system is composed of the database itself, the computer hardware and software, the data management protocols, application programs, relevant procedures, and the Data Management staff. Primary data management activities include establishing sampling designs; collecting, encoding, verifying, and validating data; performing quality assurance (QA)/quality control (QC) evaluation of data; and generating output.

Project data will consist of various types, ranging from field measurements (e.g., surveying and characterization of the groundwater) to laboratory analyses. Site data requirements for this Project will be governed by a specific type of data and DQO. Unique data-type combinations will be available to accommodate the specific data collection and reporting needs for this Project. Figure 2-1 shows the typical data life cycle, including stages of sampling plan development, data collection, data analysis, data review, and data use.

Generators of data will follow the Sampling and Analysis Plan (SAP) and program procedures (PPs) to assure that collected data adhere to Program environmental data standards. In addition, collected data will be subjected to surveillance by QA/QC personnel and technical review by Project staff. Periodic audits of analytical laboratories will be conducted also, and results will be tracked and documented through the Program Document Control Center (PDCC) to comply with analytical data reporting requirements as specified in CLEAN Technical Specification (TS)-002 (BNI 2004a).

2.1 APPLICABLE PROCEDURES

The following CLEAN PPs discuss database functions and tasks (BNI 2004b):

- PP T 2.1, Environmental Database
- PP T 2.2, Sample Information Management System
- PP T 2.3, Sample Analysis Tracking Module
- PP T 2.4, Data Review
- PP T 2.5, Data Analysis for RI/FS
- PP A 1.1, Document Control Records Keeping and Handling

The Program application of the Bechtel Environmental Integrated Data Management System (BEIDMS) is currently running Version 3.7f under Oracle Relational Database Management System, Version 9i. PP T 2.1, which includes the BEIDMS user manual and data dictionary, will be revised to reflect the current software version whenever upgrades occur.

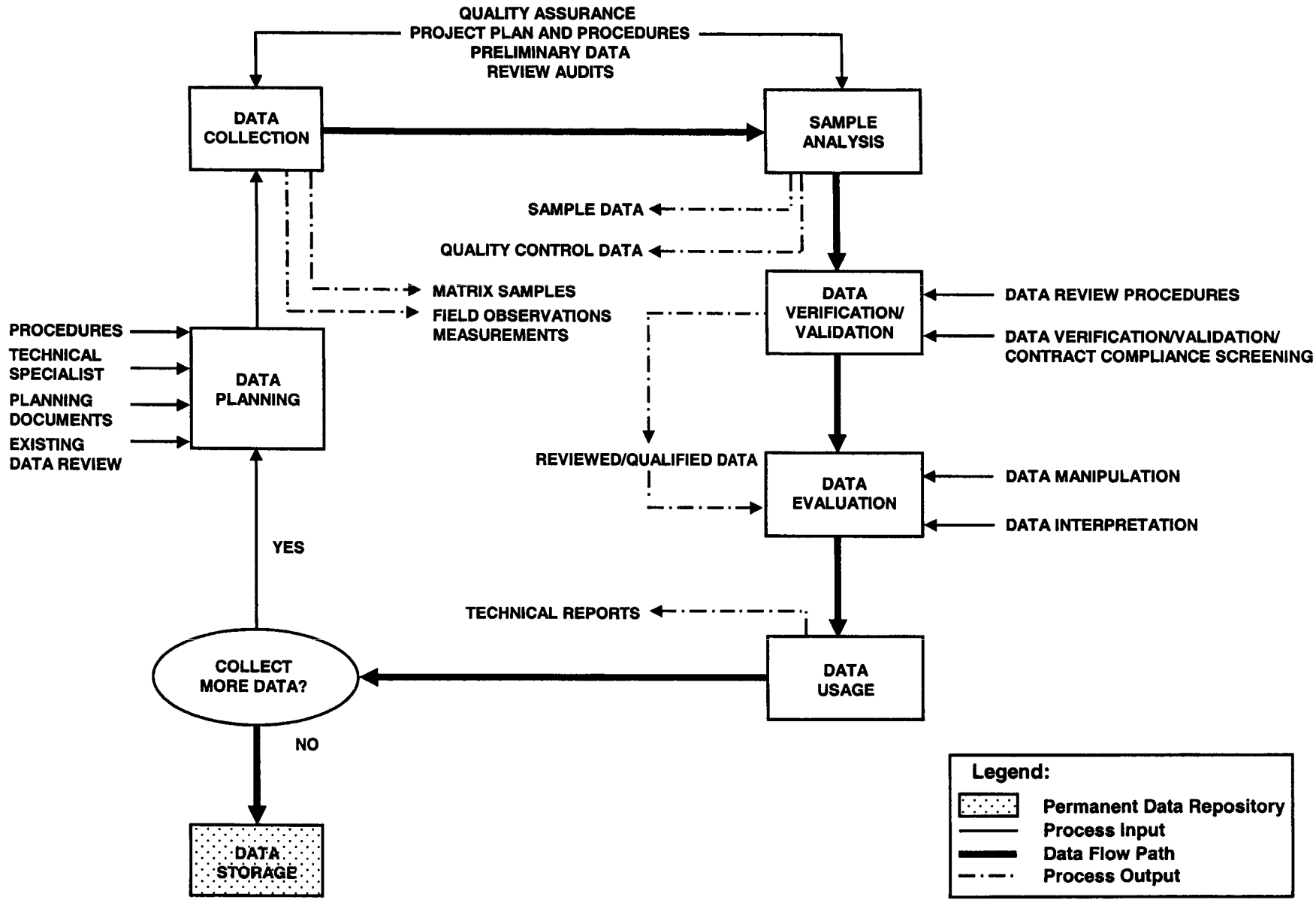

Figure 2-1
Data Life Cycle

Rev 07/20/01

2.2 DATA MANAGEMENT RESPONSIBILITIES

The Data Management staff shares responsibility for high-quality products with Project management. All stages of data processing—from the design of data collection schemes and definition of DQOs to transmittal of data to the Navy—require that the Project technical and management staffs team with Data Management staff.

The CTO Leader is responsible for:

- oversight of Project data-gathering activities;
- adherence to Program data management procedures;
- review of field-collected data;
- timely transmission of data to PDCC and the Data Management group; and
- review of hard copy data when they are received from the laboratory, providing a preliminary check on the data value accuracy.

The PDCC staff is responsible for accurate and timely entry of data transmittals from field and laboratory sources into the PDCC database (communications control register and supplier document register numbering systems) and for distribution of the appropriately numbered data submittals to the Program Database Supervisor and CTO Leader.

The Data Management staff compiles Project data into the Program database, making data readily available to Program and Project personnel; trains data users; develops application interfaces; and provides systems maintenance and data archival services. The Data Management staff is responsible for defining access levels (e.g., read-only, modify, add, and delete privileges) for new users, setting up user accounts (e.g., assigning passwords, allocating directory space, and providing instructions for logging onto the system), and defining user profiles. User profiles include the type of terminal or workstation, user expertise, and application.

The data management system is geared to meet user needs and to respond to deficiencies or new applications, as they become known. Therefore, field and sample collection staff will respond to user feedback and oversee the system in coordination with the Data Management staff. Data Management staff responds to requests from the Navy and assures conformance to the Navy's data management practices.

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Section 3
DATABASE

The database resides in a computer system at the Program San Diego office. The database is maintained by use of Oracle, a relational database management software system. (See PP T 2.1, Environmental Database, for details on database content, format, and utility.) The database files to be used in this Project are described in the following sections. Table 3-1 lists data tables and information categories used in the Program database; see the Program DMP for descriptions.

3.1 SURVEY DATA

Sampling locations will be surveyed by a civil survey subcontractor in the field. The horizontal position of sampling locations will be defined relative to the State Plane Coordinate System, North American Datum 1983. Sampling location elevations will be defined relative to the North American Vertical Datum 1988. The results will be presented as maps or drawings accurately associated with permanent benchmarks. These maps will be available to Project staff in both hard copy and electronic format.

Sample station location data will be stored in the BEIDMS database. These data will be formatted as described in the Program DMP and Naval Electronic Data Deliverable (NEDD) standard.

The database table SAMPLE_STATIONS contains the location data for either survey or global positioning system (GPS)-generated coordinates. This table is used for locations that are referenced to other data assembled in the course of the investigation or to repeated sampling events at the same location.

3.2 GEOLOGICAL DATA

In the course of subsurface drilling investigations, data will be gathered on soil classification, particle size, odor, color, and equipment performance to characterize site geology. This information must be spatially correlated with other data and, therefore, will be incorporated into mapping or drawing systems using the gINT integrated database system.

Soil and lithology data are entered into three database tables. The first is BOREHOLES, which includes soil boring characteristics observed in the field. The second is WELL_CONSTRUCTION, which contains records of well construction details for each well. The final table is LITHOLOGY, which is the repository for data specific to soil type and stratigraphic information.

3.3 CHEMICAL ANALYSIS RESULTS

Chemical analysis results include concentrations for classes of compounds, specific compounds, or elements detected in samples by field or laboratory analytical methods. The data are collected for a number of purposes, including safety and health monitoring, selection of samples for analysis, evaluation of contaminant concentrations, waste

Table 3-1
Program Data Tables and Information Categories

Table Type	Table Name
Reference	ANALYTES
Reference	ANALYTE_ALIASES
Reference	ANALYTE_TYPES
Descriptor	BOREHOLES
Tracking	CHAINS_OF_CUSTODY
Reference	COLLECTION_METHODS
Tracking	CONTAINERS
Reference	CONTAINER_TYPES
Reference	CRITERIA
Tracking	DATA_PACKAGES
Tracking	DATA_SOURCES
Descriptor	FACILITIES
Measurement	FIELD_MEASUREMENTS
Measurement	FIELD_RESULTS
Reference	INSTRUMENTS
Descriptor	LITHOLOGY
Tracking	LOG_BOOKS
Reference	MATRICES
Reference	METHODS
Reference	PAY_ITEMS
Reference	PAY_ITEMS_METHODS
Reference	PRESERVATIVES
Reference	QUALIFICATION_CODES
Reference	QUALIFIERS
Reference	QUALITY_LEVELS
Tracking	REQUESTED_ANALYSIS
Measurement	RESULTS
Tracking	RESULT_QUALCODE
Reference	RESULT_TYPES
Measurement	SAMPLES
Descriptor	SAMPLE_STATIONS
Reference	SAMPLE_TYPES
Tracking	SAMPLING_EVENTS

(table continues)

Table 3-1 (continued)

Table Type	Table Name
Descriptor	SITES
Descriptor	STATION_TYPES
Tracking	TRANSFERS
Descriptor	UNITS
Measurement	WATER_LEVEL_MEASUREMENTS
Descriptor	WELLS
Measurement	WELL_CONSTRUCTION

disposal, and prediction of fate and transport of contaminants. However, the primary purpose of data collection is to evaluate the presence of contaminants and respective concentrations.

The chemical data may be characterized as:

- field analysis data,
- field-screening data, and
- laboratory analysis data.

Each data type has a specific purpose reflecting a quality management strategy tailored to data use. This strategy is defined through the DQO process.

3.3.1 Field Analysis Data

The collection of field analysis data is expected during this project. Examples of field analysis data include water temperature, dissolved oxygen content, electrical conductivity, field pH measurements, turbidity, and oxidation/reduction potential. Field analysis data are differentiated from screening data by the level of precision and accuracy that can be expected from the procedure. Field analysis data are supported by calibration of the instruments using two or more standards, as well as by continuing calibration verification at frequencies specified in CLEAN PPs and standard operating procedures (SOPs) (BNI 2004b). The field analysis results are entered into the FIELD_MEASUREMENTS database table as appropriate.

3.3.2 Field-Screening Data

Field-screening data are used to direct the course of work; analyses are typically performed using direct-reading instrumentation. Results from field screening are compared to preestablished threshold values. The field staff may collect field-screening data during sampling or safety and health monitoring. The results are recorded in the field logbook along with any related work-process decisions. This documentation is reviewed by appropriate supervisory staff for quality; if appropriate, the data are recorded for future reference in the database table FIELD_MEASUREMENTS.

3.3.3 Laboratory Analysis Data

A large portion of the Project data management support will be associated with laboratory-based analyses. Detailed laboratory procedures will be used as specified in the SAP. These procedures must be consistent with CLEAN PPs to assure data precision, accuracy, representativeness, completeness, and comparability. To help manage the data and the many contractual and procedural requirements, analytical results will be entered in the database table RESULTS and referenced to several other associated database tables.

Management of sample information will include the use of data collection forms, chain-of-custody forms, sample labels, custody seals, etc., as necessary to follow the procedures outlined in PP T 2.2, Sample Information Management System.

The following will be monitored during fieldwork:

- submittal of samples for laboratory analysis
- schedules associated with sample analyses (including holding times)
- transfer of electronic data deliverables and hard copies from the laboratory
- tracking of data verification and validation

3.4 DATA ENTRY

In general, data will be electronically transferred to the Program database. Electronic data will be transferred using magnetic media (e.g., tapes, diskettes, or storage cartridges). Detailed procedures for transmittal of data are provided in PP T 2.2; PP A 1.1, Document Control Records Keeping and Handling; and various SOPs covering inquiry, collection, and recording of specific data types.

Field sampling data will be manually entered into the Program database. These data will include sampling dates and locations, field screening and analysis measurements, and data qualifiers from the data validation reports. Data will be entered according to appropriate QA and verification requirements.

3.5 GEOGRAPHIC INFORMATION SYSTEM DATA

Cartographic data will include spatial information and descriptions of discrete geographic features (e.g., sampling station locations and contaminant concentration levels) and continuous features (e.g., surface elevation contours). The geographic information system databases for the Program are developed and stored using ArcView software, which interfaces with the environmental database via Oracle. In cases where detailed drawings are needed for other purposes (e.g., engineering drawings), computer-assisted drafting software is used.

3.6 STANDARDIZATION

The Program DMP establishes a standard data management process. Thus, data users on each CLEAN project can retrieve data from any investigation knowing that values for given parameters are comparable. Furthermore, the data management software converts variables to standardized units whenever necessary to be consistent with the established formats. Any change to raw data will be documented on a database change request, which will be tracked through PDCC and recorded in the electronic data management system.

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Section 4
DATA REVIEW

Review of laboratory data includes data verification and evaluation; contract compliance screening (CCS); data validation, qualification, and review; and a general assessment of the data. Independent, third-party data validation may also be used to meet project DQOs, as stated in the SAP. Detailed methodologies for these processes are presented in PPs T 2.4, Data Review, and T 2.5, Data Analysis for RI/FS. Unverified and unvalidated data will be stored in a temporary repository until the appropriate level of data review has been completed.

After data review, corrections will be made and limitations identified. Then the data will be released for use.

4.1 DATA VERIFICATION AND EVALUATION

Data generators will be responsible for data verification and evaluation at each site. The generators may be the lead field investigators or the Project laboratory coordination staff.

Lead field investigators, designated by the Project manager, will collect and verify data (i.e., confirm that database entries match field logbook entries). Verification tasks will be governed by PP T 2.4 and CLEAN SOPs. Verification checklists for each type of collected data will be used and included in the PDCC document tracking system as attachments to the data collection forms and/or electronic data deliverables.

Electronic data will be transferred using magnetic media (e.g., tapes, diskettes, or storage cartridges). The transmitter will verify and document that the data on the associated hard copy match the contents of the data file. Any discrepancies will be resolved by a Project technical specialist.

In addition, a qualified professional (designated by the CTO Leader) will evaluate all data (field and laboratory) as soon as they become available. This evaluation confirms that the collected data make sense. For example, a water-level measurement collected on a date before mobilization in the field would be questioned, as would a water-quality parameter that is highly inconsistent with what is expected (e.g., when the water in the well is pure—without trace elements).

The integrity of any data modification or input will also be maintained by using standard methods. These methods include rechecking output documents by both the originator of the data and a second checker. At a minimum, the database content must match the raw data exactly as received by Data Management staff and as documented in PDCC. Any necessary changes to data in BEIDMS are tracked both on hard copy (data review/ correction forms) and within the database audit function.

4.2 CONTRACT COMPLIANCE SCREENING

Following the verification of analytical data, a CCS will be performed. The CCS will assess the completeness of laboratory deliverables and analytical laboratory subcontractor compliance with specified analytical protocols, QA/QC protocols, and the laboratory's specific subcontract requirements. All Project personnel performing the CCS will be

completely familiar with the Project data requirements. If there is significant noncompliance with the contract, the review process will stop and the compliance issues will be resolved. Resubmittals of hard copy data packages from the laboratory may be requested.

4.2.1 Completeness Assessment

The completeness assessment will determine whether all required data package deliverables are present (e.g., case narratives, chain-of-custody forms, sample results, required QC information, and raw data). A "laboratory deliverables requirements review checklist" will be completed for each analytical method and filed in PDCC with the associated data packages.

Additionally, the assessment will determine if the following requirements have been met.

- Results were reported for all samples on the chain-of-custody forms for specified analytical parameters unless laboratory sample discrepancy reports provide adequate explanations for omissions.
- Results were reported for all compounds or analytes within a given analytical method.

4.2.2 Compliance Assessment

The compliance assessment involves determining whether the laboratory has met the following criteria.

- Holding times were met.
- Data were reported in the correct units of measure.
- Correct analytical methods were employed.
- Required QA/QC was performed.
- Reporting forms were completed for all samples submitted; reporting forms were submitted for each reanalysis, dilution, and other laboratory procedure, with all requisite flags and dilution factors; and problems encountered during analysis were documented in the case narratives.
- Complete analyte names were provided in case narratives if the names were truncated by laboratory software.

4.3 DATA VALIDATION, QUALIFICATION, AND REVIEW

Laboratory data packages may be validated by an independent subcontractor, in accordance with CLEAN TSs for data review, PP T 2.4, Southwest Division Naval Facilities Engineering Command Environmental Work Instruction No. 1 (SWDIV 2001), and United States Environmental Protection Agency (U.S. EPA) National Functional Guidelines for Data Review (U.S. EPA 1999, 2004). Data generated solely for the purposes of remedial design will not be subjected to independent third-party validation.

However, the data packages submitted by the laboratory will be kept on file to allow third-party validation later (in the event that the data are applied for alternative uses, such as risk assessment or site closure). Data validation requirements are specified in the SAP.

Validation of a data package includes:

- identifying data anomalies,
- assessing method compliance,
- assessing calibration frequency and acceptability,
- assessing QC frequency and acceptability, and
- qualifying data to identify data usability limitations.

If applicable, analytical data will be assigned review qualifiers based on data validation. Review qualifiers will be in accordance with the applicable U.S. EPA guidelines (U.S. EPA 1999, 2004). Laboratory and review qualifiers are fully defined in CLEAN TS-004 (BNI 1998). Any data assigned an "R" qualifier (rejected data) will not be used for any purpose (including, but not limited to, risk assessment, data interpretation, tables, and figures).

Data may be qualified if data reports lacked sufficient supporting information to allow clear interpretation of the data. Analytical data may be further qualified based on contamination reported in associated field blanks in accordance with U.S. EPA risk assessment guidance. Any specified data qualification will be documented in the report.

The usefulness of data for specific purposes will be based on application-related data requirements, methods of collection, and validation flags for analytical results. Data qualification will be fully documented, and data quality will be easily interpreted by referencing qualifier flags within each table. Any specific data qualification that requires further explanation can be documented in comment fields within the database tables.

The data verification and validation processes result in categorizing (flagging) the data according to established classification criteria (e.g., verified, validated, unvalidated, or invalid). These classification categories are determined after technical specialists have reviewed the data. The qualified data considered "acceptable" are accompanied by documentation showing that:

- sample collection followed approved procedures and protocols that were appropriate to yield reliable and reproducible results,
- data reporting included sufficient supporting information to allow clear interpretation of the data, and
- QA/QC procedures were clearly documented and implemented both in the field and in the laboratory.

Unacceptable data are those that do not fulfill these requirements. Insufficient or questionable data will be further documented or supported by collecting more information as required.

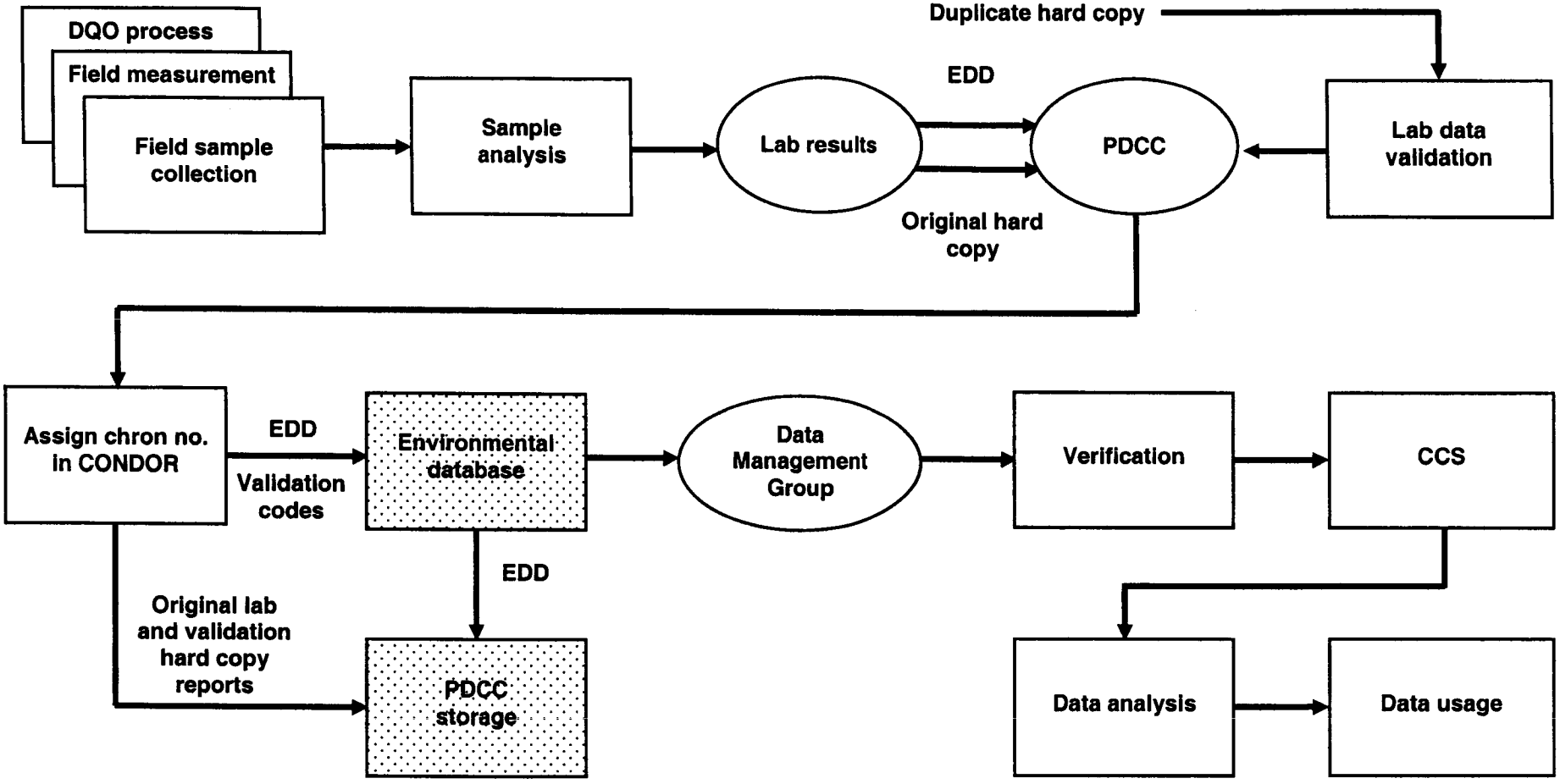
Data will be reviewed in accordance with PP T 2.4 (Figure 4-1). New data will be verified by assuring that applicable PPs are followed. The data may then be validated as directed in the SAP. Unverified and unvalidated data will be stored in a temporary repository until the appropriate level of data review has been completed. Specific project technical personnel will have access to these data for field decision-making purposes and assuring collected data make sense. Once the data review process is completed (including appropriate documentation), corrections are made, and limitations are identified, data will be loaded into the production database and released for use.

4.4 GENERAL ASSESSMENT

The general assessment is an overall evaluation of the data and a summary of data review activities and significant results. In addition to the compliance screening and data verification and validation (if applicable), the data reported from the analysis of the samples will be evaluated to assure that they are of sufficient quality for use in the investigation. Insufficient or questionable data will be further documented or supported by collecting more information as required. Data will be evaluated in accordance with PP T 2.4 (Figure 4-1).

The general assessment will include:

- evaluation of whether sampling objectives were clearly defined and whether sufficient data were collected to meet the DQOs as stated in the Work Plan;
- evaluation of whether data reported from the analysis of the samples are of sufficient quality for use in the project;
- a summary of the significant results of the laboratory QC samples;
- a summary of the significant results of the field QC samples;
- a summary of the significant data validation findings for all analytical parameters; and
- an assessment of the data based on precision, accuracy, representativeness, completeness, and comparability parameters as defined in the SAP.



Acronyms/Abbreviations:
- CCS – contract compliance screening
- CONDOR – CONtrolled DOcument Register
- DQO – data quality objective
- EDD – electronic data deliverable
- PDCC – Program Document Control Center

Legend:
- Permanent data repository
- Data flow path

Figure 4-1
Field Sampling Data Process

Rev 07/20/01

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Section 5
DATA ACCESS AND MAINTENANCE

The following subsections discuss data access, documentation, security, backup and recovery, and transfer of data to the Navy.

5.1 DATA ACCESS

The data management system provides direct user access to the verified and validated database tables through customized screens and menus. The Project applications requiring access to these data will include data reporting and statistical evaluations.

Data users assigned to this Project will be able to obtain environmental data reports by requesting specific output from the database tables. Output reports will be developed based on specifications that Project technical staff provides to Data Management staff. More sophisticated data users can perform their own queries to generate Oracle output using the appropriate access program.

5.2 DOCUMENTATION

All data input, procedures, and output (products) will be fully documented and tracked to assure retrievability and provide data users with a library of available data and applications. Detailed documentation procedures are presented in PP T 2.2, Sample Information Management System, and PP A 1.1, Document Control Records Keeping and Handling. PP T 2.1, Environmental Database, describes database table variables, data sources, file formats, measurement units, and other attributes that will be needed by data users to generate specific products. For example, Chemical Abstracts Service numbers are in the ANALYTE_ID field, and laboratory QC results are in the ANALYSIS_CODE and ANALYTE_TYPE fields. Specific data requirements associated with laboratory analytical methods employed to measure sample contaminant concentrations, site geologic characteristics, and other reference and descriptive information are presented in the SAP. These data will also be tracked and documented within the data management system.

5.3 SECURITY

Access to Project data will be unlimited to authorized users, but various levels of access will be established and maintained to assure complete data security and integrity. The data management system is designed to protect against unauthorized data access and corruption of data. User access is controlled by the use of passwords, and users will be provided read-only access to data.

On-line access to data tables will be granted to users with read-only privileges for specialized applications or for routine report generation. Only Data Management staff will be able to make changes to validated data, and such changes may occur only when database change requests have been submitted through PDCC with authorization signatures from appropriate technical and management staffs.

Oracle offers the following levels of user privileges.

- DBA (database administrator) – Create user accounts and assign passwords; grant data access by table and user privileges; and set system access on tables, views, and disk space within the database.
- RESOURCE – With read/write privileges to the database, add or change data, and create tables and views.
- CREATE SESSION – Access the database with read-only privilege.
- SELECT – Access specific rows or columns of tables and views with read-only privilege.

Preliminary data may be available for modification for specific activities such as the entry of data quality codes by data validators. However, once the data are declared to be validated/verified by authorized personnel (e.g., qualified data validators for laboratory analytical data or lead field investigators for field data collection verification), the data will be placed in production database tables. Only Data Management staff can modify production tables and only when database change requests have been completed and approved by appropriate project managers and technical specialists. Modifications to validated data will also be tracked electronically as separate variables within database tables. Tracking variables will include the user identification of the person making the change to the database, the date of the change, and the PDCC document control number of the database change request.

Data users responsible for output from application systems will be responsible for developing ways to assure integrity and security of their respective data and programs residing on the various systems. Data Management staff may assist data users in the performance of application systems and data backups.

5.4 BACKUP AND RECOVERY

System failure and other disasters create the potential for accidental data corruption. A rigorous backup and recovery program prevents this possibility. Procedures for the backup and recovery are presented in the Program DMP. The Data Management staff makes and maintains backup copies of data files and data tables for archiving. Tapes or cartridges of the backups will be stored both locally and in an area outside the computer facility.

5.5 DATA TRANSFER TO THE NAVY

All the attributes and information within the environmental database (and related applications such as gINT) will be encoded so that transfers of data to the Navy will be in accordance with NEDD as directed in the Naval Facilities Engineering Command Southwest Environmental Work Instruction No. 6 (NAVFAC Southwest 2005). Spatial data and drawing files will adhere as closely as practical with the Tri Services Spatial Data Standards. Turnover of the data will take place at CTO closure; however, interim submittals may be made at the request of the Navy Remedial Project Manager.

Section 6
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ATTACHMENT C

INVESTIGATION-DERIVED WASTE MANAGEMENT PLAN

Department of the Navy
Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

Contract No. N68711-95-D-7526

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY

CLEAN 3

FINAL INVESTIGATION-DERIVED WASTE MANAGEMENT PLAN FOR SUPPLEMENTAL REMEDIAL INVESTIGATION SAMPLING AT OPERABLE UNIT 2C ALAMEDA POINT ALAMEDA, CALIFORNIA

CTO-0093/0203
May 2007

Prepared by:

BECHTEL ENVIRONMENTAL, INC.
1230 Columbia Street, Suite 400
San Diego, California 92101-8502

Signature: Eric Johansen
Eric Johansen, CTO Leader

Date: 4/27/07

ACRONYMS/ABBREVIATIONS

CLEAN	Comprehensive Long-Term Environmental Action Navy
CTO	contract task order
IDW	investigation-derived waste
IDWMP	investigation-derived waste management plan
OU	operable unit
PPE	personal protective equipment
RI	remedial investigation
UN	United Nations

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Attachment C
INVESTIGATION-DERIVED WASTE MANAGEMENT PLAN

The following paragraphs give instructions for collecting, handling, packaging, transporting, and disposing of investigation-derived waste (IDW) generated during field activities. These activities will be conducted in support of a supplemental remedial investigation sampling effort at Operable Unit (OU)-2C at Alameda Point, Alameda, California. The sampling techniques employed will generate a minimal quantity of IDW per sample. The wastes generated will include soil cuttings from soil borings, disposable personal protective equipment (PPE), equipment-decontamination water, and purgewater from monitoring wells.

Solid IDW (e.g., soil or construction debris) at OU-2C will be placed in covered, portable roll-off bins lined with plastic sheeting or in covered United Nations (UN)-approved 55-gallon drums. The mixing of regular trash and nonhazardous construction debris with potentially contaminated IDW will be avoided. Liquid IDW (e.g., decontamination water) will be placed in Baker tanks or in covered UN-approved 55-gallon drums. Uncontaminated PPE and nonhazardous construction debris will be placed in industrial waste bins. Contaminated PPE and sampling equipment will be placed in covered UN-approved 55-gallon drums.

Each container will be clearly labeled to indicate the waste source. An example of the identification label to be affixed to each container is included as Figure 1. The label color will be black and white (black lettering on white background) and the label material will be weather-resistant. The labels will not be used for shipping or disposal purposes. Before disposal or shipment off-site, the waste-disposal subcontractor will label containers with appropriate identification and classification information. Following labeling, IDW container information will be recorded on the Container Inventory Log, an example of which is included as Figure 2. The site manager will maintain the log in the field. A weekly inspection of IDW storage will be conducted and documented.

IDW containers will be transported to and stored in a secured area designated by the Navy. Containers of IDW will be stored with secondary containment structures. IDW will be disposed off-site by the waste-disposal subcontractor within 90 days of collection. The 90-day clock begins on the first day that material is placed in the first container. The waste-disposal subcontractor will provide services including, but not limited to, sampling and profiling, handling and manifesting, and transportation and disposal of IDW. The subcontractor will collect IDW samples for analyses and waste profiling as soon as practicable. Solid and liquid IDW from subsurface sampling within Building 5 and at two locations west of Building 5 (DG347B03 and DG347B01) will be subject to the requirements of the Radiological Work Instruction (Attachment H to the Work Plan).

It has been concluded that the IDW generated during this investigation will not be classified as listed wastes under Title 40 *Code of Federal Regulations* Section 261.31 to 261.33. Samples collected as part of the field investigation will not be used to profile the waste. The Navy will be responsible for selecting the methods and location of IDW disposal and for signing all manifests.

INVESTIGATION-DERIVED WASTE

SAMPLE – PENDING ANALYSIS

DO NOT HANDLE OR MOVE DRUM OR REMOVE LID WITHOUT AUTHORIZATION

The contents of this container have been sampled and are pending analytical results. State and Federal law prohibits improper disposal. Questions regarding this container should be directed to one of the Department of the Navy representatives listed on this label below.

Project:	[Navy CLEAN 3]
Location:	[Base Name, city and state]
Installation Point of Contact:	[e.g., ROICC, on-site contact]
Site-Specific Location:	[Site location and boring/well locations]
Owner:	[e.g., U.S. Navy XYZ Base or activity]
CTO No.:	[CTO X]
Navy Remedial Project Manager:	[Fred Smith, (XXX) XXX-XXXX]
Container No.:	[e.g., # 0001]
Contents:	[e.g., drill cuttings, wastewater, used PPE]
Date Container Filled:	[Date]

Figure 1
Sample Investigation-Derived Waste Label

Acronyms/Abbreviations:
- CLEAN – Comprehensive Long-Term Environmental Action Navy
- CTO – contract task order
- PPE – personal protective equipment
- ROICC – Resident Officer in Charge of Construction

Container Inventory Log

Page ____ of ____

Field activities began _____

Field activities ended _____

Container No.	Container Contents (e.g., water, soil, sludge, PPE)	Sampling Location (e.g., boring/well #)	Date Container Filled	Comments

Figure 2
Container Inventory Log

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ATTACHMENT D

SITE-SPECIFIC SAFETY AND HEALTH PLAN SUPPLEMENT

Department of the Navy
Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

Contract No. N68711-95-D-7526

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY

CLEAN 3

FINAL
SITE-SPECIFIC SAFETY AND HEALTH PLAN SUPPLEMENT FOR SUPPLEMENTAL REMEDIAL INVESTIGATION SAMPLING AT OPERABLE UNIT 2C ALAMEDA POINT ALAMEDA, CALIFORNIA

CTO-0093/0203
April 2007

Prepared by:

BECHTEL ENVIRONMENTAL, INC.
1230 Columbia Street, Suite 400
San Diego, California 92101-8502

Signature: _____ Date: 4/17/07
Eric Johansen, CTO Leader

Signature: _____ Date: 4/17/07
Anil P. Dharmapal, Safety and Health Manager

This document serves as a supplement to the CLEAN Program Safety and Health Plan. Section numbering corresponds to section numbering contained in that document. Only sections of the Plan that have been modified appear in this Site-Specific Safety and Health Plan Supplement.

FOREWORD

This Site-Specific Safety and Health Plan Supplement (SSHP) has been prepared for use by Bechtel Environmental, Inc., in support of Comprehensive Long-Term Environmental Action Navy (CLEAN) Program management and technical environmental services of the Department of the Navy Base Realignment and Closure (BRAC) Program Management Office West. This SSHP implements the Bechtel Environmental, Inc., safety and health policies, applicable Occupational Safety and Health Administration regulations, and BRAC Program Management Office West requirements, as described in the CLEAN Program Safety and Health Plan (BNI 1997).

This SSHP describes the project site-specific requirements for implementing the CLEAN Safety and Health Program. Supplemental documents to this plan are the Navy CLEAN Program Procedures (BNI 2004). This site-specific plan supplements the CLEAN Program Safety and Health Plan (BNI 1997).

This SSHP is reviewed and approved by the Bechtel Environmental, Inc., Program Manager and Safety and Health Manager. The SSHP is submitted to the Navy for concurrence. Field revision is controlled in accordance with CLEAN Standard Operating Procedure 28, Field Change Request (BNI 2004).

This plan includes requirements for all Program personnel entering controlled areas or handling potentially contaminated items or equipment.

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N00236.002752
ALAMEDA POINT
SSIC NO. 5090.3

FOR SECTIONS NOT MODIFIED

SITE HEALTH AND SAFETY PLAN
(REVISION 2)

DATED 01 SEPTEMBER 1997

IS FILED AS ADMINISTRATIVE RECORD NO.
N00236.002210

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ACRONYMS/ABBREVIATIONS

AHA	activity hazard analyses
AOC	area of concern
AM	action memorandum
BEI	Bechtel Environmental, Inc.
bgs	below ground surface
BRAC	Base Realignment and Closure
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
CPR	cardiopulmonary resuscitation
CS	caretaker site
CTO	contract task order
EC	emergency coordinator
EDC	Economic Development Conveyance
ERT	emergency response team
°F	degrees Fahrenheit
FWBZ	first water-bearing zone
HAZMAT	hazardous materials
HEPA	high-efficiency particulate air
HWP	hazardous work permit
IDW	investigation-derived waste
IR	Installation Restoration (Program)
MSL	mean sea level
mrem	millirem
NAS	Naval Air Station
NAVFAC SW	Naval Facilities Engineering Command Southwest
OSHA	Occupational Safety and Health Administration
OU	operable unit
OV	organic vapor
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PPE	personal protective equipment
PP SH	Program Procedure Safety and Health

RASO	Radiological Affairs Support Office
RI	remedial investigation
SHM	Safety and Health Manager
SSHP	site-specific safety and health plan supplement
SSHR	Site Safety and Health Representative
SVOC	semivolatile organic compound
SWBZ	second water-bearing zone
TPH	total petroleum hydrocarbons
VOC	volatile organic compound
WP	work plan

Section 1
INTRODUCTION

This Site-Specific Safety and Health Plan Supplement (SSHP) has been developed for the supplemental remedial investigation (RI) sampling to be conducted at Operable Unit (OU)-2C at Alameda Point, Alameda, California. The main objectives of this fieldwork are to install monitoring wells; conduct soil, soil gas, and groundwater sampling; and perform aquifer testing in order to evaluate concentrations of chemical compounds in shallow soil, soil gas, and groundwater and to establish groundwater flow direction at the site. Bechtel Environmental, Inc., (BEI) will perform this work for Base Realignment and Closure Program Management Office West under Contract Task Order (CTO)-0081 of the Comprehensive Long-Term Environmental Action Navy (CLEAN) 3 Program, Contract No. N68711-95-D-7526.

1.1 SPECIFIC REQUIREMENTS

Field activities will be conducted at OU-2C, which is located in the central portion of Alameda Point. Monitoring well and piezometer installation, soil and groundwater sampling, and aquifer testing may be conducted in roadways where vehicular traffic may be present; soil gas sampling will be conducted inside buildings only. Vehicular traffic is considered a medium hazard.

When personnel are working near roads, the Site Safety and Health Representative (SSHR) will determine the appropriate level of traffic protection (i.e., warning signs, cones, delineators, and/or flagmen) required to maintain a safe working environment. Section 6.2.5 describes guidelines for working near vehicular traffic in more detail.

1.2 PURPOSE OF PLAN

This SSHP addresses sections of the CLEAN Program Safety and Health Plan, Revision 2 (BNI 1997), that have been modified specifically for fieldwork to be conducted as part of the supplemental RI at OU-2C. Section numbering parallels the Program Safety and Health Plan. Sections not modified (Section 9, Medical Surveillance, Section 13, Respiratory Protection Program, Section 15, Subcontractor Requirements, Section 17, First Aid Plan, Section 18, Field Safety Plan, Section 19, Visitor Access Requirements, and Section 20, Personnel Requirements) are not included in this supplement. Please refer to the Program Safety and Health Plan for sections not included here. Copies of this SSHP and Program Safety and Health Plan will be available in the BEI field trailer/sampling vehicles for review.

This SSHP describes the work to be performed and addresses safety and health concerns related to field activities for soil, soil gas, and groundwater sampling to be conducted at OU-2C. Personal protection requirements, safe working practices, monitoring and site control procedures, and contingency plans for emergency situations are also presented in this SSHP. Additional safety and health requirements are included in the activity hazard analyses (AHAs) that will be developed prior to the start of fieldwork, and reviewed by the field team members, subcontractors, the Navy Safety Officer and the Resident Officer in Charge of Construction. The AHAs, together with any CLEAN program procedures referenced in the SSHP will be reviewed by CLEAN field personnel, including subcontractors, and will be available for review on-site.

1.3 TASK SUMMARY

The following specific tasks will be performed at OU-2C.

- collection and analysis of soil samples from two depth intervals (between the surface and top of the water table) at up to 100 direct-push sampling locations
- collection and analysis of soil samples from three depth intervals (between the surface and top of the water table) at up to 97 direct-push sampling locations, including an estimated 44 step-out sampling locations
- collection and analysis of soil samples from four depth intervals at 8 direct-push sampling locations
- collection and analysis of discrete groundwater samples at one depth interval (10 to 15 feet below ground surface [bgs]) from 7 direct-push sampling locations (of the 205 total direct-push sampling locations described above)
- collection and analysis of discrete groundwater samples at two depth intervals (10 to 15 feet bgs and 25 to 30 feet bgs) from 34 direct-push sampling locations (of the 205 total direct-push sampling locations described above)
- collection and analysis of a discrete groundwater sample at one depth interval (4 to 8 feet bgs) from two direct-push sampling locations, and at two depth intervals (10 to 15 feet bgs and 25 to 30 feet bgs) from two direct-push sampling locations
- collection and analysis of discrete groundwater samples at two depth intervals (10 to 15 feet bgs and 25 to 30 feet bgs) from 10 direct-push step-out sampling locations
- collection and analysis of subslab soil gas samples from 100 locations beneath Building 5
- installation of up to 15 groundwater monitoring wells
- collection and geotechnical analysis of soil samples from one depth interval (10 to 15 feet bgs, 25 to 30 feet bgs, or 60 to 70 feet bgs) at 6 of the 15 groundwater monitoring well locations
- collection and analysis of groundwater samples from up to 15 new and up to 14 existing groundwater monitoring wells
- installation of up to eight piezometers or piezometer pairs for aquifer testing

Section 2
SITE DESCRIPTION

Alameda Point, located on the western tip of Alameda Island, is the location of former Naval Air Station (NAS) Alameda (Figure 2-1). Most of Alameda Point is man-made land, constructed with materials dredged from the San Francisco Bay. These materials were emplaced as early as the late 1800s, significantly before the beginning of naval activities in the area.

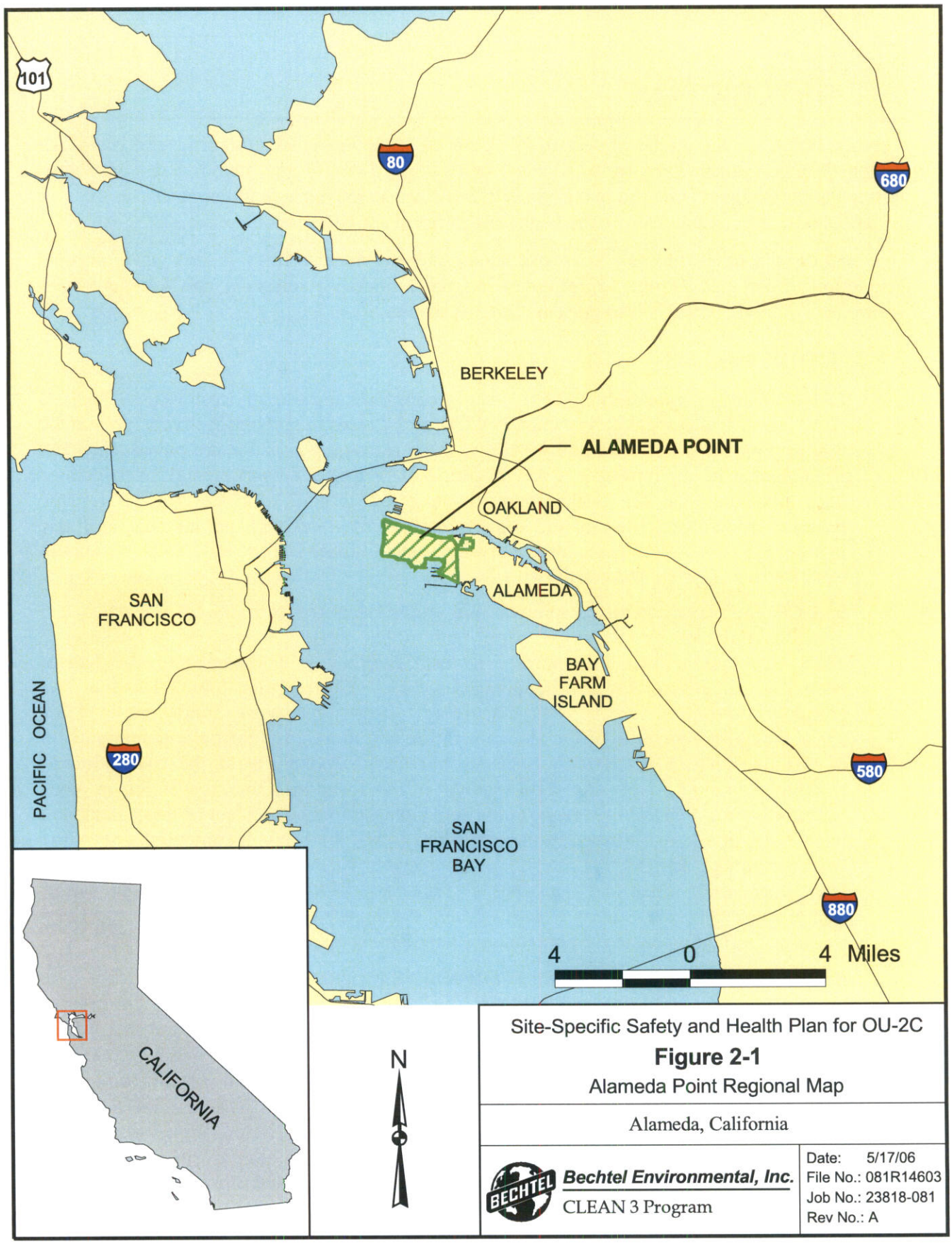
This section discusses the OU-2C work areas and provides a brief history and physical description of Alameda Point. Information on the topography, climate, and known wastes reported at Alameda Island is also presented in this section.

2.1 WORK AREAS

OU-2C is an approximately 53-acre area and comprises Installation Restoration (IR) Sites 5, 10, and 12, which are approximately 47, 4, and 2 acres in size, respectively. While the majority of OU-2C is covered by buildings, the remaining portions are paved areas and limited areas of unpaved open space (Figure 2-2). Previous environmental investigations have indicated that the contaminants in soil and groundwater are volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polynuclear aromatic hydrocarbons (PAHs), pesticides, polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH), and metals.

In 1999, the Navy completed removal and replacement of storm drain lines which had been contaminated by radium-226 from radium-dial painting operations in Building 5. These storm drain lines were located beneath Building 5 and outside of Building 5, extending southward toward Seaplane Lagoon. During this removal action, an abandoned storm drain line was discovered. Additional work conducted in 1999 characterized the location of the abandoned line and revealed radioactive contamination of this line (NAVFAC 2002). Because the structural integrity of the foundation of Building 5 could be jeopardized by removal of the abandoned line, it was left in place beneath the building. However, no sampling is planned within 15 feet of this abandoned line. Also, in a May 2002 action memorandum (AM), the Navy documented a non-time critical removal action (NTCRA) to remove materials contaminated with radium-226 from storm drain lines and manholes at IR Site 5 (NAVFAC 2002). In an earlier Radiological Closeout Survey Report (TtEMI 2001), the Navy demonstrated that there was no significant radioactive contamination remaining inside Buildings 5 and 400.

Boreholes will be advanced to three different total depths at locations within the site, including inside buildings and outdoor areas where vehicular traffic may be present (e.g., parking areas and roadways). For the upper and lower portions of the first water-bearing zone (FWBZ), boreholes will be advanced to approximately 15 and 30 feet below ground surface (bgs), respectively. Boreholes advanced to the second water-bearing zone (SWBZ) will have a total depth of approximately 70 feet bgs. The boreholes will be advanced for the collection of soil, soil gas, and discrete groundwater samples and for the installation of monitoring wells and piezometers. Additionally, groundwater samples will be collected from some existing monitoring wells at the site. Sampling locations will be selected prior to field mobilization.



Site-Specific Safety and Health Plan for OU-2C

Figure 2-1

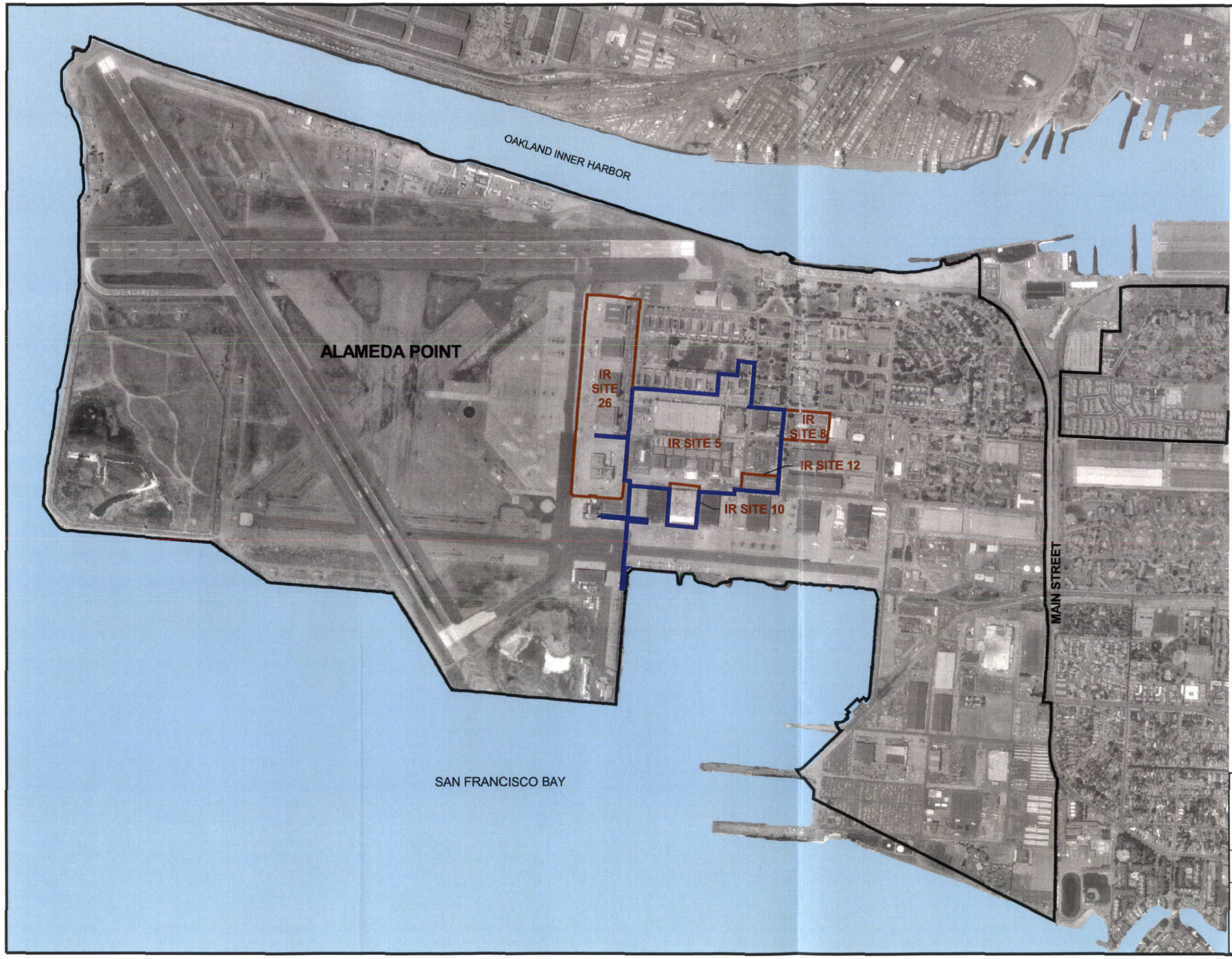
Alameda Point Regional Map

Alameda, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 5/17/06
File No.: 081R14603
Job No.: 23818-081
Rev No.: A



LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- NAVY ONSHORE PROPERTY BOUNDARIES
- WATER

NOTES:

OU – OPERABLE UNIT

IR – INSTALLATION RESTORATION (PROGRAM)

N

1200 0 1200 Feet

Site-Specific Safety and Health Plan for OU-2C

Figure 2-2

Site Location Map

Alameda, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 5/10/06
File No.: 081L14606
Job No.: 23818-081
Rev No.: A

PAGE NO. D2-4

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2.2 SITE DESCRIPTION AND HISTORY

The U.S. Army acquired the original base property from the City of Alameda in 1930 and began construction activities in 1931. In 1936, the Navy acquired title to the land from the Army and began building an air station in response to the military buildup in Europe before World War II. Construction of the base included the filling of tidelands, marshlands, and sloughs with dredge materials from the San Francisco Bay. The base was operated as an active naval facility from 1940 to 1997.

NAS Alameda and its two major tenants, the Navy Public Works Center and Naval Aviation Depot Alameda, conducted a variety of operations at Alameda Point. These included aircraft, engine, gun, and avionics maintenance; engine overhaul and repair; fueling activities; and plating, stripping, and painting activities. The Navy Public Works Center also operated two power plants, a transportation shop, and a pesticide shop at Alameda Point. In addition, the base operated a deepwater port capable of berthing aircraft carriers. The deepwater port was used primarily for minor ship maintenance.

In September 1993, NAS Alameda was designated for closure by United States Congress and the Base Realignment and Closure Commission. NAS Alameda ceased naval operations in April 1997. The Navy is currently in the process of returning the land to the City of Alameda and the United States Fish and Wildlife Service. The Navy and the City of Alameda are working with the Alameda Reuse and Redevelopment Authority to determine appropriate reuse options. On July 22, 1999, Alameda Point was placed on the National Priorities List (64 *Federal Register* 140, 39878–39885, Final Rule, July 22, 1999). The Comprehensive Environmental Response, Compensation, and Liability Information System identification number for NAS Alameda is CA2170023236.

OU-2C, located in the central portion of Alameda Point, comprises IR Sites 5, 10, and 12.

2.3 TOPOGRAPHY AND CLIMATE

Alameda Island lies at the base of a gently westward-sloping plain that extends from the Oakland-Berkeley Hills in the east to the shore of the San Francisco Bay in the west. Alameda Island is characterized by a low topographic profile, with surface elevations varying from mean sea level (MSL) to approximately 30 feet above MSL. The topography of OU-2C is primarily flat and rises to approximately 11 feet above MSL.

The San Francisco Bay area is characterized by a Mediterranean climate with mild summer and winter temperatures. The mean annual precipitation at Alameda Island is 23 inches, with most of the precipitation generally occurring from October to April. Mean yearly low and high temperatures are 52 degrees Fahrenheit (°F) and 67 °F, respectively. The wind direction is predominantly from the west or northwest, with rare occurrences of gale-force or greater winds. Heavy fog that sometimes impairs visibility for navigation occurs on an average of 21 days per year (National Weather Service 2001).

2.4 KNOWN WASTE CHARACTERISTICS

Based on previous investigations, the known contaminants and likely risk drivers at OU-2C are the following:

- Soil: VOCs, SVOCs, PAHs, PCBs, TPH, and metals
- Groundwater: VOCs, SVOCs, PAHs, pesticides, TPH, and metals

Section 3
SCOPE OF WORK

The fieldwork planned for OU-2C includes the following general activities:

- advancing direct-push shallow soil borings
- collecting soil samples
- collecting discrete groundwater samples
- collecting soil gas samples
- installing monitoring wells
- collecting monitoring well groundwater samples
- installing piezometers
- performing aquifer testing

Fieldwork activities may be conducted in roadways close to vehicular traffic and within buildings.

3.1 TASK SUMMARY

The following specific tasks will be performed at OU-2C.

- collection and analysis of soil samples from two depth intervals (between the surface and top of the water table) at up to 100 direct-push sampling locations
- collection and analysis of soil samples from three depth intervals (between the surface and top of the water table) at up to 97 direct-push sampling locations, including an estimated 44 step-out sampling locations
- collection and analysis of soil samples from four depth intervals at 8 direct-push sampling locations
- collection and analysis of discrete groundwater samples at one depth interval (10 to 15 feet bgs from 7 direct-push sampling locations (of the 205 total direct-push sampling locations described above)
- collection and analysis of discrete groundwater samples at two depth intervals (10 to 15 feet bgs and 25 to 30 feet bgs) from 34 direct-push sampling locations (of the 205 total direct-push sampling locations described above)
- collection and analysis of a discrete groundwater sample at one depth interval (4 to 8 feet bgs) from two direct-push sampling locations, and at two depth intervals (10 to 15 feet bgs and 25 to 30 feet bgs) from two direct-push sampling locations
- collection and analysis of discrete groundwater samples at two depth intervals (10 to 15 feet bgs and 25 to 30 feet bgs) from 10 direct-push step-out sampling locations
- collection and analysis of subslab soil gas samples from 100 locations beneath Building 5
- installation of up to 15 groundwater monitoring wells

- collection and geotechnical analysis of soil samples from one depth interval (10 to 15 feet bgs, 25 to 30 feet bgs, or 60 to 70 feet bgs) at 6 of the 15 groundwater monitoring well locations
- collection and analysis of groundwater samples from up to 15 new and up to 14 existing groundwater monitoring wells
- installation of up to eight piezometers or piezometer pairs for aquifer testing

3.2 PERIOD OF EXECUTION

It is anticipated that fieldwork will be performed beginning in 2007.

3.3 PRINCIPAL SUBCONTRACTORS ON-SITE

Table 3-1 identifies CLEAN subcontractors scheduled to perform field activities at OU-2C that include utility clearance, land surveying, concrete cutting, soil gas sampling, monitoring well installation, and waste disposal. Authorized field representatives for subcontractor personnel are expected to be identified at least 10 business days prior to initiating each field activity.

Table 3-1
Subcontractors for RI Activities at OU-2C

Field Activity	Subcontractor	Authorized Field Representative	Telephone
Land survey	Kier & Wright	Robert Ruiz	(925) 249-6555
Geophysical utility clearance	Advanced Geological Services	Bob Mundt	(800) 250-3402
Concrete cutting	Precision Sampling, Inc.	Mike Fraser	(510) 237-4575
	Environmental Support Technologies	Kevin Ardahl	(949) 679-9500
	Gregg Drilling & Testing, Inc	Chris Christensen	(925) 313-5800
Soil gas sampling	Environmental Support Technologies	Kevin Ardahl	(949) 679-9500
Direct-push drilling services	Precision Sampling, Inc.	Mike Fraser	(510) 237-4575
Monitoring well installation	Gregg Drilling & Testing, Inc.	Chris Christensen	(925) 313-5800
Monitoring well sampling	Blaine Tech Services, Inc.	William Jones	(408) 573-0555
IDW disposal	NRC Environmental Services	Rich Lodge	(510) 749-1390
Radiological monitoring	New World Technology	Robert Evans	(720) 260-3033

Acronyms/Abbreviations:
IDW – investigation-derived waste
OU – operable unit
RI – remedial investigation

Section 4
ORGANIZATION AND RESPONSIBILITIES

Table 4-1 identifies personnel responsible for fieldwork. Table 4-2 provides additional contact information.

Table 4-1
Responsible Personnel for the Site

Title	Name	Daytime Telephone	After Hours Telephone
Project Manager	Janet Argyres	(415) 768-9917	(510) 889-6070
Contract Task Order Leader	Eric Johansen	(619) 744-3091	(905) 331-1857
Field Coordinator	Robert Schilling	(310) 308-6343	(310) 308-6343
Field Geologist Supervisor	Cathie Stumpenhaus	(415) 768-4248	(650) 921-1419
Site Safety and Health Representative	Stephen Quayle	(510) 715-7941	(510) 865-1814
Safety and Health Manager	Anil Dharmapal	(760) 484-6520	(760) 484-6520
Radiological Control Technician	Robert Evans	(720) 260-3033	
Radiological Monitoring Support Project Manager	William Haney	(419) 855-4640	Cell (419) 297-3132

Table 4-2
Additional Contact Information

Entity	Address	Main Telephone	Facsimile	Contact/ Project Manager
Bechtel Environmental, Inc.	1230 Columbia Street, Suite 400 San Diego, CA 92101-8502 or 45 Fremont Street San Francisco, CA 94105	(619) 687-3091 (415) 768-9917	(619) 687-8787 (415) 768-5128	Eric Johansen (CTOL) or Janet Argyres (Project Manager)
Brown and Caldwell	9665 Chesapeake Drive, Suite 201 San Diego, CA 92123	(858) 514-8822	(858) 514-8833	Vijay Bedi
Kleinfelder	5015 Shoreham Place San Diego, CA 92122-5926	(858) 320-2000	(858) 320-2001	John Moossazadeh
Dean Ryan Consultants and Designers, Inc.	350 South Grand Avenue Suite 3920 Los Angeles, CA 90071	(213) 687-1130	(213) 687-1139	Wanda Martinez
BRAC Program Management Office West	1455 Frazee Road, Suite 900 San Diego, CA 92108-4310	(619) 532-0945	(619) 532-0940	Mary Parker
Navy ROICC San Francisco Bay Area	2450 Saratoga Street, Suite 200 Alameda, CA 94501-7545	(510) 749-5940	(510) 749-5949	Gregory Grace

(table continues)

Table 4-2 (continued)

Entity	Address	Main Telephone	Facsimile	Contact/ Project Manager
DoD BRAC Program Management Office	410 Palm Avenue, B-1 Suite 161 (Treasure Island) San Francisco, CA 94130-1806	(415) 743-4713	(415) 743-4700	Doug DeLong
Navy RASO	NWS P.O. Drawer 260 Building 1971 Yorktown, VA 23691-0260	(757) 887-4692	(757) 256-1414	Matthew Slack

Acronyms/Abbreviations:
BRAC – Base Realignment and Closure
CTOL – Contract Task Order Leader
DoD – Department of Defense
RASO – Radiological Affairs Support Office
ROICC – Resident Officer in Charge of Construction

Section 5
HAZARD IDENTIFICATION

This section discusses hazard assessment and significant hazards associated with the work proposed to complete the supplemental remedial investigation at OU-2C.

5.1 HAZARD ASSESSMENT

Table 5-1 identifies potential job hazards that may be encountered during the fieldwork at OU-2C based on field conditions and activities. Section 6 presents a job-hazard analysis and a multiple-site hazard assessment. Significant hazards identified during the job hazard analysis are described in Section 5.2. Table 5-2 lists chemicals suspected or determined to be present at the site.

5.2 SIGNIFICANT HAZARDS

Significant hazards identified during the job-hazard analysis include hazards associated with heavy equipment/drilling, fire and explosion, manual materials handling, and working near vehicular traffic (Table 5-1).

Separate activity hazard analyses will be developed prior to the CTO field readiness review. The activity hazard analyses will summarize in a sequential manner the principal steps of an activity and the associated safety and health hazards, recommended controls, equipment, and inspection requirements.

Table 5-1
Job Hazard Identification

Risk or Hazard	Evaluation	General Compensatory Measures
Substances identified without OSHA, ACGIH, NIOSH, or other recognized exposure limits	All substances identified have exposure limits.	Frequent exposure monitoring will be conducted. Respiratory protection will be readily available on-site.
Unidentified substances or uncontrolled dumping of objects on-site	Unidentified substances may be present in subsurface areas.	Frequent monitoring will be conducted using direct instrumentation.
Substances that may be skin-absorbed	Some organics may be skin-absorbed.	Appropriate PPE and skin protection will be used during sampling.
Substances for which skin is the principal target organ	PCBs may be present at some sampling locations.	Appropriate PPE and skin protection will be used during sampling.
Fire hazard	Risk of fire is minimal.	Fire extinguishers will be present on all site vehicles and heavy equipment. Dry brush will be cleared from site operations.
Radioactivity	Radiation hazards (radium-226) may be present at OU-2C.	Appropriate PPE with skin protection will be used during sampling, as necessary.
Regulated carcinogens	Benzene and other recognized-but-unregulated carcinogens are potentially present.	Monitoring will be done with direct-reading instrumentation; screening devices and respiratory protection will be available.
VOCs, SVOCs, PAHs, pesticides, PCBs, TPH, and metals	These analytes are expected in some soil and groundwater at the site.	Appropriate PPE will be used during sampling. Respiratory protection will be readily available on-site.
Heat stress	This hazard may be present, particularly when wearing PPE.	Personnel will be encouraged to increase fluid intake and implement a work/rest regimen; worker core temperature will be monitored.
Buried objects and underground utility lines	This hazard may be present.	Plans will be checked; underground utility survey will be performed.
Solar radiation	Outdoor work presents this hazard.	Personnel will be encouraged to use sunscreen or covering clothing.
Noise in excess of 85 dBA	This hazard may be present during drilling operations.	A hearing conservation program and hearing protection will be used.
Nip-and-pinch points	This hazard is expected with heavy equipment.	Guards will be used when possible and as required; operators will be requested to identify these points prior to work.

(table continues)

Table 5-1 (continued)

Risk or Hazard	Evaluation	General Compensatory Measures
Rotating equipment (e.g., drilling or concrete coring operations)	This hazard is present during drilling operations or concrete coring.	Although some PPE may be loose-fitting, excessively loose clothing will not be permitted. At least two people must be present when the drill rig is operating. At no time will anyone be allowed to operate a drill rig alone. Drill rigs shall be equipped with two easily accessible emergency shutdown devices (switches), one for the driller and one for the driller's helper.
Manual material handling	This hazard is possible when moving sample coolers, bags of cement, and items on the ground.	Training will be given in proper lifting techniques (including use of a helper) when lifting heavy objects.
Slip, trips, and falls	This hazard is possible with equipment and materials placed on ground.	Good housekeeping practices will be employed.
Cuts, contusions, and electrocutions	This hazard is possible from using energized equipment, improper use of equipment, no machine guarding, etc.	Lockout/tagout practices, machine guarding, and safe operating practices will be used.
Traffic	This hazard may be present.	Traffic control will be required on or at edges of roadways.
Unlawful behavior	Fieldwork will be conducted at a non-operational facility open to the public. Violent situations, although unlikely, may present themselves.	When personnel are on the site, at least two workers will be present ("buddy" system). A field cell phone will be available at each sampling location at all times.
Debris piles within buildings	This hazard is present in some of the buildings being investigated.	Locate borings away from debris piles. Clearly mark out main debris areas on a map to prevent slip, trip, and fall hazards.
Darkened work areas within abandoned buildings	This hazard is present within some of the buildings.	Provide lighting using generators (located in a dry, well-ventilated area) and using extension cords equipped with GFCI. Also, individual flashlights will be made available for all workers.

(table continues)

Table 5-1 (continued)

Risk or Hazard	Evaluation	General Compensatory Measures
Six-phase heating remediation system	The operation of the six-phase remediation system has the potential to energize subsurface utilities, underground pipes, and other metal structures within the radius of influence of the remediation system.	Coordination with the remediation contractor will be required and an assessment of the potential hazards associated with this program will be performed by the Bechtel Health and Safety Manager, who will determine the appropriate precautions to be used.
Ponding of water within abandoned buildings	This hazard may be present within some of the buildings.	Locate borings away from ponded areas. Ensure that electrical equipment is safely protected when working close to ponded areas.

Acronyms/Abbreviations:
- ACGIH – American Conference of Governmental Industrial Hygienists
- dBA – decibels measured on the A-weighted scale
- GFCI – ground-fault circuit interruptor
- NIOSH – National Institute for Occupational Safety and Health
- OSHA – Occupational Safety and Health Administration
- OU – operable unit
- PAH – polynuclear aromatic hydrocarbon
- PCB – polychlorinated biphenyl
- PPE – personal protective equipment
- SVOC – semivolatile organic compound
- TPH – total petroleum hydrocarbons
- VOC – volatile organic compound

Table 5-2
Chemicals Suspected or Determined To Be Present at OU-2C

Chemical Class	Analytes
VOCs	acetone, benzene, bromodichloromethane, carbon tetrachloride, chloroethane, chloroform, 1,4-dichlorobenzene, 1,1-dichloroethane, 1,2-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, 1,2-dichloropropane, isopropylbenzene, methylene chloride, sec-butylbenzene, tetrachloroethene, 1,1,1-trichloroethane, trichloroethene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, vinyl chloride, xylene (total)
SVOCs and PAHs	benzo(k)fluoranthene, benzo(a)pyrene-equivalent, bis(2-chloroethyl)ether, bis(2-ethylhexyl)phthalate, carbazole, dibenzofuran, naphthalene, 2,2-oxybis(1-chloropropane)
Pesticides	aldrin, beta-benzene hexachloride
PCBs	Aroclor 1254 and Aroclor 1260
TPH	gasoline, diesel, jet fuel, motor oil, and organic lead
Metals	aluminum, antimony, arsenic, barium, cadmium, total chromium, hexavalent chromium, iron, lead, manganese, nickel, thallium, vanadium, zinc

Acronyms/Abbreviations:
- OU – operable unit
- PAH – polynuclear aromatic hydrocarbon
- PCB – polychlorinated biphenyl
- SVOC – semivolatile organic compound
- TPH – total petroleum hydrocarbons
- VOC – volatile organic compound

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Section 6
HAZARD ANALYSIS

This section presents a hazard analysis and details the physical/industrial and chemical hazards identified or potentially present at Alameda Point during field activities. This section also provides a task-specific analysis of hazards encountered and/or associated with the work to be performed. Table 6-1 presents an analysis of industrial hazards by task.

6.1 RISK ANALYSIS

Field activities will produce low to medium hazards to the field crew, according to standards outlined in Program Procedure Safety and Health (PP SH) 5.1.2, Safe Work Operation Process (BNI 2004). Direct-push sampling, hollow-stem auger drilling, and working near roadways are considered medium hazards.

6.2 PHYSICAL HAZARDS

Physical hazards associated with field activities include noise, heavy equipment operation, falling, slipping, tripping, manual lifting, vehicle traffic, fire and/or explosion hazards, electrocution, and heat stress. The Program Safety and Health Plan (Revision 2) (BNI 1997) details these subjects. The following subsections address categories of physical hazards specific to field activities at OU-2C.

6.2.1 Construction Noise

Use of heavy equipment during direct-push sampling and hollow-stem auger drilling, and monitoring well installation and sampling activities can present a high noise exposure to personnel within the immediate area. Working near a direct-push sampling or hollow-stem auger rig can subject workers to noise exposure in excess of allowable limits. Personnel who do not need to be near loud equipment will be required to stay away to minimize exposure. Personnel who operate or must work next to the direct-push sampling or hollow-stem auger rig will be required to wear hearing protection. Hearing protection will be mandatory when the noise level reaches or exceeds 85 decibels measured on the A-weighted scale as an 8-hour, time-weighted average. Excessive noise areas will be established as controlled zones and will have warning signs posted. Only persons with proper hearing protection will be allowed into these areas.

6.2.2 Rotating Equipment

Drilling or concrete-coring operations provide the potential for serious injury. Personal articles that could be entangled in rotating equipment, such as loose clothing, excessively loose-fitting Tyvek suits, jewelry, loose long hair, etc., will not be permitted near rotating equipment (e.g., drill rigs, concrete corers). Rotary drill rigs will be equipped with a guard or barricade around the drill string to prevent the drilling crew or field staff from coming into contact with the drill string during operations. In addition, the drill rigs will be equipped with two easily accessible emergency shutdown devices (switches), one for the driller and one for the driller's helper.

Table 6-1
Industrial Hazard Analysis

Task	Estimated Task Duration	Hazards	Controls
Mobilization and setup	1 week	Vehicle operation Materials handling Lifting Pinch points	Safety rule training, inspection
Land and geophysical utility surveys	1 week	Vehicle operation Materials handling Lifting Pinch points	Safety rule training, inspection
Soil and discrete groundwater sampling using a direct-push method (including concrete coring to access subsurface media)	4 weeks	Rotating equipment Lifting Pinch points Heat stress (particularly when wearing PPE) Chemical exposure Radioactivity exposure	Safety rule training, site control, emergency shutdown devices, decontamination protocols, PPE, respirators, air monitoring
Monitoring well and piezometer installation using a hollow-stem auger method Monitoring well development, sampling, and testing	5 weeks	Rotating equipment Lifting Pinch points Heat stress Chemical exposure	Safety rule training, site control, auger guards and emergency shutdown devices, decontamination protocols, PPE, respirators, air monitoring
Soil gas sampling (including concrete coring to access subsurface media)	3 weeks	Rotating equipment Lifting Pinch points Heat stress Chemical exposure	Safety rule training, site control, emergency shutdown devices, decontamination protocols, PPE, respirators, air monitoring
Decontamination of equipment	Daily	Chemical exposure Steam and hot water Chemical cleaners	Safety rule training, site control, decontamination protocols, PPE, respirators, air monitoring
Demobilization and cleanup	1 week	Vehicle operation Materials handling Lifting Pinch points	Safety rule training, inspection

Acronym/Abbreviation:
PPE – personal protective equipment

6.2.3 Vehicle and Heavy Equipment Operation

Field activities will include the operation of support vehicles. Therefore, personnel may be required to work on or near mechanical, pneumatic, hydraulic, or electrical equipment. Subcontractor operations involving these types of equipment must meet the safety and health specifications as set forth in United States Army Corps of Engineers Safety and Health Requirements guidance (USACE 2003) and state and federal Occupational Safety and Health Administration (OSHA) regulations.

6.2.4 Falling, Slipping, and Tripping

Work-zone surfaces will be maintained in a neat and orderly state to avoid trip hazards. Tools and materials will not be left randomly on surfaces when not in direct use. The drilling crew supervisor will assure that the work around each sampling location is maintained in an orderly state. Plastic sheeting that can create a slip hazard will not be laid down in areas where foot traffic is expected. All liquids will be containerized, and spills will be cleaned up immediately or clearly marked with caution tape. Fall protection will be required for personnel climbing more than 6 feet above the ground.

6.2.5 Work Near Roadways

Field activities may be conducted on roadways. Field activities will be planned and conducted to minimize safety hazards to field personnel and the public, and to minimize inconvenience to the traveling public.

Employees performing traffic control will wear orange garments in the daytime and reflectorized garments after dusk, although work at night is not anticipated at this time. Work near roadways will be halted during periods of heavy rainfall. Warning signs, cones, and/or pylons will be used in work zones. A safe distance will be maintained throughout the work area where pedestrian and bicycle traffic exists. Advance warning signs will be placed to warn oncoming traffic. Flagmen will be used to direct traffic in situations where one lane of traffic is impeded.

At the beginning of each field day, the SSHR will review and discuss potential hazards, safety requirements, general roadway safety, and site-specific roadway safety with the field sampling crew.

At the completion of field activities on roadways, field personnel will restore the area to satisfactory condition. All dirt, dust, and debris will be removed from the area at the end of each day and at the end of the job.

6.2.6 Heat Stress

Heat stress is a health consideration at Alameda Point, particularly when workers wear personal protective equipment (PPE) for extended periods of time. This can result in health effects ranging from transient heat fatigue to serious illness. Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and the individual characteristics of the worker. Reduced work tolerance and

the increased risk of excessive heat stress is directly influenced by the amount and type of PPE worn. PPE adds weight and bulk, severely reduces the body's access to normal heat exchange mechanisms, and increases energy expenditure.

Weather conditions characterized by high temperatures and low humidity, combined with wearing PPE, aggravate heat-stress problems. Standard measures, including designating a shaded rest area, taking frequent rest breaks, and performing heat-stress monitoring of workers, will be used to minimize heat stress. Water and fluids containing electrolytes will be available at the work site to replenish body fluids.

The SSHR will observe workers for heat-stress symptoms and record observations. Symptoms of heat stress include profuse sweating, headache, skin flushing, dizziness, confusion, and rapid heart rate. Body core temperature will be monitored when conditions warrant. Workers exhibiting a body core temperature of 100.4 °F or greater (measured at the eardrum) will be removed to a cooler area or activity until body core temperature returns to below 99 °F. Heat-stress action levels and frequency of core temperature monitoring are discussed in Section 10.

If persons exhibiting heat-stress symptoms are not treated, the condition can elevate to heat stroke. Heat stroke is typically manifested by hot, dry skin with a body core temperature of 104 °F or greater. Heat stroke can be fatal if treatment is delayed. If a person shows signs of heat stroke, his/her core temperature will immediately be reduced by using cold packs, or cold water wipes. The heat-stroke victim will be transported to a professional medical facility while the core temperature is being reduced or immediately afterwards.

During summer, workers must wear covering clothing or sunblock to minimize the harmful effects of the sun's rays on the skin, especially where a shaded area is not readily available.

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat injuries. To prevent heat stress, the following steps may be taken by the SSHR.

- Adjust/modify work schedules.
- Provide shade during rest periods.
- Maintain workers' body fluids at normal levels.
- Encourage workers to maintain an optimal level of physical fitness.
- Provide cooling devices to aid natural body heat exchange.
- Train personnel to recognize and treat heat stress.

The field team will be properly trained to recognize the signs and symptoms of heat stress. Topics will include heat rash, heat cramps, heat exhaustion, and heat stroke.

6.2.7 Energized Equipment and Electrocution

Available Navy, Alameda Point, and City of Alameda utility maps will be reviewed before fieldwork begins. Underground utility clearance will be completed before subsurface investigation activities are begun. Furthermore, a hand auger will be advanced 4 to 5 feet bgs in each borehole to check manually for obstructions. Overhead utility lines and obstructions will also be checked.

6.2.8 Debris Piles Within Buildings

Debris areas are present in some of the buildings being investigated. Borehole locations will be selected at a sufficient distance from debris. Also, debris areas will be clearly identified with caution tape and marked on available site investigation maps to prevent accidents, slips, trips, and falls.

In the event that investigative activities need to be conducted within debris areas, the stockpiled soils and debris will be first scanned for site contaminants using the available field screening tools. Debris management will then be the task of an outside contractor prior to startup of downhole activities.

6.2.9 Darkened Work Areas Within Abandoned Buildings

Site investigative activities will not be prepared in darkened or poorly lit areas. Temporary lighting using flood lights connected via GFCI-equipped extension cords to portable generators located in dry, well-ventilated areas will be used to address this hazard.

6.2.10 Six-Phase Heating Remediation System

The operation of the six-phase remediation system has the potential to energize subsurface utilities, underground pipes, and other metal structures within the radius of influence of the remediation system. Coordination with the remediation contractor will be required and an assessment of the potential hazards associated with this program will be performed by the BEI Health and Safety Manager, who will determine the appropriate precautions to be used.

6.2.11 Ponding of Water Within Abandoned Buildings

Borings will be located away from areas of ponding. All protective measures will be taken to ensure that electrical equipment is safely protected when working close to ponded areas. Extension cords used to provide temporary lighting will not be placed in ponded areas.

6.3 RADIATION HAZARDS

The following subsections discuss the radiation hazards associated with the fieldwork at the site. A comprehensive discussion of radiation hazards is presented below.

6.3.1 Ionizing Radiation

Ionizing radiation arises from nuclear isotopic sources such as radiography cameras and radium devices (buttons, plaques, and needles) and from energized sources such as X-ray machines, accelerators, and high-voltage equipment. Information presented in a Radiological Closeout Survey Report (TtEMI 2001) demonstrated that no significant radioactive contamination remained inside Buildings 5 and 400. Also, as reported in a May 2002 AM, the NTCRA removed materials contaminated with radium-226 from storm drain lines and manholes at IR Site 5 (NAVFAC 2002). However, an abandoned contaminated storm drain line still remains beneath Building 5. There are currently no accurate drawings for these lines. BEI will review stormwater/sewer drainline maps of the Building 5 area at the Alameda County Department of Public Works in order to clearly map the affected area. In addition, geophysical surveys will be completed in the areas of concern. BEI will make a best effort to avoid the likely locations of the missing drain lines. The radiological monitoring for alpha, beta, and gamma radiations to be performed during site investigation activities is primarily for safety and health purposes and to confirm the absence of significant contamination at the site.

Radiological control protocols will be implemented to support the planned RI field activities at OU-2C. These protocols are intended to protect the health and safety of workers, the general public, and the environment to minimize the Navy's liability for risks associated with radioactive contaminants. The Radiological Work Instruction, Attachment H to the Work Plan, will be followed.

Based on process knowledge, site history, and previous sampling results, there is a possibility that the sampling activities planned for this site may involve worker encounters with radiological contaminants, primarily radium. Specifically, wastes carried through the abandoned storm drain line coming from Building 5 contained radium as a contaminant. The RI sampling and presampling location clearance process is designed to avoid intercepting these drain lines. However, leaching or leakage from the pipes may have contaminated nearby soil and possibly groundwater.

The possible radiological contaminants might contaminate equipment and materials that contact the potentially impacted soil. To avoid the risk of contaminating personnel, a trained SSHR will vigorously perform radiological measurements on equipment, materials, samples, and sample containers. Surfaces that directly contact potentially contaminated material will be periodically surveyed during the work process for contamination. If these surfaces do not become contaminated during the work process, inaccessible surfaces are unlikely to become contaminated.

If radioactive contamination is reported above background (three standard deviations above background) during a sampling activity, then that activity will stop at that impacted location and the Radiological Affairs Support Office (RASO) will be notified immediately. Decontamination of equipment and materials will not be performed without approval by RASO. A subcontractor with a radioactive materials license will be engaged to perform the radiological survey and potential materials management functions. Any potentially contaminated equipment retained for reuse will be decontaminated to below limits

established by the Nuclear Regulatory Commission (NRC) in Regulatory Guide 1.86. If personnel are contaminated, they will be decontaminated to as low a level as possible under the direct supervision of a radiological controls technician. To ensure that appropriate screening protocols are followed, all surveys and analyses will be performed by, or under the direct supervision of, a certified professional (discussed below).

Determination of significant difference from background using a three sigma difference is a multi-part process. Selection of the reference area is the first and most fundamental part of this process. As there is no reference area with similar underlying soils and construction details specifically identified at OU-2C, the staging area for the equipment will be the first-order reference area.

One-minute background counts for both contamination survey instrument types (e.g., Scintillation) will be conducted at the staging area, and the values recorded. A three-sigma value for each instrument will be calculated by deriving the square root of the number of counts and dividing by the time in minutes. This value will be multiplied by three to determine the three-sigma value. This approach is based on the assumption that the background is normally distributed.

At the work location, a 10-minute count will be conducted and recorded for each instrument type. The purpose of this count is to determine whether the subsurface and construction change the background significantly. If the values are not significantly different, the three-sigma values from the staging area will be used. If the values are significantly different, a survey will be performed of the working area to determine whether the difference is a characteristic only of a small area or is typical of the entire area. An area with background similar to the work area will be selected and the background and three-sigma value will be calculated as described above.

Because the radiological field controls are so stringent, there would be no reasonable possibility of airborne contamination or significant dose to the workers. However, measurements will be taken with a low-dose rate meter (e.g., microREM meter) intermittently throughout the sampling process to ensure that the dose rate is below twice the background dose rate. This procedure will ensure that no member of the crew could exceed the NRC limit for dose to "members of the public," i.e., nonradiation workers.

Any waste generated during this activity, including investigation-derived waste (IDW) (e.g., gloves, Tyvek, soil, water, decontamination equipment, materials, or liquids), that is above the radiological release limits will be contained in an appropriately labeled container(s) and controlled until disposal is arranged. The waste package label will contain the maximum contamination value of each type of radiation detected and assumed to be contaminanted. A subcontractor with a radioactive materials license will be engaged to perform the radiological survey and potential materials management functions. The IDW generated during this activity will be analyzed for potential contaminants using licensed laboratories. The RASO must be contacted at the time of the determination and shall arrange for appropriate disposal.

6.3.1.1 DOSE AND CONTAMINATION LIMITS

The radiological dose limit for a member of the public, which includes any individual not trained and monitored as a radiation worker, is 100 millirems (mrem) per calendar year. When this value is divided by a nominal 2,000-hour work year, a value of 0.050 mrem per hour (50 microrems per hour) is derived. This rate is easily monitored by instruments designed for this range. If the average measurement is below 50 microrems per hour, the NRC limit is maintained. However, for thoroughness, if any measurement at a location exceeds twice the background dose rate, all activities will stop at that location. If elevated exposure readings and/or contamination are identified, work will stop in the area of the suspected contamination, and RASO will be notified.

The radiological contamination limits established for unrestricted release or reuse of equipment and materials from a radiologically controlled area are established in NRC Regulatory Guide 1.86 (Table 6-2).

Table 6-2
Regulatory Guide 1.86 Radiological Release Limits

Radiation Type[a]	Release Limits (Fixed) [b,c] (dpm per 100 cm^2)	Release Limits (Removable) [b,d] (dpm per 100 cm^2)
U-nat, U-235, U-238, and associated decay products	5,000 (a)	1,000
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100	20
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000	200
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above	5,000	1,000

Notes:
- [a] where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should be applied independently
- [b] as used in this table, dpm means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector by background, efficiency, and geometric factors associated with the instrumentation
- [c] measurements of average contaminants should not be averaged over more than 1 square meter; for objects of less surface area, an average should be derived for each such object
- [d] the amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency; when removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped

Acronyms/Abbreviations:
cm^2 – square centimeters
dpm – disintegrations per minute

Radium-226, with a half-life of 1,602 years, is the principal isotope that is a contaminant of potential concern. Therefore, all detectable alpha contamination will be considered as possible radium-226 contamination.

The limiting radiological release limits for equipment and materials are 100 disintegrations per minute (dpm)/100 square centimeters (cm^2) fixed, and 20 dpm/100 cm^2 removable for alpha radiation; and 5,000 dpm/100 cm^2 fixed, and 1,000 dpm/100 cm^2 removable for beta-gamma radiation. While these are absolute limits, in practice, every effort will be made to reduce any contamination to levels below detection limits.

6.3.1.2 AREA MONITORING

Area monitoring consists of measuring radiological conditions in an area to determine its status prior to conducting intrusive activities. It also includes taking periodic low-range dose measurements and conducting contamination surveys during intrusive activities to detect any changes resulting from ongoing work. Because radiological contamination surveys are the most sensitive indicators of changes in the environment, they will be performed frequently to detect even minor changes. During sampling activities that bring material and/or liquids to the surface, this monitoring will be performed continuously.

Area monitoring will be performed in accordance with the specifications established and discussed in Section 6.1.3.6, Instrumentation. Note that all alpha measurements must be performed within 0.25 inches of the surface measured. Contact will be avoided to prevent contamination of the instrument or probe face damage.

6.3.1.3 AIR MONITORING

Use of the radiological contamination limits for release from the site as operational control limits will limit the possibility of any measurable airborne contamination. Air monitoring protocols will be evaluated upon the identification of higher levels of contamination.

6.3.1.4 PERSONNEL MONITORING

It is unlikely that any individual would receive a measurable dose of radiation from radiological contaminants, given the operational controls in place in the absence of a significant incident. Therefore, personnel external dosimetry, personal air samplers, and other personal measurements will not be used. However, every individual who enters the work area will be monitored periodically for radiological contamination during performance of the work and each time that the individual leaves the work area. The hands and feet of individuals will be monitored periodically, and a whole-body survey will be performed with the alpha-scintillation probe whenever personnel exit the area. Since contamination is possible but not expected, it is not necessary at the present time to make the area radiologically controlled. Changes to the protocol will be initiated and RASO notified if contamination is detected and the decision is made to make the area radiologically controlled.

6.3.1.5 EQUIPMENT RELEASE

Every item of equipment and material that comes into contact with subsurface materials and/or liquids will be monitored for radiological contamination. Equipment and material that are detectably contaminated will be decontaminated or disposed of following changes to the work instruction (NWT 2007) and approval by RASO. No item of equipment with contamination levels above the release limits will leave the site unless it is controlled as radioactive material or as radioactive waste.

Equipment and material release surveys will consist of radiological surveys of accessible surfaces for fixed contamination and smear surveys for removable contamination. These surveys will be performed in accordance with the specifications listed in Table 1, note "d."

If radioactive material is detected above background levels, the total and removable activities will be determined according to the specifications of NRC Regulatory Guide 1.86, and documented on a survey record.

6.3.1.6 DOCUMENTATION

All surveys performed must be documented using a level of documentation commensurate with the impact of the information. As a minimum, the surveys and the results must be documented in a controlled field logbook. For surveys where contamination is found, a separate survey sheet must be generated and signed. Signals indistinguishable from background may be recorded as such.

Survey documentation may include the following information:

- date and time of survey(s)
- individual performing survey
- instruments used (including serial numbers)
- calibration dates of instruments used
- efficiency information for instruments used
- background radiation information
- items, individuals, and/or areas surveyed (including drawings or maps)
- locations of removable contamination smears
- results of the survey(s) (fixed and removable contamination, count and dose rates)
- a signature and date

6.3.2 Solar Radiation

During summer, workers must wear covering clothing or sunblock to minimize the harmful effects of the sun's rays on the skin, especially where a shaded area is not readily available.

6.4 INDUSTRIAL HAZARDS

Program activities at OU-2C may expose personnel to various industrial hazards. The following subsections present a summary of the expected common industrial hazards. Note that description of confined space entry below is included as a reminder only; no confined space entry will be conducted during this investigation. Sampling of storm sewer locations (confined spaces) will be conducted with tools lowered into the sewer. Members of the field team will not enter the storm sewer.

6.4.1 Underground and Overhead Utilities

Since buried underground utilities may be present near proposed sampling locations, a search using specialized cable-detection equipment will be conducted prior to intrusive activities. In addition, a hand auger will be advanced 4 to 5 feet bgs at all locations before mechanically intrusive equipment is used. Overhead utility lines and obstructions will also be checked.

6.4.2 Confined Space Entry

Entry into confined spaces presents a serious risk of exposure to significant safety or health hazards. No section of confined space is entered if sampling and/or visual inspection can be performed outside the space. On all Navy CLEAN projects, all confined space entry must be planned and executed in accordance with CLEAN PP SH 5.1.3, Confined Space Entries. Tunnels considered "permit-required confined spaces" require the use of all aspects of CLEAN PP SH 5.1.3 and Title 29 *Code of Federal Regulations* (CFR) Section 1910.146. Employees associated with this work receive training in accordance with 29 CFR 1910.146. Training is required for entrants, attendants, entry supervisors, gas monitors, and rescue personnel.

All spaces must be tested prior to entry in accordance with PP SH 5.1.3. Atmospheric testing includes oxygen content, flammability limit, hydrogen sulfide, and toxic gases using photoionization detectors or flame ionization detectors and/or detector tubes.

No confined space entry will be conducted during the fieldwork for OU-2C.

6.5 CHEMICAL HAZARDS

Table 6-3 presents a list of selected contaminants suspected to be present in soil and groundwater during field activities. The toxicological properties of each selected contaminant are also described in the table.

6.6 BIOLOGICAL HAZARDS

The SSHR will screen the area for biological hazards during the initial site visit and will discuss any problems with base personnel during the pre-work preview. Multiple biological hazards are present at the site. The most common hazards anticipated are discussed below.

Table 6-3
Toxicological Properties of Selected Chemical Compounds Suspected To Be Present [a,b,c]

Chemical	Exposure Limits	Target Organs	Symptoms	Sampling Method and/or Media	Exposure Routes
Volatile Organic Compounds					
acetone	AL: NE PEL: 1,000 ppm STEL: 1,000 ppm TLV: 750 ppm IDLH: 2,500 ppm	CNS, skin, eyes, respiratory system	Irritated eyes, nose, throat; headache, dizziness, CNS depression, dermatitis.	Charcoal tube	Inhalation, ingestion, contact
benzene	AL: 0.5 ppm PEL: 1 ppm STEL: 2.5 ppm TLV: 0.5 ppm IDLH: 500 ppm	Blood, CNS, skin, bone marrow, eyes, respiratory system	Irritated eyes, skin, respiratory system; giddiness; headache; nausea; staggering gait; fatigue; anorexia; dermatitis; bone marrow depressant; NIOSH considers a carcinogen.	Charcoal tube	Inhalation, skin absorption, ingestion, contact
carbon tetrachloride	AL: NE PEL: 10 ppm STEL: 10 ppm TLV: 5 ppm IDLH: 200 ppm	Lungs, liver, kidneys, eyes, CNS, skin, liver cancer in animals	Irritated eyes, skin; CNS depression; nausea, vomiting; liver, kidney damage; drowsiness, dizziness, incoordination	Charcoal tube	Inhalation, ingestion, contact
chloroform	AL: NE PEL: 50 ppm STEL: NE TLV: 10 ppm IDLH: 500 ppm	Liver, kidneys, heart, eyes, skin, CNS	Irritated eyes, skin; CNS depression; mental dullness; anesthesia; fatigue; nausea; liver, kidney damage	Charcoal tube	Inhalation, ingestion, contact
1,1-dichloroethane	AL: NE PEL: 100 ppm STEL: 250 ppm TLV: 100 ppm IDLH: NE	Skin, liver, kidneys, lungs, CNS	Irritated skin; CNS depression; liver, kidney, lung damage	Charcoal tube	Inhalation, ingestion, contact

(table continues)

Table 6-3 (continued)

Chemical	Exposure Limits	Target Organs	Symptoms	Sampling Method and/or Media	Exposure Routes
Volatile Organic Compounds (continued)					
1,2-dichloroethane (1,2-DCA) (ethylene dichloride)	AL: NE PEL: 50 ppm STEL: 100 ppm TLV: 10 ppm IDLH: 50 ppm	Eyes, skin, kidneys, liver, CNS, CVS; NIOSH considers a carcinogen; forestomach, mammary gland, and circulatory system cancer in animals	Irritated eyes, corneal opacity; CNS depression; nausea; vomiting; dermatitis; liver, kidney and cardiovascular damage	Charcoal tube	Inhalation, skin absorption, ingestion, contact
1,2-dichloroethene (1,2-DCE)	AL: NE PEL: 200 ppm STEL: NE TLV: 200 ppm IDLH: 1,000 ppm	Eyes, respiratory system, NIOSH considers a carcinogen	Irritated eyes, respiratory system; CNS depression	Charcoal tube	Inhalation, skin absorption, ingestion, contact
tetrachloroethene (PCE)	AL: NE PEL: 25 ppm STEL: 100 ppm TLV: 25 ppm IDLH: 150 ppm	CNS, liver, kidneys, eyes, skin, respiratory system	Irritated eyes, nose, throat; nausea; flushed face, neck; vertigo, dizziness, incoordination; headache; sleepiness; skin redness; liver damage; liver tumors in animals; NIOSH considers a carcinogen	Charcoal tube	Inhalation, skin absorption, ingestion, contact
1,1,1-trichloroethane (TCA) (methyl chloroform)	AL: NE PEL: 350 ppm STEL: 450 ppm TLV: 350 ppm IDLH: 700 ppm	Eyes, skin, CNS, CVS, liver	Irritated eyes, skin; headache, lassitude, CNS depression, poor equilibrium; dermatitis; cardiac arrhythmia; liver damage	Charcoal tube	Inhalation, ingestion, contact
trichloroethene (TCE)	AL: NE PEL: 25 ppm STEL: 100 ppm TLV: 50 ppm IDLH: 1,000 ppm	Eyes, respiratory system, liver, heart, CNS, skin	Irritated eyes, skin; headaches; vertigo; vision disturbances; fatigue, giddiness, tremors, nausea, vomiting; cardiac arrhythmia, liver injury; liver and kidney cancer in animals	Charcoal tube	Inhalation, skin absorption, ingestion, contact
vinyl chloride	AL: 0.5 ppm PEL: 1 ppm STEL: NE TLV: 1 ppm IDLH: NE	Respiratory system, liver, lymphatic system, CNS, blood; (liver cancer)	Weakness; abdominal pain, GI bleeding; enlarged liver, liver cancer; pallor or cyanosis of extremities; frostbite (liquid)	Charcoal tube	Inhalation, ingestion, contact

(table continues)

Table 6-3 (continued)

Chemical	Exposure Limits	Target Organs	Symptoms	Sampling Method and/or Media	Exposure Routes
Volatile Organic Compounds (continued)					
xylene(s)	AL: NE PEL: 100 ppm STEL: 150 ppm TLV: 100 ppm IDLH: 900 ppm	CNS, liver, kidneys, skin, eyes, respiratory system, GI tract, blood	Irritated eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination; staggering gait; corneal vacuolation; anorexia, nausea, vomiting, abdominal pain; dermatitis	Charcoal tube	Inhalation, skin absorption, ingestion, contact
Semivolatile Organic Compounds and Polynuclear Aromatic Hydrocarbons					
benzo(a)pyrene	AL: NE PEL: 0.2 mg/m^3 STEL: NE TLV: NE IDLH: 80 mg/m^3	Respiratory system, skin, bladder, kidneys	Inflamed skin; bronchitis; lung, kidney, and skin cancer	Filter	Inhalation, contact
naphthalene	AL: NE PEL: 10 ppm STEL: 15 ppm TLV: 10 ppm IDLH: 250 ppm	Eyes, skin, blood, liver, kidneys, CNS	Irritated eyes; headache; confusion; excitement; malaise; nausea, vomiting, abdominal pain; profuse sweating; jaundice; irritated bladder, blood in urine, hemoglobin present in urine, renal shutdown; inflamed skin; eye inflammation and irritation, corneal damage	Charcoal filter	Inhalation, skin absorption, ingestion, contact
Pesticide					
4,4′-DDT	AL: NE PEL: 1 mg/m^3 STEL: NE TLV: 1 mg/m^3 IDLH: 500 mg/m^3	Eyes, skin, CNS, kidneys, liver, PNS	Irritated eyes and skin; tingling sensation on tongue, lips, face; tremors; apprehension; dizziness; confusion; malaise; headache; fatigue; convulsions; slight paralysis of hands; vomiting; carcinogen; liver, lung, and lymphatic tumors in animals	Particulate filter	Inhalation, skin absorption, ingestion, contact
Metals					
arsenic	AL: NE PEL: 0.01mg/m^3 STEL: NE TLV: 0.01mg/m^3 IDLH: 5 mg/m^3	Liver, kidneys, skin, lungs, lymphatic system cancer	Ulceration of the nasal septum, dermatitis, GI disturbances, respiratory irritation, peripheral hyperpigmentation of the skin; carcinogen	0.8-micron MCEF filter	Inhalation, ingestion, skin contact

(table continues)

Table 6-3 (continued)

Chemical	Exposure Limits	Target Organs	Symptoms	Sampling Method and/or Media	Exposure Routes
Metals (continued)					
chromium (III)	AL: NE PEL: 0.5 mg/m^3 STEL: NE TLV: 0.5 mg/m^3 IDLH: 25 mg/m^3	Eyes, skin	Irritated skin, sensitization dermatitis	Filter	Inhalation, ingestion, contact
chromium (VI)	AL: 2.5 µg/m^3 PEL: 5 µg/m^3 STEL: NE TLV: 0.05 mg/m^3 IDLH: 15 mg/m^3	Blood, respiratory system, liver, kidneys, eyes, skin (lung cancer)	Irritated respiratory system, nasal septum perforation; liver, kidney damage; leukocytosis, leukopenia, monocytosis, eosinophilia; eye injury; conjunctivitis; skin ulcers; sensitization dermatitis	Filter	Inhalation, ingestion, contact
lead	AL: 30 µg/m^3 PEL: 50 µg/m^3 STEL: NE TLV: 0.05 mg/m^3 IDLH: 100 mg/m^3	Eyes, GI tract, CNS, kidneys, blood, gum tissue	Irritated eyes; weakness; fatigue; insomnia; facial pallor; pale eyes; anorexia, malnutrition, low weight; abdominal pain; anemia; tremors; gingival lead line; paralysis of wrist, ankles; degenerative brain disease; kidney disease; high blood pressure	0.8-micron MCEF filter	Inhalation, ingestion, contact
manganese	AL: NE PEL: 0.2 mg/m^3 STEL: NE TLV: 0.2 mg/m^3 IDLH: 500 mg/m^3	Respiratory system, CNS, blood, kidneys	Degenerative brain changes; weakness; insomnia; mental confusion; metal fume fever; dry throat, coughing, chest tightness, dyspnea; rales; flu-like fever; lower back pain; vomiting; malaise; fatigue; kidney damage	Filter	Inhalation, ingestion
nickel	AL: NE PEL: 1 mg/m^3 STEL: NE TLV: 1 mg/m^3 IDLH: 10 mg/m^3	Nasal cavities, lungs, skin (lung and nasal cancer)	Allergic asthma, sensitization dermatitis, pneumonitis	0.8-micron MCEF filter	Inhalation, ingestion, contact
Petroleum Hydrocarbons					
aviation gasoline	AL: NE PEL: 5 ppm STEL: NE TLV: 5 ppm IDLH: 250 ppm	Eyes, skin, respiratory system, CNS, lungs, kidneys, CVS, pancreas	Irritated eyes, mucus membrane; skin burns; confusion; depression; dermatitis	XAD-2 tube	Inhalation, skin absorption, ingestion

(table continues)

Table 6-3 (continued)

Chemical	Exposure Limits	Target Organs	Symptoms	Sampling Method and/or Media	Exposure Routes
Petroleum Hydrocarbons(continued)					
diesel fuel	AL: NE PEL: NE STEL: NE TLV: 14 ppm IDLH: NE	Eyes, skin, respiratory system, CNS	Irritated eyes, skin, nose, throat; burning sensation in chest; confusion; dermatitis; chemical pneumonia from aspirated liquid	Charcoal tube	Inhalation, skin absorption, ingestion, contact
Common Asphyxiants					
methane	LEL: 5.3% UEL: 15% FP: -306 °F Lighter than air	[d]	[d]	Combustible gas meter/oxygen meter	Inhalation

Notes:

[a] ALs, PELs: 29 CFR 1910, Subpart Z; toxic and hazardous substances: General Industry Safety Orders, California CFR, Title 8, Article 5155

[b] IDLH, harmful effects, symptoms, method of analysis and routes of exposure: Pocket Guide to Chemical Hazards (NIOSH 2003)

[c] TLVs, STELs (ACGIH 2004)

[d] simple asphyxiants are inert gases or vapors; when present in high concentrations in air, a number of gases and vapors act primarily as simple asphyxiants without other significant physiologic effects; a TLV may not be recommended for each simple asphyxiant because the limiting factor is the available oxygen; the minimal oxygen content should be 18 percent by volume under normal atmospheric pressure (equivalent to a partial pressure, pO_2 of 135 torr); atmospheres deficient in O_2 do not provide adequate warning, and most simple asphyxiants are odorless; several simple asphyxiants present an explosion hazard; this factor should be taken into account in limiting the concentration of the asphyxiant

Acronyms/Abbreviations:

AL – action level
CFR – *Code of Federal Regulations*
CNS – central nervous system
CVS – cardiovascular system
DDT – dichlorodiphenyltrichloroethane
ECD – electron capture detector
°F – degrees Fahrenheit
FP – flash point
GI – gastrointestinal
IDLH – immediate danger to life and health
LEL – lower explosive limit
$\mu g/m^3$ – micrograms per cubic meter
MCEF – mixed cellular ester fiber
mg/m^3 – milligrams per cubic meter
NE – not established
NIOSH – National Institute for Occupational Safety and Health
O_2 – oxygen
PEL – permissible exposure limit
PNS – peripheral nervous system
pO_2 – partial pressure of oxygen
ppm – parts per million
STEL – short-term exposure limit
TLV – threshold limit value
torr – Torricelli (unit of pressure equal to 1/760 atmosphere)
UEL – upper explosive limit

6.6.1 Insects and Spiders

The primary insect and spider hazards for fieldwork are bees (including wasps and yellow jackets) and spiders (e.g., black widow and brown recluse). Spiders in particular like the warm, wet environments provided by protective well casing and vault enclosures as well as dark, wet areas within enclosed structures.

Prior to initial assessment, personnel with known allergenic responses to insect stings or spider bites will be identified and field supervisors made aware of this condition. In all cases, a victim suspected of being bitten by either a black widow or brown recluse spider shall receive medical attention. The venom from the brown recluse spider is capable of causing coma and kidney failure in its victim.

During well inspections, the field crew will look for evidence of spiders (e.g.,. spider webs) prior to placing hand(s) into the enclosure. The field crew should preferably be wearing nitrile gloves that will provide additional protection from exposure to insects. The Program Safety and Health Plan, Section 6.9.2 (BNI 1997), provides a more detailed discussion on the effects of spider bites and bee stings.

6.6.2 Hantavirus

Hantaviruses have been detected in mice and voles indigenous to southern California (CDC 2003). Exposure to a hantavirus can result in hantavirus pulmonary syndrome, a rare though potentially deadly respiratory disease with a fatality rate of approximately 50 percent. Mice and voles are the primary reservoir for hantaviruses. These rodents shed the virus in their saliva, urine, and feces, and virus-containing particles or droplets can become airborne. The virus can then be spread when people breathe contaminated air.

The Centers for Disease Control and Prevention recommends avoiding contact with or disturbing mice, mouse burrows, infested areas, and nesting sites. For fieldwork in southern California, the field crew should be especially cautious in the following areas:

- old buildings/structures
- opened (i.e., neglected) well vaults
- on-site debris piles and burrows

6.6.3 Arenavirus

Arenaviruses have also been documented in rodents in southern California (Bennett et al. 2000). Like hantaviruses, arenaviruses are believed to be transmitted to humans through inhalation of airborne particles or droplets contaminated with an arenavirus from the urine, feces, or saliva of infected rodents. Human infection from an arenavirus is rare; however, it can result in a fatal respiratory disease. Precautions used to minimize exposure to a hantavirus should also be used to reduce potential exposure to an_arenavirus.

6.6.4 West Nile Virus

West Nile virus has been detected in southern California. This virus is primarily transmitted among wild birds by infected mosquitoes; however, infected mosquitoes also can transmit the virus to humans (DHS 2004). Most humans infected with the virus have either no symptoms or a mild flu-like illness lasting a few days. In rare cases, the virus can cause inflammation of the brain, a condition called encephalitis. Potential exposure increases during mosquito season (i.e., May to October). Precautions to prevent infection include decreasing exposure to mosquitoes by wearing long-sleeved shirts and long pants and applying insect repellent containing N,N-diethyl-meta-toluamide (DEET).

Section 7
SITE CONTROL

For work conducted for this project, a site control program will be established in accordance with PP SH 5.1.2, Safe Work Operation Process (BNI 2004), based on site-specific characteristics. The buddy system will be used at all times. At least two personnel trained in first aid/cardiopulmonary resuscitation (CPR) and bloodborne pathogens will be present during all CLEAN field activities.

7.1 SITE WORK AUTHORIZATION

Field activities will be authorized under a hazardous work permit (HWP) system. HWPs may be prepared either for general activities at a number of site work areas with similar hazards and control measures or for a specific activity and location. The SSHR and field crew will prepare HWPs before beginning fieldwork. HWPs will be prepared in accordance with PP SH 5.1.2.

7.2 CONTROLLED AREA DESIGNATION

For intrusive field activities such as direct-push sampling operations, precautions will be taken to assure that only authorized personnel with the proper training and PPE enter work areas associated with the operation of heavy equipment and/or the potential for exposure to hazardous conditions/materials. In these areas, access is controlled with caution tape and/or barricades. At SSHR discretion, a three-zone controlled area system may be established, including an inner "exclusion zone" (contaminated area), a "contamination reduction zone" (decontamination area), and an outer "support" zone. While in the support zone, workers will not be exposed to hazardous conditions.

7.3 ACCESS CONTROL

While overseeing activities during the supplemental remedial investigation at OU-2C, the SSHR will compile an Authorized Personnel Roster. Only individuals listed on the roster will be permitted in controlled areas.

Before conducting field activities inside buildings occupied by tenants, the DoD BRAC Program Management Office, Environmental Compliance Manager (Doug DeLong) will be contacted to assist in scheduling and coordinating these activities with the tenants. Tenants will not be allowed in controlled areas during the field activities.

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Section 8
DECONTAMINATION

The primary focus of any decontamination program is to minimize the spread of contaminated material beyond a given location. Each field location will have a decontamination station based on the level of exposure established by the Safety and Health Manager and the HWP. When Level C or modified Level D PPE is used, the standard decontamination protocol for Level C PPE will be as set forth in PP SH 4.3, Personnel and Equipment Decontamination (BNI 2004). When modified Level D PPE is used, a minimal decontamination procedure (washing exposed skin with soap and water) will be required.

8.1 PERSONNEL DECONTAMINATION

A decontamination station will be established for each field sampling location chosen for this study. Field activities include direct-push sampling. These activities may present an exposure risk to personnel. A three-station decontamination system will be used on an as-needed basis.

8.2 VEHICLE AND EQUIPMENT DECONTAMINATION

During field activities, the use of a variety of heavy equipment, vehicles, and small equipment is anticipated. The level of potential contamination for vehicles and equipment at this site is low for support vehicles used for nonintrusive field activities and medium for intrusive activities in potentially contaminated sites.

Access routes from a given work area to the decontamination area will be via the shortest route practicable. To minimize the potential for contaminated material being released en route, gross contamination will be removed from each vehicle before it leaves the exclusion zone. If removal of gross contaminants is impracticable for some items, these items will be wrapped in plastic prior to transport.

8.3 APPAREL DECONTAMINATION

Single-use PPE clothing will be disposed in accordance with the IDW Management Plan (Attachment C) and Section 21, Spill Prevention and Control Measures.

8.4 HAZARDOUS WASTE MINIMIZATION PRACTICES

Personnel working in controlled areas will work to minimize the generation of hazardous waste. Disposal materials, wrapping, and packaging will not be brought into controlled areas unless required to prevent cross contamination. Separate waste containers will be set up for trash, nonhazardous waste, and potentially hazardous waste.

8.5 TESTING REQUIREMENTS FOLLOWING DECONTAMINATION

The SSHR will inspect all items and equipment before they are transported from controlled areas for proper decontamination. Generally, visual inspection (after wet wiping) of items used within controlled areas is sufficient, eliminating the need to test for chemical contamination.

8.6 CERTIFICATION OF DECONTAMINATION

A certification of decontamination will be prepared prior to releasing any government-furnished equipment from areas where field activities are conducted to uncontrolled areas. The SSHR will maintain a decontamination record log for all other equipment.

8.7 SUBCONTRACTOR REQUIREMENTS

Subcontractors will notify the SSHR before removing equipment from controlled areas.

8.8 DECONTAMINATION AREA ARRANGEMENTS

Specific areas will be designated for waste storage, vehicle and equipment decontamination, emergency supplies, and other necessary equipment. An exclusion zone will be set up around drilling areas.

8.8.1 Waste Storage Area

A waste storage area will be established at Alameda Point in a fenced area adjacent to Building 112 for temporary storage of IDW. All IDW will be contained during field activities and transported to the waste storage area. This area is limited to waste storage activities only. Any fieldwork that may cause the spread of contaminated IDW outside the waste storage area is prohibited.

8.8.2 Decontamination Process

Soil samples and discrete groundwater samples will be collected using direct-push technology or an equivalent method. Monitoring well samples will be collected using a nondedicated pump and flexible tubing. Decontamination will be required for only the down-hole sampling equipment (less than 20 feet of 2-inch-diameter pipes, sampling tools, and a hand auger) for each location and a groundwater pump and tubing for each monitoring well. The three-station decontamination system or steam cleaning station (for large equipment) will be set up on and contained by a plastic sheet, placed within the bed of a pickup truck or similar field vehicle. Decontamination fluids will be transferred daily to the IDW staging area adjacent to Building 112.

Section 10
HAZARD MONITORING

During field activities, any potentially toxic air contaminants, including VOCs and explosive gases, and radioactivity will be monitored. Monitoring instruments to be used during site activities include a flame ionization detector (e.g., organic vapor [OV] analyzer), combustible gas indicator, and colorimetric indicator tubes, including those specific for benzene and vinyl chloride. A Geiger-Mueller survey meter and MicroREM meter will also be used to monitor radioactivity for health and safety purposes. Table 10-1 summarizes instrument calibration and maintenance procedures.

10.1 CHEMICAL AGENT MONITORING

Chemical monitoring will be conducted during all intrusive operations. During direct-push sampling activities, monitoring will be conducted both at the borehole and near workers' breathing zones. VOCs will be monitored for at the borehole and near workers' breathing zones, while explosive gases will be monitored only at the borehole. Table 10-2 summarizes the action levels for compounds. Table 10-3 specifies methods and frequencies for chemical agent monitoring.

Radioactivity monitoring will be conducted during all intrusive operations. During direct-push sampling activities, monitoring will be conducted at the borehole. Monitoring will be conducted for soil samples removed from the ground both prior to and after removing a sample from the sampling device. Monitoring will also be conducted during the collection of groundwater samples. Section 6.3.1 discusses the action levels and methods for radioactivity monitoring.

10.2 ENVIRONMENTAL MONITORING

If contaminant exposures reach action levels in workers' breathing zones and work continues (in Level C protection), perimeter monitoring will be conducted at the outer edge of the controlled area. If contaminants reach action levels in any perimeter area, work will be suspended until engineering controls or natural ventilation allows ambient area contaminant concentrations to fall below action levels (i.e., to within the acceptable range).

10.3 AREA MONITORING

Where intrusive activities are performed, monitoring will be conducted in those areas suspected to be contaminated with VOCs, SVOCs, or any combination of contaminants. Direct-reading monitoring will be performed for detection of VOCs in air (see Table 10-2 for action levels).

10.4 PERSONNEL MONITORING

Personnel monitoring will be initiated if the action levels for VOCs and/or radioactivity are equaled or exceeded (Tables 10-2 and Section 6.3.1) and/or if personnel are required to work using respiratory protection for periods of more than 1 hour. In addition, personnel monitoring for health stress will be conducted if heat stress is a health consideration during fieldwork (Table 10-4).

Based on previous investigations at areas within and near OU-2C, petroleum hydrocarbons may exist in subsurface soil and groundwater in corrective action areas located within and near the site (Figure 10-1). Field personnel performing intrusive subsurface activities near these corrective action areas may encounter combustible gases. Personnel will continuously monitor lower explosive limits and follow the action levels and protection actions listed in Table 10-2.

Table 10-1
Instrument Calibration and Maintenance Information

Instrument	Calibration Data
FID	Each day, zero and span with ambient air and methane standards. Calibrate with a low-range and mid-range standard, or calibrate at 10 parts per million on both scales. Adjust zero and span hourly or whenever zero appears to drift.
Combustible gas indicator	Calibrate daily with methane or gas mixture (nominal 50 percent lower explosive limit).
Ear-insertable core temperature monitor	Check response daily before work begins, if monitor is required.
Oxygen sensor	Each day, check with ambient air away from any sources of contamination. Adjust reading whenever "ambient air reading" appears to drift.
Geiger-Mueller survey meter	Calibrate daily according to manufacturer's suggested specifications.
MicroREM meter	Calibrate daily according to manufacturer's suggested specifications.

Acronym/Abbreviation:
FID – flame ionization detector

Table 10-2
Monitoring Methods and Action Levels for Uncharacterized[a] Mixtures Using Screening Survey Instruments

Hazard	Method	Action Level[b]	Protection Action
Total organic vapor	FID	Background to 2 ppm above background	No action required
		> 2 ppm	Air-purifying respirator, full-face, Level C protection with appropriate cartridges
		> 5 ppm	Air-purifying respirator, full-face, Level C protection, personnel monitoring required to identify contaminants
		> 10 ppm	Supplied air protection, Level B
		> 50 ppm	STOP WORK
Combustible gas	Explosimeter	< 10% LEL	No action required
		10 to 20% LEL	Start continuous monitoring; permit only classified electrical equipment and nonsparking tools
		> 20% LEL	STOP WORK; ascertain source of gas
Oxygen concentration	Oxygen analyzer	< 19.5% v/v	Leave area; evaluate reason for deficiency; monitor again remotely or with IDLH entry program
		19.5 to 20.5% v/v	Slight deficiency; continue continuous monitoring
		20.5 to 21.0% v/v	Normal range
		> 22.0% v/v	Elevated reading; check calibration; investigate cause; STOP any potential spark-producing activity

Notes:
[a] carcinogenic and highly toxic materials not verified absent from atmosphere
[b] all action levels are readings observed above background; verify absence of highly toxic compounds as necessary (e.g., vinyl chloride, methylene chloride, benzene)

Acronyms/Abbreviations:
FID – flame ionization detector
IDLH – immediately dangerous to life and health
LEL – lower explosive limit
ppm – parts per million
v/v – volume per volume

Table 10-3
Chemical/Physical Agent Monitoring Requirements

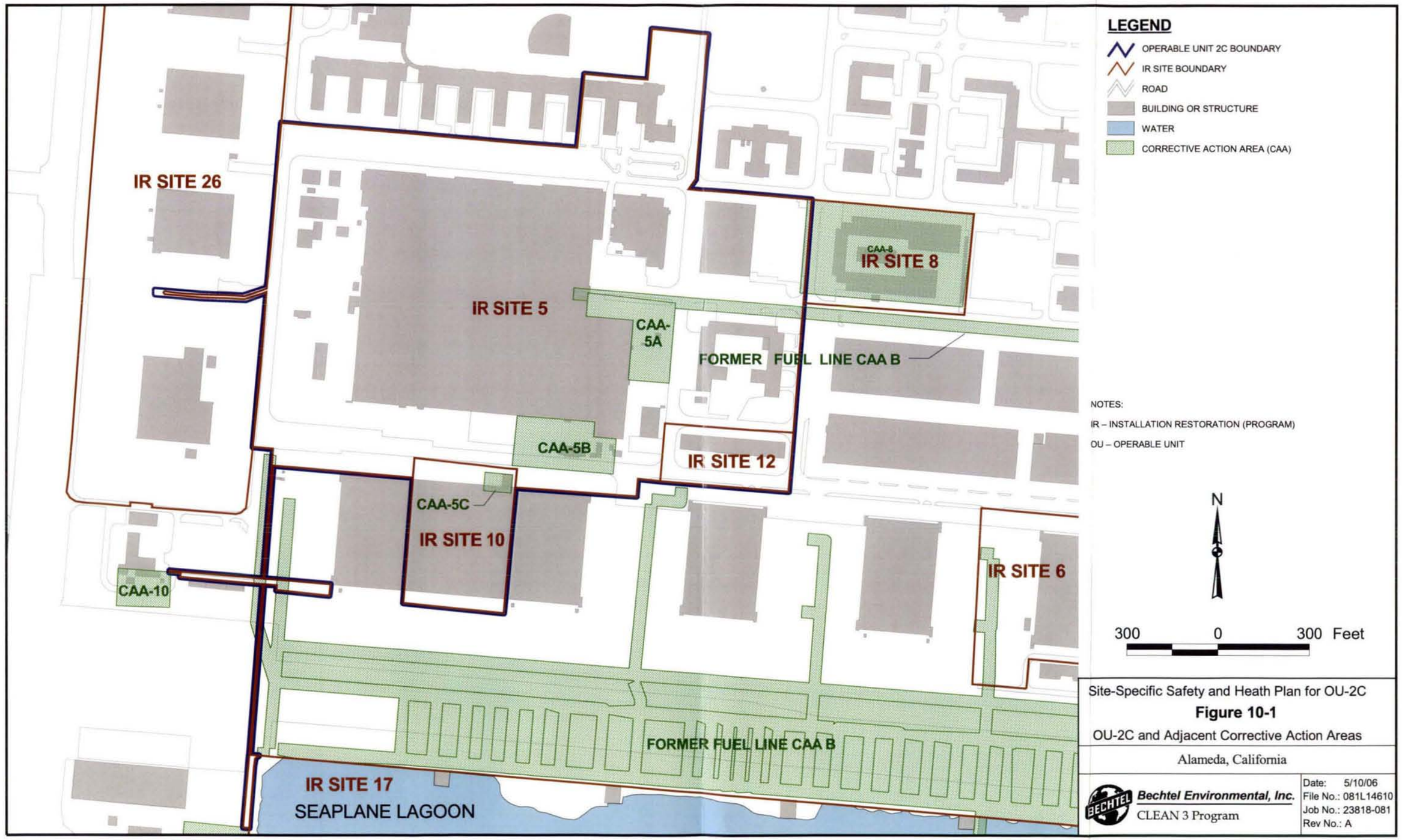
Scope of Work Task	Chemical/ Hazard	Instrument	Responsible Party	Initial Frequency
Low Hazard				
Decontamination of equipment	Organic vapor	FID	SSHR	At SSHR discretion
Moderate Hazard				
Subsurface soil and groundwater sampling	Organic vapor Explosive gases	FID Explosimeter	SSHR	Start of task, hourly, continuous if zone of contamination encountered

Acronyms/Abbreviations:
FID – flame ionization detector
SSHR – site safety and health representative

Table 10-4
Action Levels for Heat Stress

Type of Measurement	Action Level	Action
Ear insertable core temperature	> 100.4 °F	Remove from work
Ear insertable core temperature	< 99 °F	Return to work

Acronym/Abbreviation:
°F – degrees Fahrenheit



Site-Specific Safety and Heath Plan for OU-2C

Figure 10-1

OU-2C and Adjacent Corrective Action Areas

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 5/10/06
File No.: 081L14610
Job No.: 23818-081
Rev No.: A

Section 11
PERSONAL PROTECTIVE EQUIPMENT

Based on analytical results for soil and groundwater samples collected and tested during previous investigations at OU-2C, the anticipated level of PPE for the majority of the field activities will be Level D and modified Level D. Modified Level D will be required if splashes from chemicals or physical contact with contaminated soil and groundwater is likely during sampling. Level C PPE will be required if the levels of contaminants exceed the action levels listed in Section 10.

As summarized in Table 11-1, Level D PPE includes the following:

- hard hat
- safety glasses
- normal work clothes, including long pants and steel-toed leather work boots

In addition to the above-listed items, chemical-resistant gloves will be mandatory during all sampling activities.

Modified Level D PPE includes the following:

- Tyvek or polyethylene-coated Tyvek suits
- latex or nitrile gloves
- hard hats
- safety glasses
- normal work clothes, including long pants and steel-toed leather work boots
- overboots

Level C PPE includes modified Level D PPE plus a full-face respirator with high-efficiency particulate air (HEPA) and OV cartridges.

Table 11-1
Personal Protective Equipment
(for potential or actual chemical exposure)

Task	Hazard	Level	Body	Respirator	Skin	Other
Direct-push soil and groundwater sampling, hollow-stem auger drilling, aquifer testing, and monitoring well sampling	Minimal chemical exposure	D or Mod. D*	Normal work clothes Long pants	Full-face with HEPA and OV cartridges ready for use	Latex or nitrile gloves	Hard hat Safety glasses Steel-toed leather work boots
Decontamination of equipment, controlling spread of contamination	Skin contact	Mod. D	Polyethylene-coated Tyvek suit	Full-face with HEPA and OV cartridges ready for use	Latex or nitrile gloves	Hard hat Safety glasses Steel-toed leather work boots
Site walkover Geophysical survey Land survey	Minimal chemical exposure	D	Normal work clothes Long pants	NA	NA	Hard hat Safety glasses Steel-toed leather work boots

Note:
* where the potential for heat stress exists, modified Level D may be downgraded to Level D if continuous monitoring verifies the absence of organic vapor

Acronyms/Abbreviations:
HEPA – high-efficiency particulate air
Mod – modified
NA – not applicable
OV – organic vapor (filter)

Section 12
HAZARD COMMUNICATION PROGRAM

An OSHA-compliant hazard communication program will be implemented in accordance with PP SH 1.9, Hazard Communication Program (BNI 2004). Material Safety Data Sheets for all chemicals used on-site will be available from the SSHR along with the written safety and health plans.

Environmental samples of soil and groundwater from OU-2C covered by this SSHP are not expected to meet contamination criteria that would require implementation of special training, packaging, and shipment, in accordance with United States Department of Transportation requirements. In the unlikely event that sample results indicate levels of contaminants meeting these criteria, shipment of further samples will be discontinued until the appropriate training is conducted and special shipping arrangements are made.

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Section 14
TRAINING ASSIGNMENTS

A matrix summarizing training requirements for CLEAN personnel, subcontractor supervisors and personnel, visitors, and vendors is presented in Table 14-1.

Table 14-1
Training Assignment Matrix

Category	40-Hour Basic	8-Hour Refresher	24-Hour Supervised Experience	Site-Specific	CLEAN Orientation	First Aid/ CPR	Oxygen Qualified
CLEAN employee	X	X	X	X	X	X[a]	X[b]
CLEAN or subcontractor supervisor	X[c]	X[c]		X[d]	X[d]	X[a]	X[b]
Subcontractor	X[c]	X[c]		X[d]	X[d]	X[a]	X[b]
Visitor	X[e]	X[e]		X			
Vendor	X[e]	X[e]		X			

Notes:
- [a] a minimum of two people will be on-site at a given field location during fieldwork; at least two individuals will have a valid certificate in basic first aid/CPR and bloodborne pathogen training from the American Red Cross (or equivalent)
- [b] at remote sites, a minimum of two people will be qualified to deliver oxygen
- [c] the requirement for 40-hour basic and 8-hour refresher training for land survey and geophysical subcontractors will be made on a case-by-case basis by the CLEAN SHM
- [d] site-specific and CLEAN orientation may be combined for non-CLEAN personnel; the requirement for 40-hour basic and 8-hour refresher training for land survey and geophysical subcontractors will be made on a case-by-case basis by the CLEAN SHM
- [e] for vendors/visitors requiring controlled-area access to work on contaminated equipment

Acronyms/Abbreviations:
CLEAN – Comprehensive Long-Term Environmental Action Navy
CPR – cardiopulmonary resuscitation
SHM – Safety and Health Manager

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Section 16
EMERGENCY RESPONSE PLAN

This section discusses the emergency response plan and provides emergency phone numbers, contacts, and notification information.

An emergency response plan meeting the requirements of Title 29 *Code of Federal Regulations* Sections 1910.120 and 1926.65 will be established for the project. The SSHR will be responsible for establishing the Emergency Response Team (ERT) as part of the site mobilization and emergency response training. The ERT will provide initial response only for rescue, fire fighting, and spill control. Activity or off-site emergency response personnel will be immediately called in to address all issues. ERT members will be first aid/CPR-qualified and bloodborne pathogen–trained. If the potential for spills of regulated materials is present, they will also have completed fire-fighting and emergency spill–control training. The organization of the ERT will be an element of the site-specific training.

As part of the site mobilization activities, a field readiness review will be conducted by the project team. The readiness review will include the pre-emergency planning and notifications of the proposed work activities to the nearest medical facility located in Alameda. The Field Team Leader, R. Schilling, will be the primary point of contact for the field program. Prior to the start of fieldwork, the field team members and subcontractors will be briefed on the contents of the site safety and health plans, pertinent work procedures, and AHAs. Additional topics to be discussed at the daily safety tailgate meetings will include the following:

- specifics of the field program and hazards present at the various sites
- personnel roles, lines of authority, and communication rules
- safe distances and places of refuge
- site security and control measures
- evacuation routes and the route to the nearest hospital (the field team should drive to the facility)
- availability of emergency first aid
- important contact information and phone numbers
- procedures for reporting incidences to local, state, and Navy authorities

In the event of a medical emergency or fire during fieldwork at OU-2C, call the standard "**911**" emergency telephone number from the on-site mobile phone or any public phone. A mobile telephone will be available during all field activities. At each work location, the SSHR and/or field team leader will verify on a daily basis that mobile phones are operational. Since fieldwork at OU-2C will be conducted at several large areas, the central emergency meeting location for all field personnel will be designated during the safety and health briefing at the beginning of each day.

Table 16-1 lists pertinent emergency phone numbers. Table 16-2 lists emergency facility locations. Table 16-3 lists Navy and CLEAN Program emergency notification contacts. All project vehicles will maintain a copy of this section (Section 16), together with the appropriate emergency maps, in a readily accessible location at all times.

The emergency facility located closest to Alameda Point is the Alameda Hospital. The hospital address is 2070 Clinton Avenue (Figure 16-1).

As part of the site-specific safety and health briefing at the beginning of each day, the SSHR will describe the route to both the emergency meeting location and the nearest hospital. As shown on Figure 16-1, the route from the old East Gate of Alameda Point to the hospital is as follows.

1. Exit through the old East Gate.
2. Turn right onto Main Street.
3. Stay on Main Street as it curves and heads south.
4. Go through the traffic light at Pacific Avenue by making a slight jog to the left. The street will turn into Central Avenue.
5. Follow Central Avenue as it curves and heads east (it will become Highway 61).
6. Bear to the right onto Encinal Avenue (at the intersection of Central Avenue and Sherman).
7. Turn right onto Willow Street.
8. Turn right onto Clinton Avenue and take immediate first left into the emergency entrance of the hospital.

16.1 EMERGENCY EQUIPMENT

The following additional emergency equipment will be maintained in ready condition at the site:

- full-face respirators (HEPA/OV) (two of each size)
- coveralls, SARANEX (four)
- spill cleanup and control supplies (one kit)
- self-contained pressurized eyewash equipment

16.2 COMMUNICATIONS

Readily accessible communication devices will be maintained on-site. Communication devices will be tested at least once per shift and at each new work location. The SSHR will always have a radio or phone in his/her possession. At least one working mobile phone is required on-site at all times. A cell phone and/or radio will be used for normal communications as well as during emergencies.

Table 16-1
Emergency Phone Numbers
(to be posted by Site Safety and Health Representative at all phone locations)

Emergency	Number	Contact	Notes
Medical	911	Emergency operator	
Fire	911	Emergency operator	
Police	911	Emergency operator	
Poison	(800) 222-1222	Emergency operator	
Medical center	General information: (510) 522-3700 Emergency care center: (510) 523-4357	Alameda Hospital 2070 Clinton Avenue Alameda, California	

REPORTING AN EMERGENCY:

When calling for assistance in an emergency situation, the following information should be provided:

- name of the person making the call
- telephone number at the location of the person making the call
- name of the injured person (if known)
- nature of incident
- actions already taken
- location of the incident
- what assistance is needed

IMPORTANT! DO NOT HANG UP UNTIL THE OPERATOR HAS ALL THE INFORMATION NEEDED.

To ensure that senior management is aware of and has the opportunity to engage in the response to medical emergencies and/or fires, the Safety and Health Manager (SHM) will be immediately notified by the SSHR. The lead geologist and/or SSHR will also contact the CTO Leader/Project Manager to inform them of the emergency event. It is the responsibility of the SHM to inform the Navy CLEAN Program Manager, who will notify the appropriate Bechtel Environmental, Inc., management of the event.

The Resident Officer in Charge of Construction and Remedial Project Manager will also be notified by the SSHR.

Table 16-2
Emergency Facilities Locations

Facility	Nearest Location	Alternative Location
Safety shower	Not required	Not applicable
Portable deluge	Each work area	Support vehicle
Decontamination area	Each work area	Support vehicle
Self-contained pressurized emergency eyewash unit	Each work area	Support vehicle
First-aid kit	Each work area	Support vehicle
Other emergency supplies	Each work area	Support vehicle
Emergency oxygen	Not required	Not applicable
Fire extinguishers	Each work area	Support vehicle

Table 16-3
Site and Program Emergency Notification Contacts

Contact	Telephone
Project Manager, Janet Argyres	(415) 768-9917
Contract Task Order Leader, Eric Johansen	(619) 744-3091
Bechtel Field Team Leader, Robert Schilling	(310) 308-6343 (cell)
Site Safety and Health Representative, Stephen Quayle	(510) 865-1814 (cell)
Safety and Health Manager, Anil Dharmapal	(619) 744-3099 and (760) 484-6520 (cell)
Environmental Safety Officer, NAVFAC SW, Alan Freeman	(619) 532-4157 and (619) 572-8141 (cell)
Remedial Project Manager, Mary Parker	(619) 532-0945
Environmental Compliance Manager, Doug DeLong	(415) 743-4713 and (510) 772-8832(cell)
ROICC Project Engineer, Gregory Grace	(510) 749-5940 and (510) 755-5884 (cell)
Bechtel Environmental, Inc., San Diego and San Francisco Offices	(619) 687-8700 and (415) 768-1234
RASO, Matthew Slack	(757) 887-4483
NWT Radiological Control Technician, Robert Evans	(720) 260-3033
Kleinfelder, San Diego Office	(858) 320-2000
Brown and Caldwell, San Diego Office	(858) 514-8822
Dean Ryan Consultants and Designers, Inc., Los Angeles Office	(213) 687-1130

Acronym/Abbreviation:
NWT – New World Technology
RASO – Radiological Affairs Support Office
ROICC – Resident Officer in Charge of Construction

LEGEND

- OPERABLE UNIT 2C BOUNDARY
- BUILDING
- RUNWAY
- WATER
- EMERGENCY MEETING LOCATION
- COMMON ROUTE FROM ALAMEDA POINT TO HOSPITAL
- ALAMEDA HOSPITAL
  2070 CLINTON AVE
  ALAMEDA, CA

DRIVING DIRECTIONS TO ALAMEDA HOSPITAL:

1. EXIT THROUGH THE OLD EAST GATE.
2. TURN RIGHT ONTO MAIN STREET.
3. STAY ON MAIN STREET AS IT CURVES AND HEADS SOUTH.
4. GO THROUGH THE TRAFFIC LIGHT AT PACIFIC AVENUE BY MAKING A SLIGHT JOG TO THE LEFT. THE STREET WILL TURN INTO CENTRAL AVENUE.
5. FOLLOW CENTRAL AVENUE AS IT CURVES AND HEADS EAST (IT WILL BECOME HIGHWAY 61).
6. BEAR TO THE RIGHT ONTO ENCINAL AVENUE (AT THE INTERSECTION OF CENTRAL AVENUE AND SHERMAN).
7. TURN RIGHT ONTO WILLOW STREET.
8. TURN RIGHT ONTO CLINTON AVENUE AND TAKE IMMEDIATE FIRST LEFT INTO THE EMERGENCY ENTRANCE OF THE HOSPITAL.

N

2500 0 2500 Feet

Site-Specific Safety and Health Plan for OU-2C

Figure 16-1

Map to Emergency Medical Facility

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 1/2/07
File No.: 081L14611
Job No.: 23818-093
Rev No.: B

Section 21
SPILL PREVENTION AND CONTROL MEASURES

This section discusses spill prevention, control, and containment and emergency response in the event of a spill.

21.1 SPILL PREVENTION, CONTROL, AND CONTAINMENT

Chemicals or hazardous substances could be spilled during site tasks as a result of:

- transportation accidents;
- improper packaging practices;
- rupturing of tanks, drums, or other storage containers; or
- improper handling of hazardous materials during off-loading.

The emergency plan will be activated in the event of unplanned spills of hazardous or unknown substances. In the event of any spill at the site, the field team leader and SSHR are to be notified immediately by whoever first witnesses the emergency event.

21.1.1 Facility and General Prevention/Control Measures

The following specific measures for spill prevention and control include procedures to be implemented in the field by CLEAN field personnel to reduce the possibility of liquid waste spillage, as well as actions to be taken if a spill occurs.

21.1.1.1 PREVENTIVE MEASURES

Preventive measures include the following activities.

- Inspect 55-gallon drums, bins, and/or Baker tanks for visible defects (e.g., holes, corrosion) upon delivery to the site.
- Inspect all 55-gallon drums upon delivery to the site to assure that each drum includes a resealable lid or a resealable lid with a small resealable sampling port (bung) near the top, on the side, or on the lid, and that the closure is not deformed or distorted.
- Set the 55-gallon drums on wooden pallets to facilitate transport via forklift (if necessary).
- Transfer contents of 55-gallon drums to a Baker tank prior to concluding each work period.
- Perform weekly inspections of the storage area including 55-gallon drums, bins, and/or Baker tanks while they are being filled and immediately after they are relocated to a temporary on-site storage area to check for possible leaks.
- Select flat areas for temporary storage away from high-traffic zones and storm or sewer drains.

21.1.1.2 SPILL CONTAINMENT AND CONTROL

The following actions will be taken by CLEAN field personnel assigned to the field activities in the event of a spill.

- The site coordinator (field team leader) and SSHR are to be notified immediately.
- Workers not involved in spill containment and/or cleanup will evacuate the immediate area to reduce the likelihood of spreading contamination or being exposed to contamination.
- Designated emergency response personnel attired in SARANEX coveralls and Level C PPE (if applicable) will proceed to the spill area with a spill cleanup and control kit that includes absorbent materials.
- Attempts will be made to stop the source(s) of spillage immediately.
- The SSHR will monitor for exposure to chemicals or hazardous substances during spill cleanup work.
- The SSHR will stay at the spill area until the area has been cleared, inspected, and readied for reentry.
- A spill incident report will be prepared by the SSHR.
- If the spill is of a known or potentially hazardous waste and the waste is stored under the 90-day accumulation rule, additional reports required by state law will be prepared.

21.1.2 Spill Prevention

The purpose of this section is to provide planning instructions for response to spills of IDW or other hazardous materials stored for disposal at the Alameda Point waste storage site location. IDW will be stored in a fenced area adjacent to Building 112 on Alameda Point. The field team leader, waste storage area supervisor, and any other designated individuals must identify situations having potential for hazardous material releases. The IDW storage area inspection log is used and maintained as part of the storage area facility record. This form can be found in CLEAN Standard Operating Procedure 22, Investigation-Derived Waste Management (BNI 2004). The IDW storage area inspection log identifies items that will be checked weekly at each IDW storage area operation. Weekly inspections of the IDW storage area and emergency response supplies are to be performed by the SSHR during the operations phase.

21.1.3 Spill Containment

Each IDW spill, leak, or incident will be assessed by the field team leader, waste area storage supervisor, or other qualified individual promptly upon discovery. This assessment will be conducted to characterize the degree of hazard to personnel and the environment and to implement effective control procedures. The responsible individual should attempt to determine the following information:

- type of materials released, container types, and storage location
- amount of materials released or at risk of being released
- location and direction of flow of the release
- hazardous characteristics of the released material
- occurrences due to spill (e.g., fire, injury, illnesses, damage to environment)

The assessment will include possible environmental and human-health hazards from the release including inhalation exposure, water runoff, and chemical agents used to control the emergency.

Table 21-1 lists suggested site-specific spill control equipment to choose from, location, and capabilities to be maintained for each IDW storage area.

21.1.4 Personal Protective Equipment

An HWP for the waste storage area will be prepared to indicate the appropriate PPE for an emergency response. This HWP will be updated based on the hazard potential for any particular waste stored. An emergency response team (ERT) composed of Navy CLEAN field personnel will use the PPE ensemble specified by the HWP until the release has been characterized or until relieved by base ERT members. PPE for spill containment operations, which will be maintained ready for use, include two sets of the following:

- hard hats
- safety goggles
- rubber boots (at least knee length) with toe protection
- chemical-resistant inner and outer gloves
- SARANEX-coated Tyvek coveralls with hoods
- full-face air-purifying respirators with OV/acid gas/HEPA cartridges

21.1.5 Monitoring

While the ERT is cleaning the spill, the SSHR will monitor for chemical exposures. During the cleanup, direct-reading instrumentation will be employed, including a photoionization detector and/or flame ionization detector and colorimetric indicator tubes, if indicated. Personnel monitoring using sampling pumps and collection media such as activated charcoal tubes may also be employed, depending on the SSHR assessment.

Table 21-1
Suggested Containment Equipment

Item	Capability	Location
Absorbent 10-pound bag (minimum) or sufficient material to contain a 55-gallon drum spill (sorbent packs/pillows) compatible with the stored wastes	Absorb contents of a single drum of liquid or leakage from larger containers of solids or semisolids	Emergency supply bin within storage area
Shovel, polyethylene (nonsparking material) long-handled	Collect spilled material	Emergency supply bin within storage area
Scoop, short-handled	Collect spilled material	Emergency supply bin within storage area
Two extra drums or overpacks for material storage and disposal	Overpack for damaged drum or container to collect used absorbent material	Storage area
Noncorrodible hand-operated pump for liquid transfer, with appurtenances	Transfer liquid from damaged drum at 2 gallons per minute	Emergency supply bin within storage area
Duct tape	Seal or join plastic sheet, temporary patch of drums	Emergency supply bin within storage area
Emergency barrier warning tape or traffic cones	Control access to site, warn unauthorized personnel	Emergency supply bin within storage area
Heavy-duty plastic bags	Collect contaminated trash, personal protective equipment	Emergency supply bin within storage area
Labels for drums	Label all generated waste	Emergency supply bin within storage area
Sheet plastic, 6-mil polyethylene or herculite (400 square feet)	Cover ground, cover waste piles	Emergency supply bin within storage area
Warning signs	Warn unauthorized personnel	Posted
Spill kit inventory list	Assure kit content complete	Emergency supply bin within storage area
Fire extinguisher	Size 3A:40BC	Emergency supply bin within storage area

21.1.6 Record Keeping

The SSHR and CTO Leader will document the spill in an Incident Report in accordance with program procedures. The Incident Report will be forwarded to the CLEAN SHM. Records of all hazardous materials releases will be maintained with the project files and the facility operating record. Information will include the following:

- time and date of incident
- location of incident
- size of release
- chemicals involved
- names of SSHR and ERT
- cleanup procedures
- unusual or pertinent incidents during the cleanup
- disposition of cleanup waste
- follow-up actions
- government agencies contacted

In addition to the above information, the final Release Report will be maintained in the project files.

21.1.7 Waste Management

All cleanup materials resulting from an incident will be managed as the initial waste materials.

21.2 EMERGENCY RESPONSE CALLOUT

A basic emergency plan is incorporated in Section 21 of the Program Safety and Health Plan (BNI 1997). This plan will be activated in the event of unplanned spills or releases of hazardous or unknown substances. This plan provides for designation of an Emergency Coordinator (EC) and SSHR, and specifies responsibilities during an emergency. The plan also directs that nonessential workers should leave the immediate area. This will reduce the likelihood of spreading contamination outside the restricted area and minimize the number of potentially contaminated, exposed, or injured personnel.

21.2.1 Response Implementation

In the event of an unplanned release or spill of unknown or hazardous substances, the EC will notify activity-designated personnel who may implement the activity spill-control plan. The activity will request outside or off-site assistance if required. Once at the site, the EC will designate the spill as a restricted area and only authorized personnel, such as the ERT, will be permitted within the spill confines. ERT members will be trained to contain and clean up spills from typical materials and quantities used on the project

location. The SSHR will set up physical barriers warning unauthorized personnel to stay clear of the site and provide technical guidance to the ERT as needed.

Once barriers have been established, the EC and SSHR will assess the spill conditions, as described in the above-mentioned assessment section, and determine whether the spill is small or large. This determination is based on the following criteria.

- Small spills involve a maximum volume of 55 gallons of a liquid or a maximum weight of 100 pounds of a solid.
- Large spills involve a volume of liquid greater than 55 gallons or solids weighing more than 100 pounds.

Small spills may be remediated using absorbent materials. This task will be conducted by on-site workers, supervised by the SSHR and EC. The SSHR will direct spill response operations and stay at the spill area until the area has been cleaned, surveyed, and authorized for reentry.

Action plans for large spills or small spills of highly toxic material should be developed quickly due to the potential for catastrophic events and off-site environmental contamination to the groundwater or neighboring facilities.

In the event of large spills, proper safety and health procedures will be established and communicated to the ERT prior to any control activity. The EC will transfer response to the Hazardous Materials (HAZMAT) Team.

Until the HAZMAT Team can respond, ERT responsibilities consist of containing the spill to prevent contamination from spreading to outside areas and keeping unauthorized personnel from entering the restricted area. The HAZMAT Team is responsible for actual spill containment and materials release termination in accordance with the activity spill containment and emergency response plans.

The EC and ERT will provide assistance to the HAZMAT Team upon request and will stay at the spill area until released, or until the area has been cleaned, surveyed, and authorized for reentry.

The CTO Leader and SHM will approve the reentry to the site for routine use and will issue a final release report pertaining to cleanup of the area.

21.2.2 Notification

If, in the EC's assessment, off-site impacts are possible, the EC will immediately notify the Navy Caretaker Site (CS) Office – San Francisco Bay Area (Doug DeLong, phone [415] 743-4713 and cell [510] 772-8832). The Navy CS Office will notify off-site authorities, if necessary. The EC will provide a report for immediate transmission to the State Office of Emergency Services (or other state-designated agency) containing the following:

- name and telephone number of reporter
- name and address of facility

- time and type of incident
- name and quantity of materials involved
- extent of injuries
- possible off-site hazards to human health and/or the environment

The types and quantities of hazardous material spills/releases that could be anticipated at this site are within the capabilities of control by on-site personnel. However, should an incident involve a situation that represents potential life-threatening situations or damage to the environment, the EC will contact the designated activity environmental contacts for emergency response support. It is the EC's responsibility to notify the Navy CS Office and relate pertinent information for response purposes. It may also be necessary to contact federal, state, or local agencies for compliance with environmental and safety and health regulations. Agency notification is the responsibility of the CTO Leader in coordination with the Activity Environmental Coordinator.

Prior to reactivation of the facility, the California Environmental Protection Agency Department of Toxic Substances Control and other appropriate state and local authorities will be notified that the facility is in compliance with Title 22 *California Code of Regulations* Section 66265.56(h).

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Section 22
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ATTACHMENT E

RISK ASSESSMENT WORK PLAN

Department of the Navy
Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

Contract No. N68711-95-D-7526

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY

CLEAN 3

FINAL
RISK ASSESSMENT WORK PLAN FOR SUPPLEMENTAL REMEDIAL INVESTIGATION SAMPLING AT OPERABLE UNIT 2C ALAMEDA POINT ALAMEDA, CALIFORNIA

CTO-0093/0203
May 2007

Prepared by:

BECHTEL ENVIRONMENTAL, INC.
1230 Columbia Street, Suite 400
San Diego, California 92101-8502

Signature: Eric Johansen
Eric Johansen, CTO Leader
Date: 4/27/07

Signature: T. Heironimus
Tim Heironimus, PG 4897
Date: 4/27/07

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ACRONYMS/ABBREVIATIONS

AST	aboveground storage tank
BAF	bioaccumulation factor
bgs	below ground surface
BTAG	Biological Technical Assistance Group
Cal/EPA	California Environmental Protection Agency
CLEAN	Comprehensive Long-Term Environmental Action Navy
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CTO	contract task order
DTSC	(Cal/EPA) Department of Toxic Substances Control
EPC	exposure point concentration
ERA	ecological risk assessment
GAP	generator accumulation point
g/day	grams per day
g/kg/day	grams per kilogram per day
HHRA	human-health risk assessment
HI	hazard index
HQ	hazard quotient
IR	Installation Restoration (Program)
IRIS	Integrated Risk Information System
LOEC	lowest observed effect concentration
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/kg-day	milligrams per kilogram per day
MSL	mean sea level
NAS	Naval Air Station
NCEA	National Center for Environmental Assessment
NOAEL	no observed adverse effects level
NOEC	no observed effect concentration
ORNL	Oak Ridge National Laboratory
OU	operable unit
OWS	oil/water separator

PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PG	Professional Geologist
PPRTV	provisional peer reviewed toxicity value
PRG	preliminary remediation goal
RAWP	risk assessment work plan
RESRAD	residual radioactivity
RI	remedial investigation
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TRV	toxicity reference value
UCL	upper confidence limit
U.S. EPA	United States Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound

Section 1
INTRODUCTION

This Risk Assessment Work Plan (RAWP) provides site-specific guidance related to conducting a human-health risk assessment (HHRA) and ecological risk assessment (ERA) for the supplemental remedial investigation (RI) sampling at Operable Unit (OU) 2C, Alameda Point, Alameda, California. Bechtel Environmental, Inc., prepared this RAWP for the Base Realignment and Closure Program Management Office West under Contract Task Order (CTO)-0081 of the Comprehensive Long-Term Environmental Action Navy (CLEAN) 3 Program, Contract No. N68711-95-D-7526.

Located in the central section of Alameda Point, OU-2C consists of Installation Restoration (IR) Sites 5, 10, and 12. Historical uses of OU-2C by the Navy were industrial; previous investigations reported the presence of chemicals of potential concern (COPCs) in soil and groundwater at OU-2C.

Supplemental RI sampling is proposed for several areas within OU-2C that have been identified by the Navy and regulatory agencies as needing further evaluation to complete the RI. OU-2C (approximately 53 acres) includes the former aircraft rework facility (Building 5/5A), missile rework facility (Building 400), power plant (Building 10), metal treatment shop (Building 32), dry cleaning operation (eastern portion of Building 2), and repair shop and steam cleaning facility (Building 6). OU-2C also includes a number of smaller buildings that historically used or stored chemicals and a number of oil/water separator (OWSs), solid waste management units (SWMUs), underground storage tanks (USTs), and aboveground storage tanks (ASTs). Additionally, release of radium from operations within Building 5 between the 1940s and early 1970s resulted in radiation-impacted storm sewer lines draining into Seaplane Lagoon at Outfall F.

Areas requiring further evaluation were initially determined based on the draft RI Report (SulTech 2005) and on regulatory agency review comments for that report (see Attachment F). The draft RI Report recommended further evaluation of several areas within OU-2C, and based on a combined assessment of historical uses, data evaluation results, risk evaluation, and comments from the regulatory agencies regarding data gaps in the report, areas requiring further sampling were identified. During an April 18, 2006 meeting, the list of areas requiring further evaluation at OU-2C was refined by the Navy and regulatory agencies. It was agreed that 6 evaluation areas, 13 data gap areas, and 22 SWMUs (including 4 OWSs) would be subject to further evaluation at OU-2C. These study areas are described below.

- 6 evaluation areas requiring further field activities
  - Evaluation Area 1: OU-2C groundwater impacted by volatile organic compounds (VOCs), metals, and cyanide; and potentially impacted by radium-226 and radium-228 beneath Building 5 and by 1,4-dioxane
  - Evaluation Area 2: soil and groundwater in the vicinity of Building 2 (former dry cleaning operations, including Naval Air Station [NAS] generator accumulation point [GAP] 05)
  - Evaluation Area 3: soil beneath the southern portion of Building 5 (plating shop, foundry, etc.)

  - Evaluation Area 4: soil beneath the Aircraft Maintenance Line and adjoining shop area in the northern portion of Building 5
  - Evaluation Area 5: soil south of Building 5
  - Evaluation Area 6: soil east of Building 5
- 13 data gap areas
  - IR Site 5: Buildings 6, 34, 43, 44, 102, 282, 347, 405, 415, 500, and 505
  - IR Site 5: polynuclear aromatic hydrocarbon (PAH) data gap area and former materials storage area south and east of Building 44
  - IR Site 10: Building 400 hangar floor
- 22 SWMUs
  - 4 OWSs (OWS 005, OWS 006A, OWS 006B, and OWS 010)
  - 1 AST (AST 005G, removed)
  - 4 solvent distillation units (M-01, M-02, M-05, and M-08)
  - 1 coolant recovery system (M-09)
  - 9 Naval Aviation Depot (NADEP) GAPs (NADEP GAPs 02, 04, 17, 20, 25, 27, 31, 57, 70)
  - 1 NAS GAP (NAS GAP 01)
  - 1 Resource Conservation and Recovery Act [RCRA] area of concern (AOC) (AOC 005; also known as USTs 5-2 and 5-3, both removed)
  - 1 RCRA UST (UST[R]-02, also known as USTs 6-1 and 6-2; both removed)

Previous investigations identified concentrations of one or more of the following classes of chemicals in the soil and groundwater:

- VOCs
- total petroleum hydrocarbons
- semivolatile organic compounds (SVOCs), including PAHs
- pesticides and polychlorinated biphenyls (PCBs)
- metals (including hexavalent chromium)
- cyanide

This risk assessment will assess risk to human health and ecological receptors from soil and groundwater.

1.1 SITE DESCRIPTION

Alameda Point is located at the west end of Alameda Island, which lies at the base of a gently westward-sloping plain that extends from the Oakland-Berkeley hills on the east to the shore of the San Francisco Bay on the west. The San Francisco Bay also borders the

island to the south and the Oakland Inner Harbor borders the island to the north. The base is rectangular in shape and is approximately 2 miles long and 1 mile wide. Approximately 1,526 acres of Alameda Point are above water, and 1,108 acres are below water in lagoons and harbor areas. OU-2C is located on the central portion of Alameda Point.

The three sites (IR Sites 5, 10, and 12) that make up OU-2C are described in the following subsections.

1.1.1 IR Site 5

IR Site 5, approximately 47 acres in size, is located on the north side of OU-2C. The site is relatively flat and includes several buildings, including Building 5, which is the largest and covers approximately 40 percent of the site. The remaining 60 percent of the site is open space. IR Site 5 was used for aircraft and aircraft component repair and maintenance operations. These activities included cleaning, reworking, and manufacturing of metal parts; plating, painting, and tool maintenance operations; and radioluminescent painting of aircraft dial faces (SulTech 2005). Waste generated at Building 5 included spent solvents, waste paints, waste oils, and plating-operations wastewaters containing hexavalent chromium and cyanide. Building 5 is currently vacant.

1.1.2 IR Site 10

IR Site 10, approximately 4 acres in size, is located on the south side of OU-2C. Site features include Building 400 (which covers approximately 85 percent of IR Site 10) and a former UST. IR Site 10 and Building 400 were used as a missile rework and avionic rework facility. Operations associated with Building 400 include paint stripping, construction of fiberglass airplane components, airplane parts cleaning and degreasing, silk screening, photographic development, and radioluminescent painting of aircraft dial faces. Waste generated at Building 400 included paint sludges, metal shavings, paint strippers, cleaning solvents such as trichloroethene (TCE) and carbon tetrachloride, testing fluids, and miscellaneous oil and grease (SulTech 2005). Currently, Building 400 is used by a movie production company as office space and a production lot.

1.1.3 IR Site 12

IR Site 12, approximately 2 acres in size, is located on the southwestern corner of OU-2C. Site features include Building 10 (which covers approximately 25 percent of the site), several ASTs, and USTs. Building 10 was formerly used as the power plant, which generated steam and compressed air (using Bunker C oil) from the late 1930s to the early 1970s. At that time, the plant was converted to a natural gas power plant with diesel fuel as a backup fuel source. Petroleum products, plant treatment chemicals, microbiocide, morpholine, and corrosives are documented to have been stored in Building 10 (SulTech 2005). Currently, Building 10 is vacant.

1.2 SUMMARY OF PREVIOUS INVESTIGATIONS

The following is a list of previous investigations related to OU-2C:

- Phases 2B and 3 Investigation (PRC and JMM 1992)
- Additional Work at Sites 4 and 5 (PRC and Montgomery Watson 1995, PRC and JMM 1993)
- Follow-On Remedial Investigation, CTO-260 (PRC and Montogomery Watson 1996a)
- Follow-On Remedial Investigation, CTO-280 (PRC and Montgomery Watson 1996b)
- Environmental Baseline Survey
  - Phase 1 (ERM-West 1994)
  - Phase 2 (IT 2001a)
- Storm Sewer Investigations (TtEMI 1997, 2000; IT 2001b)
- Geochemical Profiling to Define Chlorinated Solvent Plumes (OGISO Environmental 1997)
- Electrokinetic Pilot-Scale Treatability Study (TtEMI 1999b)
- Supplemental Remedial Investigation Data Gaps Sampling (TtEMI 2002)
- Sites 5 and 14 Removal Action Site Closeout Report (IT 2002a, TtEMI 2001)
- Chlorinated Solvent Plume Definition and Dense Nonaqueous-Phase Liquid Treatability Studies (Surbec-ART Environmental 2000, Shaw 2003)
- Polynuclear Aromatic Hydrocarbon Studies at Alameda Point (BEI 2002, 2004)
- Basewide Groundwater Monitoring Program (Shaw 2003; TtEMI 1998)
- Tidal Influence Study (PRC and Montgomery Watson 1995)
- Total Petroleum Hydrocarbon Investigations (TtEMI 1999a,c,d; 2003b; PWC 1996a,b,c,d; 1997a,b; IT 2001b, 2002b)
- Radiation Investigations (New World Technology 2002)
- Resource Conservation and Recovery Act Investigations (DTSC 1992)
- Dense Nonaqueous-Phase Liquid Source Removal Action (Shaw 2006)

The draft RI Report for OU-2C was completed in July 2005 (SulTech 2005). Following their review of that report, the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) and the San Francisco Bay Water Board recommended that further investigation be conducted at the site and revisions to the RI Report be completed. This RAWP has been prepared in accordance with specific recommendations made by the regulatory agencies.

1.3 CONCEPTUAL SITE MODEL

The conceptual site model for OU-2C is presented on Figure 1-1. Potential sources of impacts to OU-2C include the following:

- chlorinated VOC plume in the shallower and deeper first water-bearing zone (FWBZ) beneath Building 5
- petroleum hydrocarbons and bis(2-ethylhexyl)phalate in soil and in the shallower FWBZ to the south of and at the eastern margin of Building 5
- hexavalent chromium and cyanide in the shallower FWBZ beneath Building 5
- arsenic, chromium, lead, and thallium in soil beneath Building 5
- twelve buildings identified as possible data gaps where surface releases of chemicals may have occurred from chemical storage or handling activities
- PAHs in soil along the former fuel line in the area south of Building 44 (west of Building 5)
- SWMUs (OWSs and former UST locations) where subsurface releases of chemicals may have occurred
- SWMUs where surface releases of chemicals may have occurred from temporary storage or handling of wastes

Historical uses of OU-2C by the Navy were industrial (Buildings 5, 6, 10, 32, 62, and 400) and residential (Building 2). According to the City of Alameda General Plan, Alameda Point Amendment, OU-2C is located in the Civic Core district. The Civic Core district is designated "...a mixed-use area with a major emphasis on Research and Development/Industrial 'flex' uses" (City of Alameda 2003). According to the Navy, the City of Alameda will not include residential land use within the OU-2C portion of the Civic Core area (Peck, pers. com. 2006).

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Section 2
HUMAN-HEALTH RISK ASSESSMENT

The methodology presented in this section outlines the procedures that will be used in the HHRA to address COPCs in soil, soil gas, and groundwater for OU-2C. The HHRA will be conducted in accordance with the Risk Assessment Guidance for Superfund, Part A (U.S. EPA 1989), Part B (U.S. EPA 1991a), Part E (U.S. EPA 2004a), and supporting documents and guidelines published by Cal/EPA (DTSC 1993, 1994, 1999).

This section presents the steps that will be used to calculate the human-health risks. Within each step there will be a need to make various decisions based on the data collected. The combined historical data and proposed RI sampling data is of sufficient density to provide a statistically valid data set to calculate risks to human health and environmental receptors for OU-2C in whatever separate decision areas are finally demarcated upon completion of the Supplemental RI activities. The Navy is proposing an iterative process for making these decisions to allow progressive consensus between the regulatory agencies and the Navy. Specifically, this RAWP does not identify exposure units for the risk assessment because it is most appropriate to do this task once the historical and new data have been compiled and evaluated. This approach will allow flexibility in making decisions based on areas of impact that may be unknown at this time, and allow more collaboration between the regulatory agencies and the Navy. Prior to completion of the risk assessment, the Navy will discuss various possible approaches to expedite preparation of multiple risk assessments without compromising the calculation of the correct baseline human health cancer risks and noncancer hazard indices.

2.1 DATA EVALUATION

All chemicals and radionuclides reported at concentrations or activities above detection limits in at least one sample in which data are considered applicable and usable will be included as COPCs in the HHRA. The historical and proposed RI data are considered adequate to support this HHRA.

2.2 EXPOSURE ASSESSMENT

The objective of the exposure assessment is to evaluate the type and magnitude of exposures to a human receptor from COPCs at a site. The following subsections describe the receptors, the exposure concentrations, the estimation of chemical intake that will be used to quantify exposure for each pathway, and reasons for their selection.

2.2.1 Receptor Analysis

As described in the conceptual site model (Figure 1-1), potential receptors are future residents and occupational and construction workers. These receptors could come into contact with COPCs through ingestion of soil, inhalation of vapors in indoor and outdoor air, and dermal contact with chemicals in soil. Residents could also ingest homegrown produce grown in local soil.

2.2.2 Estimation of Exposure Point Concentrations

An exposure point concentration (EPC) is the concentration of a chemical in a contaminated medium at the point of contact with a receptor. The United States Environmental Protection Agency (U.S. EPA) recommends using the 95 percent upper confidence limit (UCL) of the arithmetic mean or the maximum concentration, whichever is lower (U.S. EPA 1989, 2002a). In cases where there are fewer than ten samples, the maximum concentration will be used. An EPC will be calculated for each COPC using the U.S. EPA software ProUCL, Version 3.00.02 (U.S. EPA 2006b), as follows.

1. The distribution of the data will be determined. Samples reported as nondetect will be included as values with a concentration of one-half the detection limit. There will be no limitations on the percentage of nondetects.
2. The Student's t-test will be used to calculate the EPC for normal data, the Land equation for lognormal data, and the gamma UCL for data that fit a gamma distribution. The approximate Chebyshev limit will be used for nonparametric data.
3. The maximum concentration will be used as the EPC if the appropriate 95 percent UCL will be greater than the maximum concentration.

2.2.3 Modeled Exposure Concentrations

Two types of data will be used to estimate indoor air concentrations: subslab soil gas data from existing buildings, and groundwater data. Subslab soil gas to indoor air will be modeled using Cal/EPA attenuation factors applied to the soil gas data (DTSC 2005).

Groundwater data will also be used to model indoor air concentrations in areas where there are no subslab soil gas data. Also, groundwater data will be used to model outdoor air in the vicinity of Building 5 with the assumption that the building and foundation have been removed. Groundwater data will also be used to determine whether any chemicals identified in the subslab soil gas are derived from chemicals in groundwater.

The Johnson and Ettinger model, using site-specific input parameters, will be used to calculate EPCs for inhalation of vapors in indoor air from volatile COPCs in soil and groundwater (U.S. EPA 2004c). Default Johnson and Ettinger model parameters will be used except for the following site-specific input values:

- soil type
- soil vapor permeability
- vadose zone soil dry bulk density
- vadose zone soil total porosity
- vadose zone soil water-filled porosity
- residential air and industrial air exchange rates

The U.S. EPA Region 9 volatilization factors and particulate emission factor presented in the preliminary remediation goals (PRGs) will be used to calculate EPCs for inhalation of vapors and particulates in outdoor air originating in soil (U.S. EPA 2004d).

Site-specific assumptions will be developed for ingestion of homegrown produce. The transfer of COPCs from soil to plants is estimated with an uptake factor (DTSC 1993). Uptake factors for inorganic chemicals will be developed by U.S. EPA from empirical data for plant uptake (U.S. EPA 1996). For PAHs, field data are used from studies that measured the concentrations in the soil and in produce (Samsφe-Petersen et al. 2002). For other organic chemicals, uptake factors are calculated from the chemical-specific octanol-water partition coefficient and the organic-carbon-normalized partition coefficient (DTSC 1993). Volatile chemicals are not included in this pathway because they are not known to accumulate appreciably in plants or vegetables. Also, volatile chemicals are not likely to be persistent in shallow soils where the roots of plants would be able to absorb them.

The exposure frequency for ingestion of homegrown produce will be calculated using 20 percent of the total days of exposure frequency for the residential scenario (resulting in 70 days per year). Ingestion rates will be selected from U.S. EPA guidance (U.S. EPA 1997b). U.S. EPA estimates that homegrown fruits and vegetables account for 4 percent and 6.8 percent, respectively, of receptor diets. Using the 95th percentile of fruit and vegetable intakes (12 grams per kilogram per day [g/kg/day] and 10 g/kg/day, respectively), a 70-kilogram adult would ingest 33.6 and 47.6 grams per day (g/day) of homegrown fruit and vegetables, respectively, and a 15-kilogram child would ingest 7.2 and 10.2 g/day, respectively. These values will be summed to provide the total daily intake of homegrown produce. These values are for total produce intake, and represent the edible portions of the produce (U.S. EPA 1997c).

2.2.4 Estimation of Dose Rates

Exposure dose rates are the amount of chemical to which a receptor is exposed per unit body weight and time. Dose rates are estimated by integrating intake variables, such as body weight and exposure duration, with the EPC. Exposure values used in the estimation of dose rates are presented in Tables 2-1 and 2-2 for reasonable maximum exposure and central tendency exposure, respectively.

2.3 TOXICITY ASSESSMENT

The hierarchy of human-health toxicity values used by U.S. EPA Region 9 in their PRGs follows Directive 9285.7-53, issued by U.S. EPA's Office of Solid Waste and Emergency Response on December 5, 2003, as follows:

- Tier 1 – U.S. EPA Integrated Risk Information System (IRIS) database (U.S. EPA 2006c)
- Tier 2 – U.S. EPA Provisional Peer-Reviewed Toxicity Values (PPRTVs)
- Tier 3 – Health Effects Assessment Summary Tables (U.S. EPA 1997d) and National Center for Environmental Assessment (NCEA)

The toxicity values used in this risk assessment will be compiled from the U.S. EPA Region 9 PRG Table (U.S. EPA 2004d). Values from IRIS will be confirmed through a review of U.S. EPA's IRIS database (U.S. EPA 2006c) to check for updates that have occurred since the publication of the PRGs.

Toxicity values are compiled from U.S. EPA Region 9 PRGs because PPRTVs and values from NCEA are not available to the public. Therefore, any updates to PPRTVs since publication of the PRGs are not available for inclusion.

Toxicity values developed by Cal/EPA will be also used in the risk assessment. The Cal/EPA cancer slope factors for carcinogens are listed in the Office of Environmental Health and Hazard Assessment toxicity database, accessible at http://www.oehha.ca.gov/risk/ChemicalDB/index.asp. Use of Cal/EPA toxicity values in addition to the U.S. EPA toxicity values results in the creation of a separate risk assessment incorporating the Cal/EPA toxicity values. However, it should be noted that the Navy agrees at this time to evaluate Cal/EPA toxicity values, but clearly and expressly reserves the right to evaluate the legal and technical justification for these values, and accept or reject them, before or at the time of the Navy cleanup decisions.

The potential for health effects from lead will be evaluated by comparison of the EPC to site-specific PRGs for lead (DTSC 1999).

Slope factors for radionuclides will be taken from the Federal Guidance Report No. 13, Radionuclide Table (U.S. EPA 2001a) or the most recent values available for cancer slope factors from U.S. EPA http://www.epa.gov//superfund/resources/radiation/radrisk.htm.#prg. If these two sources do not agree, the value from the EPA website will be used.

2.4 RISK CHARACTERIZATION

The final step will be the characterization of risk, in which exposure (e.g., daily intake) and toxicity information (e.g., toxicity values) are integrated to calculate potential cancer and noncancer health risks. According to the U.S. EPA directive, Memorandum Regarding the Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions (U.S. EPA 1991b):

> Where cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 1E-04, and the noncarcinogenic hazard quotient is less than 1, action generally is not warranted unless there are adverse environmental impacts.

2.4.1 Cancer Risk Characterization

Cancer risk represents the probability that exposure to COPCs could result in an increased risk of cancer. Cancer risk is termed "the probability of increased individual excess cancer." This means the risk over and above everyone's natural risk of cancer. Cancer risk is a statistical probability, and does not predict how many cases of cancer will occur.

Cancer risk = daily intake × cancer slope factor

The cancer risks are added across all the exposure pathways for each chemical and then across chemicals to estimate overall risk. Total risks will be presented as the sum of the incremental risk associated with both chemical and radiological exposure. Cancer risks are discussed in the context of a risk management range of 1 in 1,000,000 (10^{-6}) to 1 in 10,000 (10^{-4}). For risks between 10^{-6} and 10^{-4}, site-specific factors are considered when making decisions about whether or not action is required to reduce risk.

Cancer risk for radionuclides will be calculated using residual radioactivity (DOE 1990) or site-specific U.S. EPA PRGs (U.S. EPA 2006e), depending on the final data results.

2.4.2 Noncancer and Lead Risk Characterization

Noncancer health effects are evaluated based on a hazard quotient (HQ) for individual chemicals. An HQ value of 1 indicates that lifetime exposure has limited potential for causing an adverse effect in sensitive populations, and values of less than 1 can generally be considered acceptable.

The sum of chemical-specific HQs is called a hazard index (HI). It is appropriate to add HQ values for different chemicals only if they have the same health effect. Adding HQ values into a single cumulative HI value across chemicals is a preliminary estimate of the highest possible noncancer risk. HI values of less than 1 can generally be considered acceptable. Values greater than 1 are usually given closer attention.

noncancer risk = daily intake / reference dose

The EPC for lead will be compared to the site-specific PRG.

2.5 UNCERTAINTY ANALYSIS

The uncertainty analysis discusses the sources of uncertainty in the risk assessment and determines the level of confidence that can be placed in the findings. The uncertainty analysis will consider the adequacy of the data, the representativeness of the exposure assumptions and exposure concentration of site conditions, confidence in the toxicity information for the COPCs, and risk calculations.

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Section 3
ECOLOGICAL RISK ASSESSMENT

This section presents the general methods and procedures for conducting a screening-level ERA along with a supplemental risk assessment using Step 3a refined exposure assumptions (Figure 3-1) for OU-2C.

3.1 OVERVIEW OF SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3a

The purpose of the screening-level ERA is to evaluate whether chemicals present in the soil and groundwater pose a potential hazard to ecological habitats or biota.

The screening-level ERA will follow the Navy's guidance for conducting ERAs (DON 1999, 2001). The Navy's policy requires a tiered approach and is consistent with the U.S. EPA Superfund ERA guidance (U.S. EPA 1997b). Tier 1 of the Navy's guidance is analogous to Steps 1 and 2 of the U.S. EPA Superfund guidance (U.S. EPA 1997b), which also result in a screening-level ERA.

The state of California has also prepared guidance documents pertaining to an ERA (Cal/EPA 1996a,b). The Navy's Tier 1 process is similar to the first two components of the California process: scoping assessment and Phase I predictive assessment. Following the process for an ERA described in the Navy policy (DON 1999, 2001) is expected to provide an approach that is consistent with the California process.

A Tier 1 screening-level ERA employs existing data and conservative assumptions regarding contaminant exposure. The objectives of the Tier 1 screening-level ERA are to provide a scientific basis for deciding whether a site may be eliminated from concern, to identify risk conditions that may require immediate attention, and to determine whether additional ERA is warranted. Within Tier 1, the primary objective of Step 1 is to determine whether complete exposure pathways exist between chemicals and selected ecological receptors at the site. In Step 2, risks are characterized using screening ecotoxicity estimates and conservative exposure assumptions for those chemicals for which complete pathways are identified.

At the conclusion of the screening-level ERA, there is a scientific management decision point at which a risk management decision is made regarding the status of the site. The following are the three possible outcomes of the Tier 1 screening-level ERA.

- Site conditions pose an acceptable risk and no further action is warranted.
- Site conditions pose a potentially unacceptable risk that requires additional evaluation with a Tier 2 baseline ERA.
- Site conditions pose a potentially unacceptable risk and accelerated site remediation is warranted.

It is unlikely that a screening-level ERA using conservative exposure assumptions will indicate the absence of potential ecological risk at this site; therefore, a supplemental risk assessment using Step 3a refined exposure assumptions will also be provided (Figure 3-1). The supplemental risk assessment is described at the beginning of the Tier 2 process,

Step 3 – Refinement of Preliminary Chemicals of Concern (U.S. EPA 1997b) and Step 3a – Refinement of Conservative Exposure Assumptions (DON 1999), and uses refined exposure assumptions that are less conservative but are expected to provide a more realistic exposure estimate.

If the process continues, the screening-level ERA will identify exposure pathways and chemicals of potential ecological concern (COPECs) for the Tier 2 baseline ERA. If sufficient supporting evidence is available, and the Navy and regulatory agencies agree, those contaminants and exposure pathways identified during the screening-level ERA as posing negligible risk will be eliminated.

3.2 EXPOSURE PATHWAY EVALUATION

To develop a site-specific evaluation of potential exposure pathways, available site-specific data will be reviewed and preliminary COPECs will be identified. Ecotoxicity profiles for COPECs will be evaluated in the risk assessment. Assessment end points and ecological receptors are proposed in the following sections. The exposure models for the screening-level ERA and for the Step 3a refined screening-level risk assessment are summarized in Table 3-1.

3.2.1 Site Location and Description

Alameda Point is at the west end of Alameda Island, which is located along the eastern margin of the San Francisco Bay near the City of Oakland in Alameda County, California (Figure 3-2). OU-2C, approximately 53 acres in size, is located in the central portion of Alameda Point. Section 1 of this RAWP provides site descriptions for OU-2C and IR Sites 5, 10, and 12. The screening-level ERA will address the soil and groundwater at OU-2C.

The land that is Alameda Point was created by filling natural bay tidelands and offshore areas with dredge spoils from the Oakland Estuary (now the Oakland Inner Harbor), Seaplane Lagoon, and the San Francisco Bay. Seaplane Lagoon, an extension of the San Francisco Bay, is located in the southeastern portion of Alameda Point and is approximately 1,000 feet south of OU-2C (Figure 3-3). Because Seaplane Lagoon is contiguous with the San Francisco Bay, all references to "the bay" in this ERA refer also to Seaplane Lagoon.

OU-2C is bounded in all directions by various industrial areas of Alameda Point. The site is primarily covered by pavement and buildings (Figure 3-4). The ground surface at OU-2C is flat, with an approximate elevation of 12 feet above mean sea level (MSL). Average groundwater elevation at OU-2C is 5.1 feet above MSL (approximately 6.9 feet below ground surface [bgs]). No naturally occurring surface water bodies exist on Alameda Point.

3.2.2 Ecological Setting

This section describes biological habitats; representative organisms; and rare, endangered, or threatened species in the vicinity of OU-2C. Habitat descriptions are

based on information presented in the California Wildlife Habitat Relationships System (CDFG 2001; Sawyer and Keeler-Wolf 1995; Mayer and Laudenslayer, Jr. 1988).

3.2.2.1 ECOLOGICAL HABITATS

The following ecological habitats occur within a 1-mile vicinity of OU-2C.

- Barren habitat occurs at OU-2C as bare soil, paved areas, and buildings; and on adjacent land at Alameda Point and in the Cities of Oakland and Alameda as roads, parking areas, buildings, and runways.
- Urban habitat occurs on adjacent land at Alameda Point and in the Cities of Oakland and Alameda as ornamental shrubs, trees, and landscaped areas.
- Nonnative grassland habitat occurs on Alameda Point to the west of OU-2C.
- Estuarine habitat occurs in portions of San Francisco Bay, such as the Oakland Inner Harbor to the north of Alameda Point, Seaplane Lagoon to the south of OU-2C, and the main San Francisco Bay to the south of Alameda Point.

Barren habitat generally offers little value to wildlife; it may serve as a corridor between other habitats or as a place of brief resting, but is not a significant place of shelter.

Urban habitat generally supports few wildlife species due to human disturbances and limited vegetation. Vegetation includes grass lawns, ornamental trees, and landscaped shrubs. Typical animal representatives of the urban habitat include the house finch (*Carpodacus mexicanus*), house sparrow (*Passer domesticus*), American robin (*Turdus migratorius*), red-winged blackbird (*Agelaius phoeniceus*), scrub jays (*Aphelocoma californica*), California ground squirrel (*Spermophilus beecheyi*), and feral cats. In addition, raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and Virginia opossum (*Didelphis virginiana*) may occur occasionally.

Nonnative grassland habitat offers shelter, forage, and nesting opportunities for a variety of animal species. The northern harrier (*Circus cyaneus*), killdeer (*Charadrius vociferus*), California horned lark (*Eremophila alpestris actia*), and burrowing owl (*Athene cunicularia*) are avian species that nest in the grassland habitat of Alameda Point. Avian predators occurring in the grassland habitat include the red-tailed hawk (*Buteo jamaicensis*), northern harrier, American peregrine falcon (*Falco peregrinus anatum*), white-tailed kite (*Elanus leucurus*), and American kestrel (*Falco sparverius*). Prey species occurring in the grassland habitat include the rock dove (*Columba livia*), mourning dove (*Zenaida macroura*), black-tailed hare (*Lepus californicus*), rabbit (*Sylvilagus floridanus*), and California ground squirrel. Raccoon, striped skunk, and Virginia opossum may forage in the grassland region. Small areas of scrub habitat occur within the grassland habitat.

Estuarine habitat of San Francisco Bay exists in the intertidal and subtidal zones along the shoreline of Alameda Point and nearby areas. To the north of Alameda Point is the San Francisco Bay waterway known as the Oakland Inner Harbor. An embayment known as Seaplane Lagoon is located south of OU-2C. The main body of San Francisco Bay is adjacent to the southern margin of Alameda Point. Predominant vegetation

includes eelgrass (*Zostera marinara*), various marine algae, and phytoplankton. The estuarine habitat supports numerous invertebrates, including polychaete worms, amphipod crustaceans, clams, snails, and crabs. Representative fish species include topsmelt, anchovy, surfperch, and gobies. Numerous other fish species are also present. Fish and invertebrates occurring in the estuarine habitat represent a food source for many birds, including the California least tern, California brown pelican (*Pelecanus occidentalis californicus*), western grebe (*Aechmophorus occidentalis*), and western snowy plover (*Charadrius alexandrinus nivosus*).

3.2.2.2 THREATENED, ENDANGERED, AND OF-CONCERN SPECIES

Special-status species for the screening-level ERA are those plant and animal species that are classified as threatened, endangered, or species-of-concern by state or federal agencies, and that are known to occur or have the potential to occur in the terrestrial or aquatic habitats in the vicinity of OU-2C (CDFG 2004a,b; 2006a,b). Table 3-2 provides a list of these special-status species for Alameda Point. Local environmental impact reports were used to determine the likelihood of these species occurring at or in the vicinity of Alameda Point (LSA 2001, WRT 2002). Because of the barren and disturbed habitat at OU-2C, the listed species are unlikely to occur at the site.

Point Reyes bird's-beak (*Cordylanthus maritimus palustris*), a small annual herb that grows along the fringe of coastal salt marshes, is a federally listed endangered species and has not been reported at Alameda Point since 1917. According to historical records, the grassland and scrub plant species Santa Cruz tarplant (*Holocarpha macradenia*), Kellogg's horkelia (*Horkelia cuneata sericea*), Contra Costa goldfields (*Lasthenia conjugens*), and Adobe sanicle (*Sanicula maritima*) have also not been observed in the area for many years. It is therefore unlikely that these species will occur at Alameda Point. In fact, none of the plant species on state or federal lists were reported in vegetation surveys conducted at Alameda Point in 1995 and 1997 (TtEMI 2003a).

Steelhead (*Oncorhynchus mykiss*) and Chinook salmon (*Oncorhynchus tshawytscha*) traverse the San Francisco Bay during migration from the ocean to the Sacramento River delta and freshwater rivers and streams (USACE et al. 1998). Green sturgeon (*Acipenser medirostris*) occur primarily in the northern portion of San Francisco Bay (San Pablo and Suisun Bays) and spawn in the rivers (USACE et al. 1998). Steelhead, salmon, and sturgeon may occasionally occur in the vicinity of Alameda Point.

The Alameda whipsnake (*Masticophis lateralis euryxanthus*) occurs primarily in scrub habitat and occasionally in grassland habitat. The Alameda whipsnake has not been observed at Alameda Point and is unlikely to occur there due to limited habitat.

Steller sea lion (*Eumetopias jubatus*) have been recorded in the area near Alameda Point but are not expected to occur regularly. The salt marsh harvest mouse and salt marsh wandering shrew (*Sorex vagrans halicoetes*) inhabit salt marshes, but neither has been observed at Alameda Point. No salt marsh harvest mice were reported during a biological survey in 1995 (TtEMI 2003a). The San Francisco dusky-footed woodrat (*Neotoma fuscipes annectens*) and Alameda Island mole (*Scapanus latimanus parvus*) are unlikely to occur at OU-2C, based on infrequent sightings in the past. The California

mastiff bat (*Eumops perotis californicus*) and Townsend's western big-eared bat (*Corynorhinus townsendii townsendii*) may occur at Alameda Point and may forage in the vicinity of OU-2C.

Several sea birds, shore birds, and salt marsh birds such as the western snowy plover, California least tern, double-crested cormorant, California brown pelican, California clapper rail, California black rail (*Laterallus jamaicensis coturniculus*), salt marsh common yellowthroat, and Alameda song sparrow occur or may potentially occur at Alameda Point. However, the shore birds and marsh birds are not expected to occur at OU-2C because they prefer a salt marsh habitat. The sea birds such as cormorant, pelican, and tern may forage for fish in the bay at Oakland Inner Harbor or Seaplane Lagoon. Several birds occur in the grassland or scrub habitat in areas adjacent to OU-2C; these birds include the northern harrier, merlin, burrowing owl, California horned lark, loggerhead shrike (*Lanius ludovicianus*), white-tailed kite, and American peregrine falcon. These avian species may occasionally occur at OU-2C.

3.2.3 Description of Available Data

Results from previous investigations at OU-2C indicate the presence of various organic and inorganic chemical compounds in soil and groundwater. OU-2C soil and groundwater samples have been analyzed for VOCs, SVOCs, metals, pesticides, and PCBs. Most of the SVOCs reported in soil and groundwater samples are PAHs. Preliminary COPECs including metals, VOCs, SVOCs, pesticides, and cyanide were identified in the draft RI Report (SulTech 2005).

3.2.3.1 SOIL COPECs

Typically, COPECs in soil are identified using analytical data from soil samples collected between 0 and 6 feet bgs (Cal/EPA 1998). For OU-2C, COPECs in soil may be identified using analytical data from soil samples collected between 0 and 7 feet bgs, since groundwater is at approximately 7 feet bgs. Soil sample collection depth will be addressed in the uncertainties discussion. The initial COPEC list for soil will include all chemical compounds that are reported at least once at a concentration greater than the detection limit.

3.2.3.2 GROUNDWATER COPECs

COPECs in groundwater will be identified using analytical data collected from groundwater monitoring wells. The initial COPEC list for groundwater will include all chemical compounds that are reported at least once at a concentration greater than the detection limit.

3.2.4 Ecotoxicity Profiles

Compounds listed on the preliminary COPEC list are known to have adverse ecological effects on various aquatic organisms. Ecotoxicity profiles for COPECs will be prepared from existing literature to support evaluation of exposure pathways. The ecotoxicity

profile of a COPEC will include descriptions of toxic mechanisms, environmental fate and transport, and levels associated with adverse effects.

3.2.5 Assessment End Points and Associated Ecological Receptors

Assessment end points represent those aspects of the ecosystem that are to be protected from potential adverse effects due to exposure to site contaminants. Assessment end points are likely to address particular roles or functions within the ecosystem rather than specific species, although threatened or endangered species will be addressed. Ecological receptors associated with the selected assessment end points will be identified. This provides a means of specifically evaluating the assessment end point.

Assessment end points generally include considerations for survival, growth, and reproduction of populations; characteristics of communities; and functions of habitats.

Representative ecological receptors would optimally represent a large number of individual species, including species that share a similar ecological or trophic function, are considered recreationally important, and are listed as threatened or endangered. The assessment and measurement end points for the OU-2C evaluation are presented in Table 3-3.

Identification of assessment end points and representative ecological receptors provides a list of important biota at the site that is potentially susceptible to the preliminary COPECs. The presence of a contact mechanism (exposure pathway) between the ecological receptors and the COPECs will then be evaluated.

3.2.6 Potential Exposure Pathways

Potential exposure pathways represent a potential mechanism by which preliminary COPECs occurring in a particular medium may come into contact with an ecological receptor. Evaluation of potential exposure pathways must include a consideration of the fate and transport mechanisms that describe the potential for COPECs to migrate from one medium to another. Fate and transport mechanisms to be considered include surface runoff, groundwater transport and discharge, sediment transport, volatilization, adsorption, and bioaccumulation.

Generally, potential exposure pathways between ecological receptors and contaminated media include direct media contact and indirect media contact (via food) as follows:

- ingestion of contaminated media
- ingestion of contaminated food items
- inhalation or respiration (via lungs, gills, and skin) of contaminated media
- dermal contact with contaminated media

Exposure by ingestion of contaminated media and food items is the typical scenario for larger organisms, such as mammals and birds. Exposures of mammals and birds by inhalation and dermal contact are present but are generally considered minor compared to the exposure by ingestion and will not be included in the risk assessment.

Exposure to contaminated media via dermal contact, respiration (which includes contaminant transport across the body wall and gills), and ingestion is the typical scenario for smaller organisms (e.g., invertebrates), amphibians, and most aquatic species (e.g., fish).

3.2.7 Preliminary Conceptual Site Model

The preliminary conceptual site model integrates the site-specific evaluations listed previously and presents the expected relationship between the preliminary COPECs and the ecological receptors. The conceptual site model identifies and discusses the following:

- sources of contamination
- fate and transport mechanisms
- contaminated media
- complete exposure pathways
- COPECs
- assessment end points and associated ecological receptors

Figure 1-1 shows potential exposure pathways for the OU-2C habitat.

3.3 ECOLOGICAL EFFECTS EVALUATION

Screening-level ecological effects values are presented as threshold concentrations or doses.

3.3.1 Surface Water Effects Values for Aquatic Life

The preferred aquatic threshold value will be a compound-specific ambient water quality chronic criterion for saltwater aquatic life (see Table 3-4 for a preliminary list of COPECs). The preferred values will be ambient water quality criteria presented in the California Toxics Rule (U.S. EPA 2000a).

The cadmium value listed in the California Toxics Rule (9.3 micrograms per liter [µg/L]) will be replaced with an updated value (8.8 µg/L) due a recent revision to the cadmium national ambient water quality criterion (U.S. EPA 2001b).

A saltwater chronic value for mercury is not listed in the California Toxics Rule. The screening level assessment will use the value, 0.025 µg/L, listed in the San Francisco Bay Basin Plan (Cal/EPA 1995) and in the San Francisco Bay Ecological Screening Levels (Cal/EPA 2005), which is based on the criteria listed in U.S. EPA's Ambient Water Quality Criteria for Mercury – 1984 (U.S. EPA 1985). The refined assessment will use the national recommended water quality criterion (0.94 µg/L) for aquatic life (fish and invertebrates) based on U.S. EPA updates (U.S. EPA 1995a, U.S. EPA 2002b , U.S. EPA 2006d).

If a value for a compound is not listed in the California Toxics Rule, a value will be selected from the following resources in the order presented:

- proposed federal water quality criteria (criteria continuous concentration) for saltwater aquatic life
  - antimony (U.S. EPA 1990)
  - phenanthrene (U.S. EPA 1990)
- chronic screening value for saltwater, U.S. EPA Region 4 (U.S. EPA 2001c)
- available data from scientific literature
  - chronic no observed effect concentration (NOEC), adjustment factor 1
  - acute NOEC, adjustment factor 0.1
  - acute LOEC, adjustment factor 0.01
  - chronic LOEC, adjustment factor 0.1
  - 96-hour lethal concentration 50 percent, adjustment factor 0.01

3.3.2 Vertebrate Toxicity Effects Values

COPECs will be evaluated with ecotoxicity estimates. These values will be preferentially based on a no-effect level for chronic exposures. Preliminary COPECs identified in soil are known or suspected to cause various adverse responses in terrestrial wildlife. Guideline toxicity reference values (TRVs) originally prepared by the Navy and the U.S. EPA Region 9 Biological Technical Assistance Group (BTAG) (EFA-West 1998) are included in ERA guidance documents by the Cal/EPA (2000, 2002). Wildlife TRVs are presented in the guidance documents as a lower estimate and an upper estimate of effect thresholds. The low-TRV, based on no observed adverse effect level (NOAEL) data, represents a threshold below which no adverse effect is expected. The high-TRV, based on an approximate midpoint of the range of effect levels, represents a threshold above which an adverse effect is likely to occur. TRVs used in the screening-level ERA will be low-TRVs unless otherwise noted.

For compounds without a Navy-BTAG TRV, a TRV will be selected from the scientific literature. If literature-based values are not chronic NOAEL values, a factor of 0.1 will be used to convert to a chronic value, and a factor of 0.1 will be used to convert to a NOAEL value, as necessary. If an avian TRV is unavailable for a COPEC, the mammalian TRV will be used with an adjustment factor of 0.1. TRVs for a preliminary list of COPECs are listed in Table 3-5 for mammals and in Table 3-6 for birds.

If the difference in body weight is more than two orders of magnitude (Cal/EPA 1999), wildlife TRVs will be adjusted for the difference in sensitivity between test species (usually standard laboratory animals) and selected ecological receptors for the site. An allometric adjustment will be used for mammalian and avian species (Sample and Arenal 1999) based on body weights of the test species described in the scientific literature. Scaling factors presented by Sample and Arenal (1999) indicate that mammalian

sensitivity increases with increased body weight, and avian sensitivity increases with decreased body weight.

For mammals, TRVs will be calculated using

$$TRV_{wildlife} = NOAEL_{test} * (BW_{test}/BW_{wildlife})^{[1-0.94]}$$

For birds, TRVs will be calculated using

$$TRV_{wildlife} = NOAEL_{test} * (BW_{test}/BW_{wildlife})^{[1-1.2]}$$

where

$TRV_{wildlife}$ = toxicity reference value for wildlife species
$NOAEL_{test}$ = no observed adverse effect level for test species
BW_{test} = body weight for test species
$BW_{wildlife}$ = body weight for wildlife species

3.4 EXPOSURE ESTIMATION

Risk characterizations will be prepared as HQs for vertebrate wildlife based on realistic exposure estimates and screening ecotoxicity values.

Exposure estimates will be prepared for complete exposure pathways between the COPECs and the selected ecological receptors. The exposure models for the screening-level risk assessment and for the Step 3a refined screening-level risk assessment are summarized in Table 3-1.

For the screening-level risk assessment, ingestion exposure for vertebrate wildlife will be estimated from the maximum concentration present in the ingested items. COPEC concentrations in invertebrate prey items (food) will be estimated with bioaccumulation factors (BAFs).

Ingestion exposures for larger organisms, such as mammals and birds, will be based on dose calculations (quantity of COPEC per day by body weight, milligrams per kilogram per day [mg/kg-day]). Dose calculations will be prepared for each ingested medium or food item, and then summed for a total dose. The basic dose calculation for a medium or food item is:

$$Dose_i = C_i \times IR \times F_i \times SUF \times AE_i \times BW^{-1}$$

where

$Dose_i$ = COPEC daily dose per ingested medium or food (mg/kg-day)
C_i = chemical concentration of COPEC in medium or food (milligrams per kilogram [mg/kg])
IR = ingestion rate (kilograms per day)
F_i = fraction of medium or food in total diet of receptor (unitless)
SUF = site-use factor, ratio of site area to home range (unitless)
AE_i = assimilation efficiency of COPEC in medium or food (unitless)
BW = body weight of receptor (kilograms)
i = identifier for environmental medium or food item

For typical receptor organisms, U.S. EPA summarizes exposure factors such as *IR* and F_i (U.S. EPA 1993a). Exposure factors for the representative vertebrate wildlife receptors are listed in Table 3-7 for the screening-level risk assessment and Table 3-8 for the Step 3a refined screening-level risk assessment. Exposure factors for representative aquatic vertebrate wildlife receptors are listed in Table 3-9 for the screening-level risk assessment and Table 3-10 for the Step 3a refined screening-level risk assessment.

Soil-to-plant BAF values for some inorganic COPECs were developed at Oak Ridge National Laboratory (ORNL). Median values will be selected from those developed by Bechtel Jacobs Company LLC (1998), Efroymson et al. (2001), and Baes et al. (1984). Soil-to-plant BAF values for organic COPECs will be estimated using median values listed in U.S. EPA (2003). BAF for organic compounds for which no median values are available will be estimated with the regression equation of U.S. EPA (2003):

$$\text{Log soil-to-plant } BAF = (0.4965 * \text{Log } K_{ow}) + 2.53$$

where

K_{ow} = octanol-water partition coefficient

Soil-to-invertebrate BAF values for some inorganic COPECs were developed at ORNL. Median values will be selected from Sample et al. (1998a, 1999). The BAF values for antimony and thallium will be selected from values recommended by U.S. EPA (1999a). BAFs for pesticides and PCBs will be estimated with median uptake factors for PCBs (Sample et al. 1999). BAF values for PAHs will be selected from Beyer and Stafford (1993). The BAF values for SVOCs will be estimated with the median uptake factor for 2,3,7,8-tetrachlorodibenzo-p-dioxin (Sample et al. 1999). BAF values for VOCs will be estimated using the equation of Southworth et al. (1978):

$$\text{Log soil-to-invertebrate } BAF = (0.819 * \text{Log } K_{ow}) - 1.146$$

where

K_{ow} = octanol-water partition coefficient

Soil-to-small-mammal BAF values for some inorganic COPECs were developed at ORNL. Median values will be selected from Sample et al. (1998b). Because BAF values for antimony, beryllium, and molybdenum are not available, a BAF value of 1 will be assumed. Soil-to-small-mammal BAF values for organic COPECs will be estimated using the median value for tetrachlorodibenzodioxin from Sample et al. (1998b).

Tissue residue concentrations of the groundwater COPECs in prey species will be estimated with water-to-invertebrate and water-to-fish BAFs. The aquatic BAFs will be estimated as the bioconcentration factor (BCF) multiplied by the food chain multiplier (FCM) (U.S. EPA 1995b).

Water-to-invertebrate BCFs will be selected from U.S. EPA values (1999b). If U.S. EPA values are not available, BCF values will be selected from the scientific literature or water-to-fish BCF values will be used.

Water-to-fish BCFs for inorganic compounds will be selected from U.S. EPA values (1999b). Water-to-fish BCFs for organic compounds will be selected from a predictive model ("BCFwin") available from the U.S. EPA (2000c) based on octanol-water partition coefficient (Kow) values. The Kow values will be selected from a database and predictive model ("KOWwin") available from the U.S. EPA (2000c). If BCF values are not available through these methods, values will be selected from the scientific literature.

3.5 CHARACTERIZATION OF RISK

Risk characterization will be prepared for the assessment end points (as represented by the ecological receptors) for which complete exposure pathways have been identified that link the site COPECs with the ecological receptors. Risk managers may use the risk characterization to determine the direction of any future investigation or the disposition of the site.

3.5.1 Hazard Quotient

The principal approach for risk characterization is use of the HQ, which is the ratio of the exposure estimate to the screening ecotoxicity value. Development of the exposure estimates and the screening ecotoxicity values has been described in earlier sections. HQs will be prepared on a receptor-COPEC basis. Typically, HQ values less than or equal to 1.0 are considered representative of negligible or acceptable risk. HQ values greater than 1.0 are considered representative of potentially unacceptable risk, based on conservative screening criteria.

3.5.2 Hazard Index

An HI may be calculated that represents the sum of several HQ values for a particular receptor. HI values will be applicable and developed only for COPECs that demonstrate cumulative effects and similar modes of toxic action.

3.6 CONCLUSIONS

The conclusion of the Tier 1 screening-level risk assessment will present a characterization of risk to the selected assessment end points presented by exposure to COPECs at the site. The conclusion will provide information upon which risk management decisions may be prepared for future assessment or subsequent disposition of the site.

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Section 4
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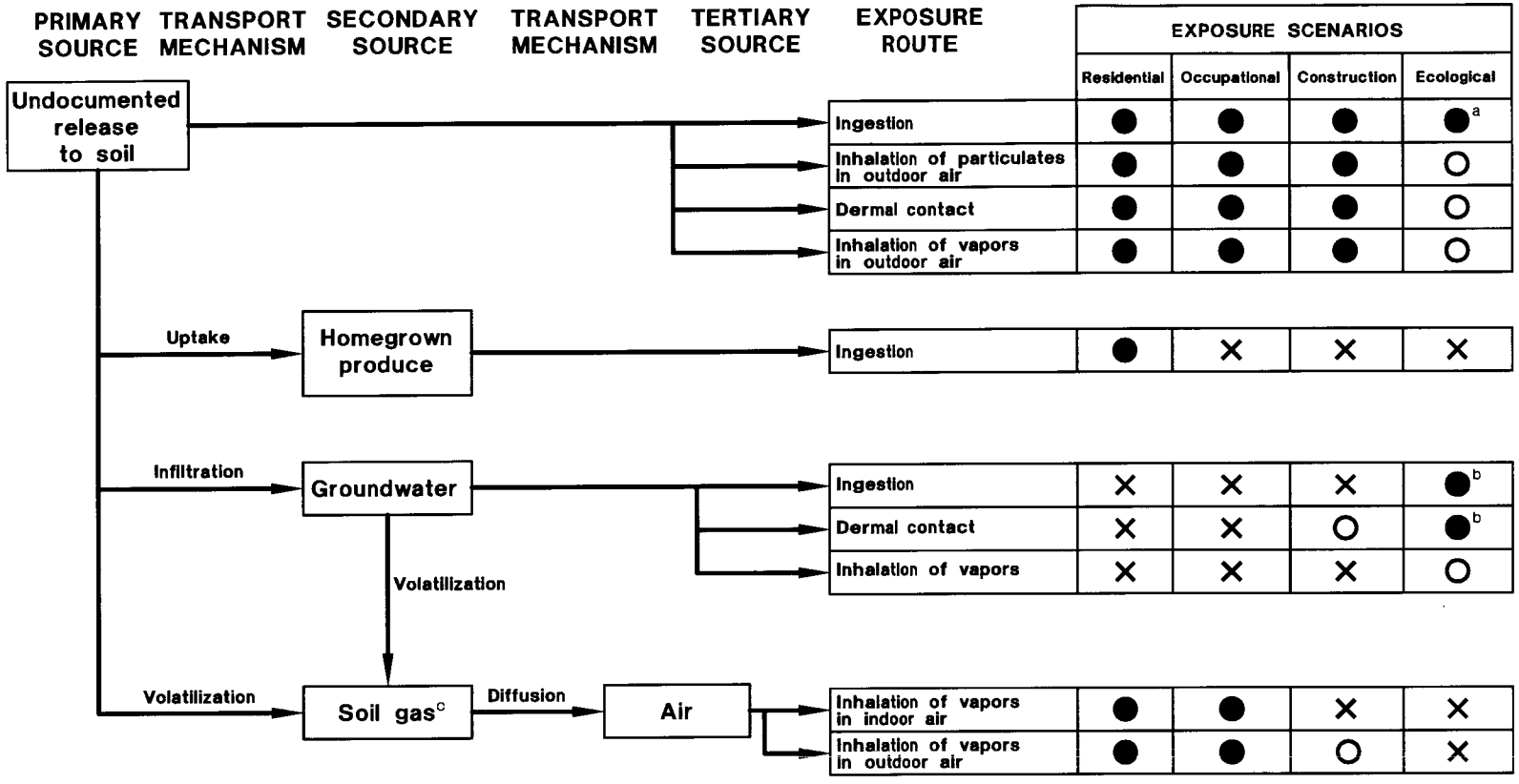


LEGEND:

- ● potentially complete exposure pathway
- ✕ incomplete exposure pathway
- ○ not considered a significant source of exposure

NOTES:

[a] ingestion of soil and food items by terrestrial receptors

[b] will only be considered complete if there is evidence that groundwater is discharging to San Francisco Bay, Seaplane Lagoon, or Oakland Inner Harbor, which will be determined upon completeion of supplemental Remedial Investigation sampling

[c] subslab soil gas data will be used for indoor air concentrations when available; otherwise shallow groundwater and soil data will be used to estimate potential air concentrations

Risk Assessment Work Plan for OU-2C

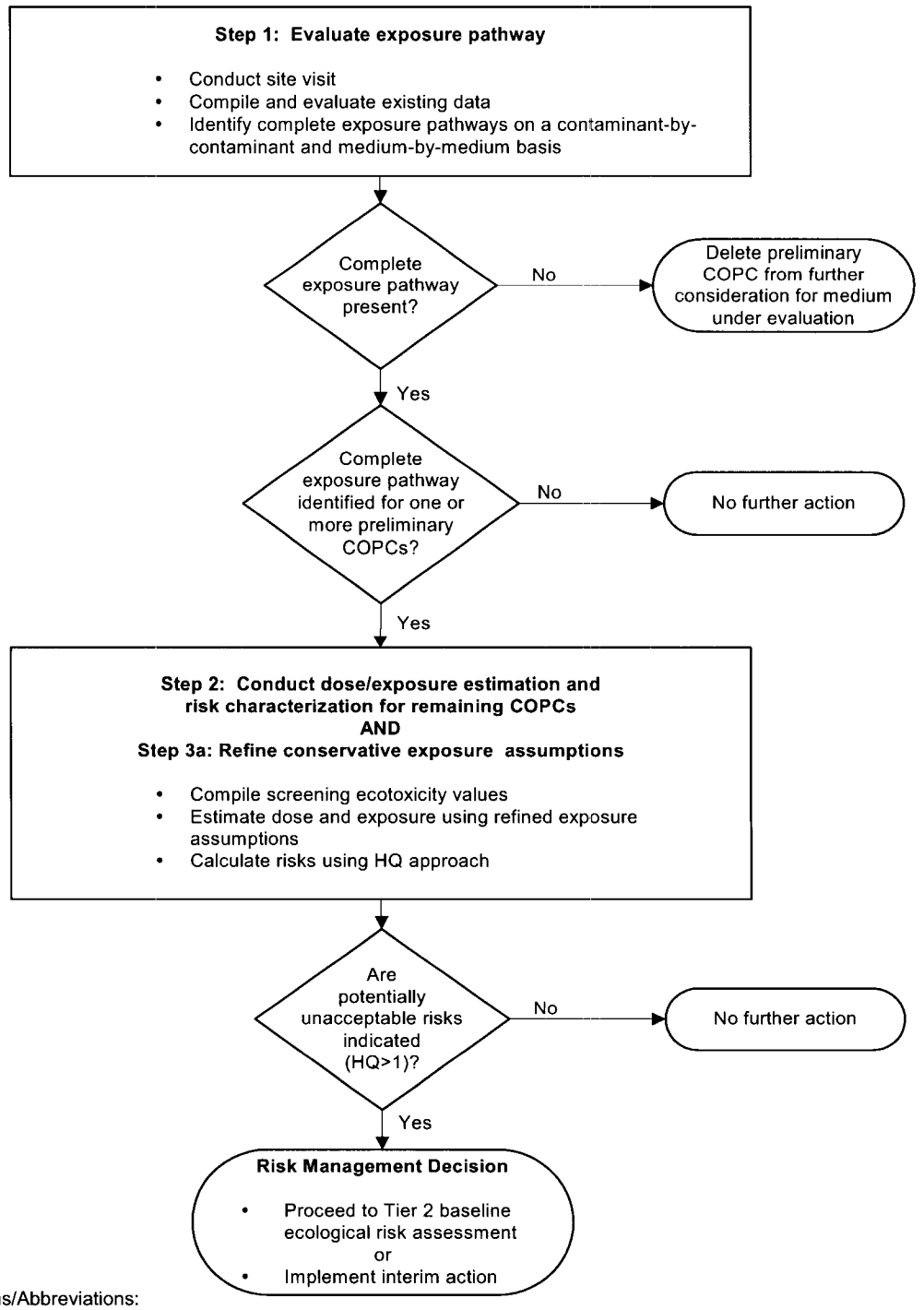
Figure 1-1

Conceptual Site Model

Alameda, California

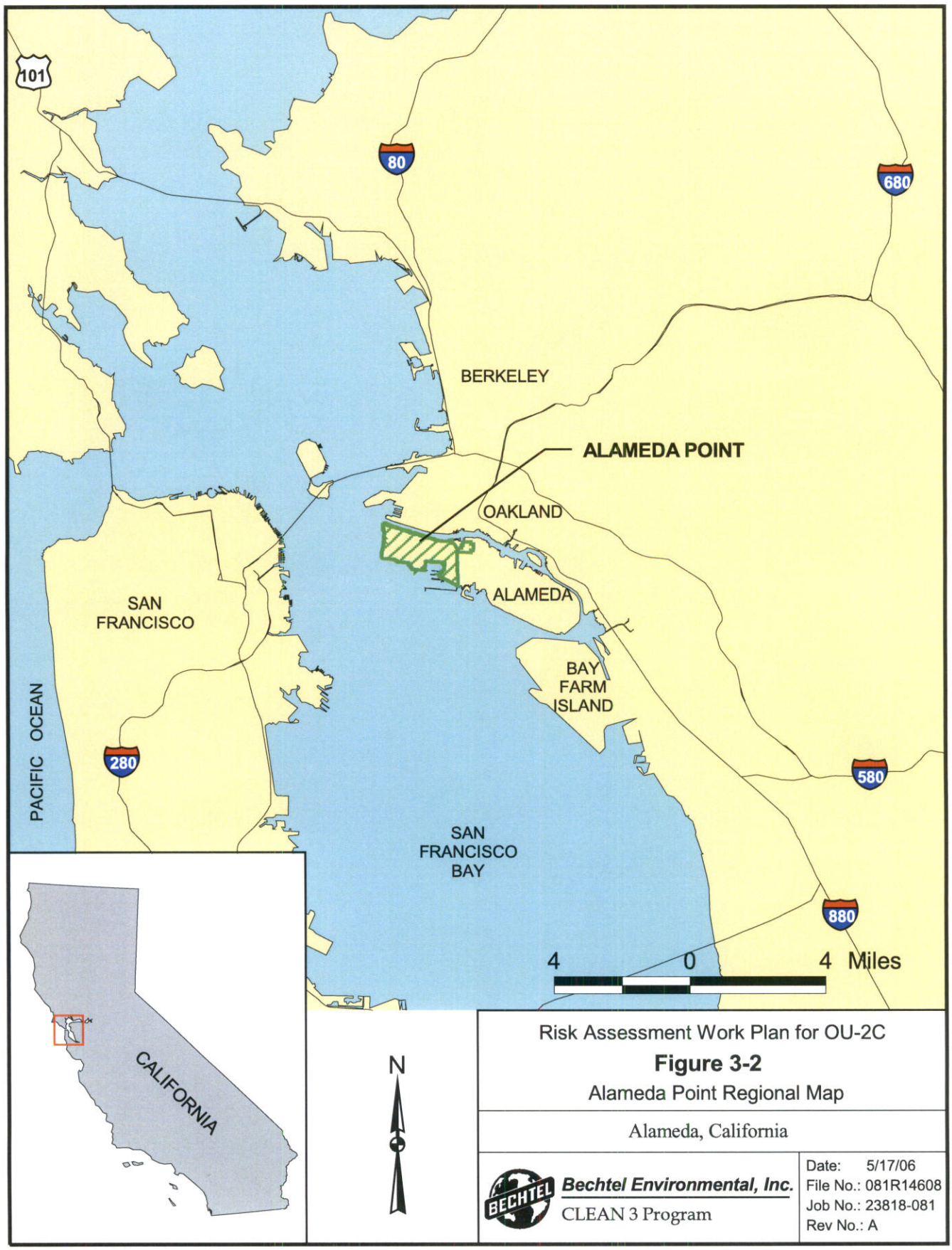
Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 12/19/06
File No: 081C14551
Job No: 23818-093
Rev No: F



Acronyms/Abbreviations:
COPC – chemical of potential concern
HQ – hazard quotient

Figure 3-1
Screening-Level Risk Assessment Process



Risk Assessment Work Plan for OU-2C

Figure 3-2

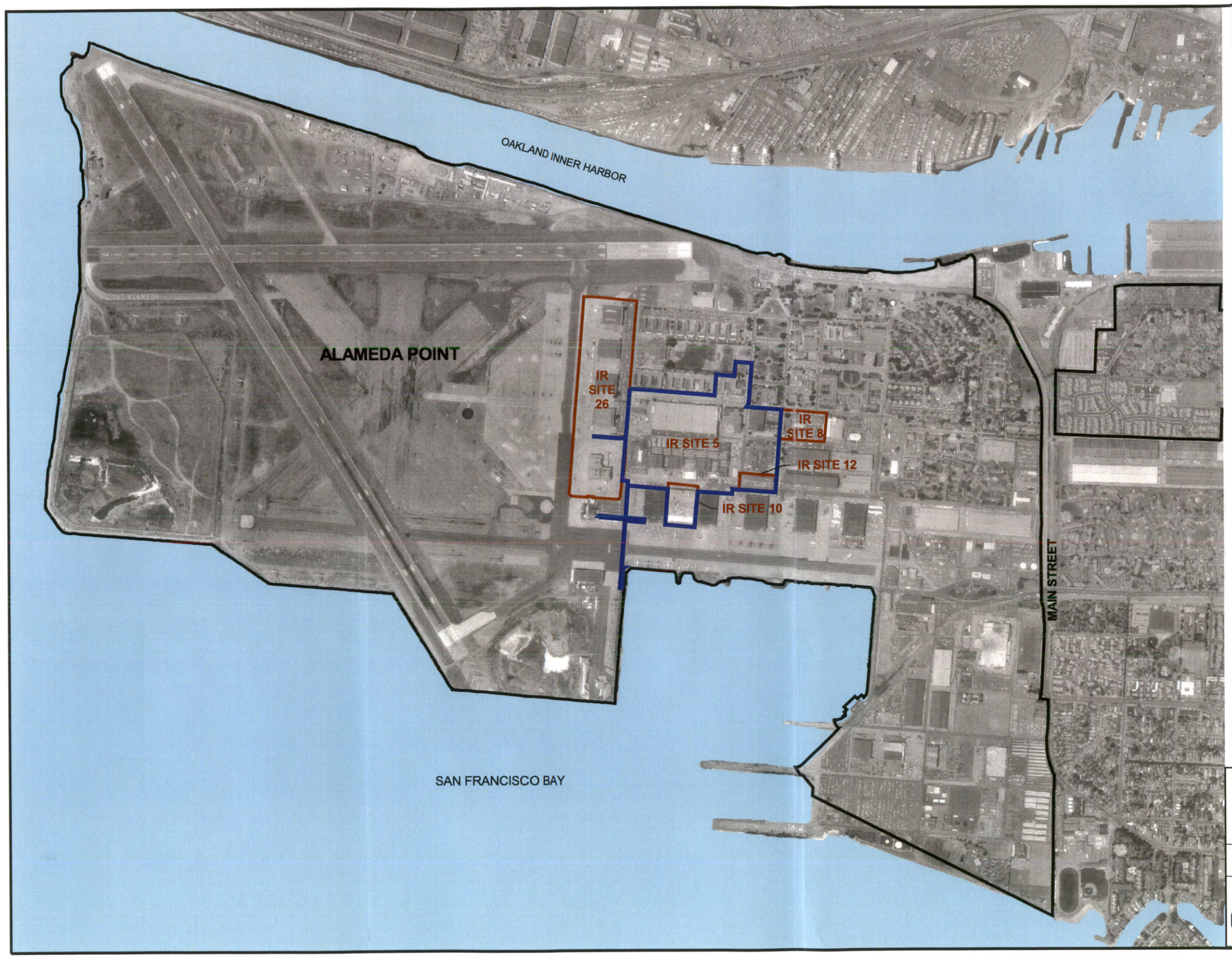
Alameda Point Regional Map

Alameda, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 5/17/06
File No.: 081R14608
Job No.: 23818-081
Rev No.: A



LEGEND

- OPERABLE UNIT 2C BOUNDARY
- IR SITE BOUNDARY
- NAVY ONSHORE PROPERTY BOUNDARIES
- WATER

NOTES:

IR – INSTALLATION RESTORATION (PROGRAM)

OU – OPERABLE UNIT

N

1200 0 1200 Feet

Risk Assessment Work Plan for OU-2C

Figure 3-3

Site Location Map

Alameda, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 5/10/06
File No.: 081L14607
Job No.: 23818-081
Rev No.: A

Risk Assessment Work Plan for OU-2C

Figure 3-4

Habitat Areas in Operable Unit 2C

Alameda, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 5/17/06
File No.: 081L14609
Job No.: 23818-081
Rev No.: A

Table 2-1
Reasonable Maximum Exposure Values Used for Daily Intake

Equation Parameter		Units	Residential Child[a]		Residential Adult[b]		Construction Worker		Occupational Worker		Intake Equation
Ingestion of Soil											
Concentration in soil	C_S	mg/kg	Chemical-specific		Chemical-specific		Chemical-specific		Chemical-specific		$(C_S \times CF \times IRS \times EF \times ED) / (BW \times AT)$
Conversion factor	CF	kg/mg	1.00E-06	U.S. EPA 2004d	1.00E-06	U.S. EPA 2004d	1.00E-06	U.S. EPA 2004d	1.00E-06	U.S. EPA 2004d	
Intake rate	IRS	mg/day	200	U.S. EPA 2004d	100	U.S. EPA 2004d	330	RWQCB 2005	100	U.S. EPA 2004d	
Exposure frequency	EF	days/year	350	U.S. EPA 2004d	350	U.S. EPA 2004d	20	RWQCB 2005	250	U.S. EPA 2004d	
Exposure duration	ED	years	6	U.S. EPA 2004d	24	U.S. EPA 2004d	7	RWQCB 2005	25	U.S. EPA 2004d	
Body weight	BW	kg	15	U.S. EPA 2004d	70	U.S. EPA 2004d	70	U.S. EPA 2004d	70	U.S. EPA 2004d	
Averaging time (cancer)	AT_C	days	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	
Averaging time (noncancer)	AT_{NC}	days	2,190	U.S. EPA 2004d	8,760	U.S. EPA 2004d	2,555	U.S. EPA 2004d	9,125	U.S. EPA 2004d	
Dermal Contact with Soil											
Concentration in soil	C_S	mg/kg	Chemical-specific		Chemical-specific		Chemical-specific		Chemical-specific		$(C_S \times CF \times AF \times SA \times DAF \times EF \times ED) / (BW \times AT)$
Conversion factor	CF	kg/mg	1.00E-06	U.S. EPA 2004d	1.00E-06	U.S. EPA 2004d	1.00E-06	U.S. EPA 2004d	1.00E-06	U.S. EPA 2004d	
Adherence factor	AF	mg/cm²	0.2	U.S. EPA 2004d	0.07	U.S. EPA 2004d	0.51	RWQCB 2005	0.2	U.S. EPA 2004d	
Exposed skin area	SA	cm²/day	2,800	U.S. EPA 2004a U.S. EPA 2004d	5,700	U.S. EPA 2004a U.S. EPA 2004d	5,800	RWQCB 2005	3,300	U.S. EPA 2004a U.S. EPA 2004d	
Dermal absorption factor	DAF	unitless	Chemical-specific	U.S. EPA 2004a DTSC 1994 U.S. EPA 2004d	Chemical-specific	U.S. EPA 2004a DTSC 1994 U.S. EPA 2004d	Chemical-specific	DTSC 1994 U.S. EPA 2004d	Chemical-specific	U.S. EPA 2004a DTSC 1994 U.S. EPA 2004d	
Exposure frequency	EF	days/year	350	U.S. EPA 2004d	350	U.S. EPA 2004d	20	RWQCB 2005	250	U.S. EPA 2004d	
Exposure duration	ED	years	6	U.S. EPA 2004d	24	U.S. EPA 2004d	7	RWQCB 2005	25	U.S. EPA 2004d	
Body weight	BW	kg	15	U.S. EPA 2004d	70	U.S. EPA 2004d	70	U.S. EPA 2004d	70	U.S. EPA 2004d	
Averaging time (cancer)	AT_C	days	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	
Averaging time (noncancer)	AT_{NC}	days	2,190	U.S. EPA 2004d	8,760	U.S. EPA 2004d	2,555	U.S. EPA 2004d	9,125	U.S. EPA 2004d	
Ingestion of Homegrown Produce											
Concentration in soil	C_S	mg/kg	Chemical-specific		Chemical-specific		NA	—	NA	—	$(C_S \times UF \times IRS \times EF \times ED) / (BW \times AT)$
Uptake factor	UF	—	Chemical-specific		Chemical-specific		NA	—	NA	—	
Intake rate	IRS	kg/day	0.0174	U.S. EPA 1997c	0.0812	U.S. EPA 1997c	NA	—	NA	—	
Exposure frequency	EF	days/year	70	Site specific	70	Site specific	NA	—	NA	—	
Exposure duration	ED	years	6	U.S. EPA 2004d	24	U.S. EPA 2004d	NA	—	NA	—	
Body weight	BW	kg	15	U.S. EPA 2004d	70	U.S. EPA 2004d	NA	—	NA	—	
Averaging time (cancer)	AT_C	days	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	NA	—	NA	—	
Averaging time (noncancer)	AT_{NC}	days	2,190	U.S. EPA 2004d	8,760	U.S. EPA 2004d	NA	—	NA	—	
Inhalation of Vapors in Indoor Air Originating from Soil and Groundwater											
Concentration in indoor air based on concentration in soil and groundwater	C_A	mg/m³	Chemical-specific	U.S. EPA 2004c	Chemical-specific	U.S. EPA 2004c	NA	—	Chemical-specific	U.S. EPA 2004c	$(C_A \times IRA \times ET \times EF \times ED) / (BW \times AT)$
Intake rate	IRA	m³/hour	0.42	U.S. EPA 2004d	0.83	U.S. EPA 2004d	NA	—	0.83	U.S. EPA 2004d	
Exposure time	ET	hours/day	24		24		NA	—	8		
Exposure frequency	EF	days/year	350	U.S. EPA 2004d	350	U.S. EPA 2004d	NA	—	250	U.S. EPA 2004d	
Exposure duration	ED	years	6	U.S. EPA 2004d	24	U.S. EPA 2004d	NA	—	25	U.S. EPA 2004d	
Body weight	BW	kg	15	U.S. EPA 2004d	70	U.S. EPA 2004d	NA	—	70	U.S. EPA 2004d	
Averaging time (cancer)	AT_C	days	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	NA	—	25,550	U.S. EPA 2004d	
Averaging time (noncancer)	AT_{NC}	days	2,190	U.S. EPA 2004d	8,760	U.S. EPA 2004d	NA	—	9,125	U.S. EPA 2004d	

Table 2-1
Reasonable Maximum Exposure Values Used for Daily Intake

Equation Parameter		Units	Residential Child[a]		Residential Adult[b]		Construction Worker		Occupational Worker		Intake Equation
Inhalation of Vapors in Outdoor Air Originating from Soil											
Concentration in soil	C_S	mg/kg	Chemical-specific		Chemical-specific		Chemical-specific		Chemical-specific		$(C_S \times IRA \times ET \times EF \times ED) / (VF \times BW \times AT)$
Intake rate	IRA	m³/hour	0.42	U.S. EPA 2004d	0.83	U.S. EPA 2004d	0.83	RWQCB 2005	0.83	U.S. EPA 2004d	
Volatilization factor	VF	m³/kg	Chemical-specific		Chemical-specific		Chemical-specific		Chemical-specific		
Exposure time	ET	hours/day	24		24		8		8		
Exposure frequency	EF	days/year	350	U.S. EPA 2004d	350	U.S. EPA 2004d	20	RWQCB 2005	250	U.S. EPA 2004d	
Exposure duration	ED	years	6	U.S. EPA 2004d	24	U.S. EPA 2004d	7	RWQCB 2005	25	U.S. EPA 2004d	
Body weight	BW	kg	15	U.S. EPA 2004d	70	U.S. EPA 2004d	70	U.S. EPA 2004d	70	U.S. EPA 2004d	
Averaging time (cancer)	AT_C	days	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	
Averaging time (noncancer)	AT_{NC}	days	2,190	U.S. EPA 2004d	8,760	U.S. EPA 2004d	2,555	U.S. EPA 2004d	9,125	U.S. EPA 2004d	
Inhalation of Soil Particulates in Outdoor Air											
Concentration in soil	C_S	mg/kg	Chemical-specific		Chemical-specific		Chemical-specific		Chemical-specific		$(C_S \times IRA \times ET \times EF \times ED) / (PEF \times BW \times AT)$
Intake rate	IRA	m³/hour	0.42	U.S. EPA 2004d	0.83	U.S. EPA 2004d	0.83	RWQCB 2005	0.83	U.S. EPA 2004d	
Particulate emission factor	PEF	m³/kg	1.316E+09	U.S. EPA 2004d	1.316E+09	U.S. EPA 2004d	1.44E+06	RWQCB 2005	1.316E+09	U.S. EPA 2004d	
Exposure time	ET	hours/day	24		24		8		8		
Exposure frequency	EF	days/year	350	U.S. EPA 2004d	350	U.S. EPA 2004d	20	RWQCB 2005	250	U.S. EPA 2004d	
Exposure duration	ED	years	6	U.S. EPA 2004d	24	U.S. EPA 2004d	7	RWQCB 2005	25	U.S. EPA 2004d	
Body weight	BW	kg	15	U.S. EPA 2004d	70	U.S. EPA 2004d	70	U.S. EPA 2004d	70	U.S. EPA 2004d	
Averaging time (cancer)	AT_C	days	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	
Averaging time (noncancer)	AT_{NC}	days	2,190	U.S. EPA 2004d	8,760	U.S. EPA 2004d	2,555	U.S. EPA 2004d	9,125	U.S. EPA 2004d	

References:

DTSC 1994. Preliminary Endangerment Assessment Guidance Manual.
RWQCB 2005. Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, San Francisco Bay Region.
U.S. EPA 1997c. Exposure Factors Handbook.
U.S. EPA 2004a. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005.
U.S. EPA 2004c. Software Implementation of Johnson and Ettinger Model. Version 3.0.
U.S. EPA 2004d. Region 9 Preliminary Remediation Goals.

Notes:

[a] residential child age is 0 to 6 years
[b] residental carcinogenic exposure was assumed for a total of 30 years; 6 years as a child and 24 years as an adult; residential noncarcinogenic exposure was assumed for a total of 6 years as a child

Acronyms/Abbreviations:

cm²/day – square centimeters per day
days/year – days per year
DTSC – (California Environmental Protection Agency) Department of Toxic Substances Control
hours/day – hours per day
kg – kilograms
kg/day – kilograms per day
kg/mg – kilograms per milligram
mg/cm² – milligrams per square centimeter
mg/day – milligrams per day
mg/kg – milligrams per kilogram
mg/m³ – milligrams per cubic meter
m³/hour – cubic meters per hour
m³/kg – cubic meters per kilogram
NA – not applicable
RWQCB – (California) Regional Water Quality Control Board
U.S. EPA – United States Environmental Protection Agency

Table 2-2
Central Tendency Exposure Values Used for Daily Intake

Equation Parameter		Units	Residential Child[a]		Residential Adult[b]		Construction Worker		Occupational Worker		Intake Equation
Ingestion of Soil											
Concentration in soil	C_S	mg/kg	Chemical-specific		Chemical-specific		Chemical-specific		Chemical-specific		$(C_S \times CF \times IRS \times EF \times ED) / (BW \times AT)$
Conversion factor	CF	kg/mg	1.00E-06	U.S. EPA 2004d	1.00E-06	U.S. EPA 2004d	1.00E-06	U.S. EPA 2004d	1.00E-06	U.S. EPA 2004d	
Intake rate	IRS	mg/day	100	U.S. EPA 1993a	50	U.S. EPA 1993a	330	RWQCB 2005	50	U.S. EPA 1993a	
Exposure frequency	EF	days/year	234	U.S. EPA 1993a	234	U.S. EPA 1993a	20	RWQCB 2005	219	U.S. EPA 1993a	
Exposure duration	ED	years	6	U.S. EPA 2004d	9	U.S. EPA 1993a	7	RWQCB 2005	6.6	U.S. EPA 1997c	
Body weight	BW	kg	15	U.S. EPA 2004d	70	U.S. EPA 2004d	70	U.S. EPA 2004d	70	U.S. EPA 2004d	
Averaging time (cancer)	AT_C	days	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	
Averaging time (noncancer)	AT_{NC}	days	2,190	U.S. EPA 2004d	3,285	U.S. EPA 2004d	2,555	U.S. EPA 2004d	2,409	U.S. EPA 2004d	
Dermal Contact with Soil											
Concentration in soil	C_S	mg/kg	Chemical-specific		Chemical-specific		Chemical-specific		Chemical-specific		$(C_S \times CF \times AF \times SA \times DAF \times EF \times ED) / (BW \times AT)$
Conversion factor	CF	kg/mg	1.00E-06	U.S. EPA 2004d	1.00E-06	U.S. EPA 2004d	1.00E-06	U.S. EPA 2004d	1.00E-06	U.S. EPA 2004d	
Adherence factor	AF	mg/cm²	0.04	U.S. EPA 2004a	0.01	U.S. EPA 2004a	0.51	RWQCB 2005	0.02	U.S. EPA 2004a	
Exposed skin area	SA	cm²/day	2,800	U.S. EPA 2004d	5,700	U.S. EPA 2004d	5,800	RWQCB 2005	3,300	U.S. EPA 2004d	
Dermal absorption factor	DAF	unitless	Chemical-specific	U.S. EPA 2004a DTSC 1994 U.S. EPA 2004d	Chemical-specific	U.S. EPA 2004a DTSC 1994 U.S. EPA 2004d	Chemical-specific	DTSC 1994 U.S. EPA 2004d	Chemical-specific	U.S. EPA 2004a DTSC 1994 U.S. EPA 2004d	
Exposure frequency	EF	days/year	234	U.S. EPA 1993a	234	U.S. EPA 1993a	20	RWQCB 2005	219	U.S. EPA 1993a	
Exposure duration	ED	years	6	U.S. EPA 2004d	9	U.S. EPA 1993a	7	RWQCB 2005	6.6	U.S. EPA 1997c	
Body weight	BW	kg	15	U.S. EPA 2004d	70	U.S. EPA 2004d	70	U.S. EPA 2004d	70	U.S. EPA 2004d	
Averaging time (cancer)	AT_C	days	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	
Averaging time (noncancer)	AT_{NC}	days	2,190	U.S. EPA 2004d	3,285	U.S. EPA 2004d	2,555	U.S. EPA 2004d	2,409	U.S. EPA 2004d	
Ingestion of Homegrown Produce											
Concentration in soil	C_S	mg/kg	Chemical-specific		Chemical-specific		NA	—	NA	—	$(C_S \times UF \times IRS \times EF \times ED) / (BW \times AT)$
Uptake factor	UF	—	Chemical-specific		Chemical-specific		NA	—	NA	—	
Intake rate	IRS	kg/day	0.0064	U.S. EPA 1997c	0.03	U.S. EPA 1997c	NA	—	NA	—	
Exposure frequency	EF	days/year	47	Site specific	47	Site specific	NA	—	NA	—	
Exposure duration	ED	years	6	U.S. EPA 2004d	9	U.S. EPA 1993a	NA	—	NA	—	
Body weight	BW	kg	15	U.S. EPA 2004d	70	U.S. EPA 2004d	NA	—	NA	—	
Averaging time (cancer)	AT_C	days	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	NA	—	NA	—	
Averaging time (noncancer)	AT_{NC}	days	2,190	U.S. EPA 2004d	3,285	U.S. EPA 2004d	NA	—	NA	—	
Inhalation of Vapors in Indoor Air Originating from Soil and Groundwater											
Concentration in indoor air based on concentration in soil and groundwater	C_A	mg/m³	Chemical-specific	U.S. EPA 2004c	Chemical-specific	U.S. EPA 2004c	NA	—	Chemical-specific	U.S. EPA 2004c	$(C_A \times IRA \times ET \times EF \times ED) / (BW \times AT)$
Intake rate	IRA	m³/hour	0.42	U.S. EPA 2004d	0.83	U.S. EPA 2004d	NA	—	0.83	U.S. EPA 2004d	
Exposure time	ET	hours/day	24		24		NA	—	8		
Exposure frequency	EF	days/year	234	U.S. EPA 1993a	234	U.S. EPA 1993a	NA	—	219	U.S. EPA 1993a	
Exposure duration	ED	years	6	U.S. EPA 2004d	9	U.S. EPA 1993a	NA	—	6.6	U.S. EPA 1997c	
Body weight	BW	kg	15	U.S. EPA 2004d	70	U.S. EPA 2004d	NA	—	70	U.S. EPA 2004d	
Averaging time (cancer)	AT_C	days	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	NA	—	25,550	U.S. EPA 2004d	
Averaging time (noncancer)	AT_{NC}	days	2,190	U.S. EPA 2004d	3,285	U.S. EPA 2004d	NA	—	2,409	U.S. EPA 2004d	

Table 2-2
Central Tendency Exposure Values Used for Daily Intake

Equation Parameter		Units	Residential Child[a]		Residential Adult[b]		Construction Worker		Occupational Worker		Intake Equation
Inhalation of Vapors in Outdoor Air Originating from Soil											
Concentration in soil	C_S	mg/kg	Chemical-specific		Chemical-specific		Chemical-specific		Chemical-specific		$(C_S \times IRA \times ET \times EF \times ED) / (VF \times BW \times AT)$
Intake rate	IRA	m³/hour	0.42	U.S. EPA 2004d	0.83	U.S. EPA 2004d	0.83	RWQCB 2005	0.83	U.S. EPA 2004d	
Volatilization factor	VF	m³/kg	Chemical-specific		Chemical-specific		Chemical-specific		Chemical-specific		
Exposure time	ET	hours/day	24		24		8		8		
Exposure frequency	EF	days/year	234	U.S. EPA 1993a	234	U.S. EPA 1993a	20	RWQCB 2005	219	U.S. EPA 1993a	
Exposure duration	ED	years	6	U.S. EPA 2004d	9	U.S. EPA 1993a	7	RWQCB 2005	6.6	U.S. EPA 1997c	
Body weight	BW	kg	15	U.S. EPA 2004d	70	U.S. EPA 2004d	70	U.S. EPA 2004d	70	U.S. EPA 2004d	
Averaging time (cancer)	AT_C	days	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	
Averaging time (noncancer)	AT_{NC}	days	2,190	U.S. EPA 2004d	3,285	U.S. EPA 2004d	2,555	U.S. EPA 2004d	2,409	U.S. EPA 2004d	
Inhalation of Soil Particulates in Outdoor Air											
Concentration in soil	C_S	mg/kg	Chemical-specific		Chemical-specific		Chemical-specific		Chemical-specific		$(C_S \times IRA \times ET \times EF \times ED) / (PEF \times BW \times AT)$
Intake rate	IRA	m³/hour	0.42	U.S. EPA 2004d	0.83	U.S. EPA 2004d	0.83	RWQCB 2005	0.83	U.S. EPA 2004d	
Particulate emission factor	PEF	m³/kg	1.316E+09	U.S. EPA 2004d	1.316E+09	U.S. EPA 2004d	1.44E+06	RWQCB 2005	1.316E+09	U.S. EPA 2004d	
Exposure time	ET	hours/day	24		24		8		8		
Exposure frequency	EF	days/year	234	U.S. EPA 1993a	234	U.S. EPA 1993a	20	RWQCB 2005	219	U.S. EPA 1993a	
Exposure duration	ED	years	6	U.S. EPA 2004d	9	U.S. EPA 1993a	7	RWQCB 2005	6.6	U.S. EPA 1997c	
Body weight	BW	kg	15	U.S. EPA 2004d	70	U.S. EPA 2004d	70	U.S. EPA 2004d	70	U.S. EPA 2004d	
Averaging time (cancer)	AT_C	days	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	25,550	U.S. EPA 2004d	
Averaging time (noncancer)	AT_{NC}	days	2,190	U.S. EPA 2004d	3,285	U.S. EPA 2004d	2,555	U.S. EPA 2004d	2,409	U.S. EPA 2004d	

References:

DTSC 1994. Preliminary Endangerment Assessment Guidance Manual.
RWQCB 2005. Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, San Francisco Bay Region.
U.S. EPA 1993a. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.
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U.S. EPA 2004c. Software Implementation of Johnson and Ettinger Model. Version 3.0.
U.S. EPA 2004d. Region 9 Preliminary Remediation Goals.

Notes:

[a] residential child age is 0 to 6 years
[b] residental carcinogenic exposure was assumed for a total of 30 years; 6 years as a child and 24 years as an adult; residential noncarcinogenic exposure was assumed for a total of 6 years as a child

Acronyms/Abbreviations:

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DTSC – (California Environmental Protection Agency) Department of Toxic Substances Control
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kg – kilograms
kg/day – kilograms per day
kg/mg – kilograms per milligram
mg/cm² – milligrams per square centimeter
mg/day – milligrams per day
mg/kg – milligrams per kilogram
mg/m³ – milligrams per cubic meter
m³/hour – cubic meters per hour
m³/kg – cubic meters per kilogram
NA – not applicable
RWQCB – (California) Regional Water Quality Control Board
U.S. EPA – United States Environmental Protection Agency

Table 3-1
Ecological Risk Assessment Exposure Assumptions Summary

Exposure Assumptions	Screening-Level Risk Assessment	Step 3a Refined Screening-Level Risk Assessment
Aquatic Invertebrates and Fish		
Media concentration	Maximum (groundwater)	95% UCL of mean (groundwater)
Toxicity reference	Water quality benchmarks	Water quality benchmarks
Vertebrate Wildlife (Birds/Mammals)		
Media concentration	Maximum (soil)	95% UCL of mean (soil)
Ingestion rate	Allometric (maximum body weight)	Allometric (mean body weight)
Body weight	Minimum	Mean
Diet composition	100% target trophic level	Typical diet composition
Assimilation	1	1
Site-use factor	1	Site area/home range
Toxicity reference	Navy/$BTAG_{Low}$	Navy/$BTAG_{Low}$ and Navy/$BTAG_{High}$

Acronyms/Abbreviations:
BTAG – (U.S. EPA Region 9) Biological Technical Assistance Group
UCL – upper confidence limit
U.S. EPA – United States Environmental Protection Agency

Table 3-2
Special-Status Species Occurring or Potentially Occurring in the Habitats of Alameda Point

Scientific Name	Common Name	Status
Plants		
Cordylanthus maritimus palustris	Point Reyes bird's-beak	CNPS-1B
Holocarpha macradenia	Santa Cruz tarplant	FT/SE
Horkelia cuneata sericea	Kellogg's horkelia	CNPS-1B
Lasthenia conjugens	Contra Costa goldfields	FE/CNPS-1B
Sanicula maritima	Adobe sanicle	SR
Fish		
Acipenser medirostris	Green sturgeon	FSC/CSC
Eucyclogobius newberryi	Tidewater goby	FE/CSC
Hypomesus transpacificus	Delta smelt	FT/ST
Oncorhynchus mykiss	Steelhead	FT/CSC
Oncorhynchus tshawytscha	Chinook salmon, winter run	FE/SE
Spirinichus thaleichthys	Longfin smelt	FSC/CSC
Reptiles		
Masticophis lateralis euryxanthus	Alameda whipsnake	FT/ST
Mammals		
Corynorhinus townsendii townsendii	Townsend's western big-eared bat	FSC/CSC
Eumetopias jubatus	Steller sea lion	FT
Eumops perotis californicus	California mastiff bat	FSC/CSC
Neotoma fuscipes annectens	San Francisco dusky-footed woodrat	FSC/CSC
Reithrodontomys raviventris	Salt marsh harvest mouse	FE/SE
Scapanus latimanus parvus	Alameda Island mole	FSC/CSC
Sorex vagrans halicoetes	Salt marsh wandering shrew	FSC/CSC
Birds		
Athene cunicularia	Burrowing owl	FSC/CSC
Charadrius alexandrinus nivosus	Western snowy plover	FT/CSC
Circus cyaneus	Northern harrier	CSC
Elanus leucurus	White-tailed kite	FSC/CFP
Eremophila alpestris actia	California horned lark	CSC
Falco columbarius	Merlin	CSC
Falco peregrinus anatum	American peregrine falcon	FSC/SE
Geothlypis trichas sinuosa	Salt marsh common yellowthroat	FSC/CSC
Lanius ludovicianus	Loggerhead shrike	FSC/CSC
Laterallus jamaicensis coturniculus	California black rail	FSC/ST
Melospiza melodia pusillula	Alameda song sparrow	FSC/CSC
Pelecanus occidentalis californicus	California brown pelican	FE/SE
Phalacrocorax auritus	Double-crested cormorant	CSC
Rallus longirostris obsoletus	California clapper rail	FE/SE
Sterna antillarum browni	California least tern	FE/SE

Table 3-2 (continued)

Acronyms/Abbreviations:

1B – plants rare, threatened, or endangered in California and elsewhere
CFP – California Department of Fish and Game – fully protected
CNPS – California Native Plant Society
CSC – California special-concern species
FE – federally listed – endangered
FSC – federal special-concern species
FT – federally listed – threatened
SE – California state listed – endangered
SR – California state listed – rare
ST – California state listed – threatened

Table 3-3
Assessment and Measurement End Points for OU-2C

ASSESSMENT END POINT POPULATIONS			MEASUREMENT END POINTS		
Receptor Group	**Trophic Level (food source)**	**Representative Species/Group**	**Data Source**	**Representative Receptor**	**Measurement End Point**
Aquatic invertebrates and fish	Various	Invertebrates and fish	Surface water chemistry	Invertebrates and fish	Direct media contact exposure; ratio to benchmark
Birds	Omnivore	Song sparrow	BAF from soil to food items	Song sparrow	Food chain exposure; hazard quotient
	Omnivore	American robin	BAF from soil to food items	American robin	Food chain exposure; hazard quotient
	Carnivore	Red-tailed hawk	BAF from soil to food items	Red-tailed hawk	Food chain exposure; hazard quotient
Mammals	Omnivore	Deer mouse	BAF from soil to food items	Deer mouse	Food chain exposure; hazard quotient
	Omnivore	Ground squirrel	BAF from soil to food items	Ground squirrel	Food chain exposure; hazard quotient

Acronyms/Abbreviations:
BAF – bioaccumulation factor
OU – operable unit

Table 3-4
Aquatic Life Toxicity Reference Values

COPEC	Selected TRV (µg/L)	Literature-Based Toxicity Thresholds
Volatile Organic Compounds		
benzene	109	Chronic Screening Value, U.S. EPA 2001b
n-butylbenzene	4.3	Chronic Screening Value, U.S. EPA 2001b, ethylbenzene
sec-butylbenzene	4.3	Chronic Screening Value, U.S. EPA 2001b, ethylbenzene
tert-butylbenzene	4.3	Chronic Screening Value, U.S. EPA 2001b, ethylbenzene
chlorobenzene	105	Chronic Screening Value, U.S. EPA 2001b
chloroethane	1,130	Chronic Screening Value, U.S. EPA 2001b, 1,2-dichloroethane
chloroform	815	Chronic Screening Value, U.S. EPA 2001b
chloromethane	2,700	Chronic Screening Value, U.S. EPA 2001b
1,2-dichlorobenzene	19.7	Chronic Screening Value, U.S. EPA 2001b
1,3-dichlorobenzene	28.5	Chronic Screening Value, U.S. EPA 2001b
1,4-dichlorobenzene	19.9	Chronic Screening Value, U.S. EPA 2001b
1,1-dichloroethane	1,130	Chronic Screening Value, U.S. EPA 2001b, 1,2-dichloroethane
1,1-dichloroethene	2,240	Chronic Screening Value, U.S. EPA 2001b
1,2-dichloroethene	2,240	Chronic Screening Value, U.S. EPA 2001b, 1,1-dichloroethylene
cis-1,2-dichloroethene	2,240	Chronic Screening Value, U.S. EPA 2001b, 1,1-dichloroethylene
trans-1,2-dichloroethene	2,240	Chronic Screening Value, U.S. EPA 2001b, 1,1-dichloroethylene
trans-1,3-dichloropropene	7.9	Chronic Screening Value, U.S. EPA 2001b
ethane	1,130	Chronic Screening Value, U.S. EPA 2001b, 1,2-dichloroethane
ethene	2,240	Chronic Screening Value, U.S. EPA 2001b, 1,1-dichloroethylene
ethylbenzene	4.3	Chronic Screening Value, U.S. EPA 2001b
isopropylbenzene	4.3	Chronic Screening Value, U.S. EPA 2001b, ethylbenzene
p-isopropyltoluene	4.3	Chronic Screening Value, U.S. EPA 2001b, ethylbenzene
methane	2,700	Chronic Screening Value, U.S. EPA 2001b, chloromethane
methyl tert-butyl ether	18,000	CCC proposed, U.S. EPA 2006d, Mancini et al. 2002
methylene chloride	2,560	Chronic Screening Value, U.S. EPA 2001b
n-propylbenzene	4.3	Chronic Screening Value, U.S. EPA 2001b, ethylbenzene
tetrachloroethene	45	Chronic Screening Value, U.S. EPA 2001b
toluene	37	Chronic Screening Value, U.S. EPA 2001b
trichloroethene	140	14,000 µg/L 96-hour LC50, *Americamysis bahia*, UF 0.01, Ward et al. 1986
trichlorofluoromethane	815	Chronic Screening Value, U.S. EPA 2001b, chloroform
1,2,4-trimethylbenzene	4.3	Chronic Screening Value, U.S. EPA 2001b, ethylbenzene
1,3,5-trimethylbenzene	4.3	Chronic Screening Value, U.S. EPA 2001b, ethylbenzene
vinyl chloride	2,240	Chronic Screening Value, U.S. EPA 2001b, 1,1-dichloroethylene
m-, p-xylene	74	7,400 µg/L 96-hour LC50, *Palaemonetes pugio*, UF 0.01, Tatem et al. 1978
o-xylene	13	1,300 µg/L 96-hour LC50, *Crangon franciscorum*, UF 0.01, Benville and Korn 1977

Table 3-4 (continued)

COPEC	Selected TRV (µg/L)	Literature-based Toxicity Thresholds
Polynuclear Aromatic Hydrocarbons		
acenaphthene	9.7	Chronic Screening Value, U.S. EPA 2001b
acenaphthylene	4.6	CCC proposed, U.S. EPA 1990, phenanthrene
benz(a)anthracene	1.6	Chronic Screening Value, U.S. EPA 2001b, fluoranthene
benzo(a)pyrene	10	<1,000 µg/L 96-hour LC50, *Neanthes arenaceodentata*, UF 0.01, Rossi and Neff 1978
benzo(g,h,i)perylene	1.6	Chronic Screening Value, U.S. EPA 2001b, fluoranthene
chrysene	10	<1,000 µg/L 96-hour LC50, *Neanthes arenaceodentata*, UF 0.01, Rossi and Neff 1978
dibenz(a,h)anthracene	1.6	Chronic Screening Value, U.S. EPA 2001b, fluoranthene
fluoranthene	1.6	Chronic Screening Value, U.S. EPA 2001b
fluorene	10	1,000 µg/L 96-hour LC50, *Neanthes arenaceodentata*, UF 0.01, Rossi and Neff 1978
indeno(1,2,3-cd)pyrene	1.6	Chronic Screening Value, U.S. EPA 2001b, fluoranthene
2-methylnaphthalene	4.6	CCC proposed, U.S. EPA 1990, phenanthrene
naphthalene	23.5	Chronic Screening Value, U.S. EPA 2001b
phenanthrene	4.6	CCC proposed, U.S. EPA 1990
pyrene	95	9,454 µg/L 96-hour LC50, *Mulinia lateralis*, UF 0.01, Pelletier et al. 1997
Metals		
aluminum	2.71	LT50 salmon 271 µg/L, Poleo & Muniz 1993, UF 0.01
antimony	500	CCC proposed, U.S. EPA 1990
arsenic	36	CCC, U.S. EPA 2000a (CTR)
barium	5,000	LC50 opossum shrimp >500,000 µg/L, U.S. EPA 1978, UF 0.01
beryllium	50	Mortality NOEC mummichog 5,000 µg/L (Eisler 1974)
cadmium	8.8	CCC, U.S. EPA 2001a
chromium	50	CCC, U.S. EPA 2000a (CTR), hexavalent chromium
chromium, hexavalent	50	CCC, U.S. EPA 2000a (CTR), hexavalent chromium
cobalt	10	Growth NOEC, oyster 10 µg/L, Watling 1983
copper	3.1	CCC, U.S. EPA 2000a (CTR)
iron	150	Median growth EC50 15,000 µg/L, UF 0.01
lead	8.1	CCC, U.S. EPA 2000a (CTR)
manganese	2,500	Mortality NOEC, sea star 25,000 µg/L, Hansen and Bjerregaard 1995, UF 0.1
mercury	0.025	Screening level, Cal/EPA (1995, 2005)
molybdenum	1,230	96-hour LC50, 123,000 µg/L, *Americamysis bahia*, MoO3, Carr 1987, UF 0.01
nickel	8.2	CCC, U.S. EPA 2000a (CTR)
selenium	71	CCC, U.S. EPA 2000a (CTR)
vanadium	205	Median EC50 growth 20,500 µg/L UF 0.01
zinc	81	CCC, U.S. EPA 2000a (CTR)

Table 3-4 (continued)

Acronyms/Abbreviations:

Cal/EPA –California Environmental Protection Agency
CCC – criteria continuous concentration
COPEC – chemical of potential ecological concern
CTR – California Toxics Rule
EC50 – effective concentration for 50 percent of the organisms
LC50 – lethal concentration for 50 percent of organisms
LT50 – lethal threshold for 50 percent of the organisms
μg/L – micrograms per liter
NOEC – no observed effect concentration
PAH – polynuclear aromatic hydrocarbon
TRV – toxicity reference value
UF – uncertainty factor

Table 3-5
Mammalian Toxicity Reference Values

COPEC*	TRV (mg/kg-day)	Species	Body Weight (kg)	Reference
Volatile Organic Compounds				
acetone	10	Rat	0.35	U.S. EPA 1986a
benzene	26.36	Mouse	0.03	Nawrot and Staples 1979
bromoform	60	Mouse	0.03	Roe et al. 1979
2-butanone	1,771	Rat	0.35	Cox et al. 1975
n-butylbenzene	2.1	Mouse	0.03	Marks et al. 1982
sec-butylbenzene	2.1	Mouse	0.03	Marks et al. 1982
tert-butylbenzene	2.1	Mouse	0.03	Marks et al. 1982
chlorobenzene	85.7	Mouse	0.03	NTP 1985
chloroethane	50	Mouse	0.035	Lane et al. 1982
chloroform	60	Mouse	0.03	Roe et al. 1979
chloromethane	1.4	Rat	0.35	Danse et al. 1984
1,2-dichlorobenzene	85.7	Mouse	0.03	NTP 1985
1,3-dichlorobenzene	85.7	Mouse	0.03	NTP 1985
1,4-dichlorobenzene	85.7	Mouse	0.03	NTP 1985
1,1-dichloroethane	50	Mouse	0.035	Lane et al. 1982
1,1-dichloroethene	30	Rat	0.35	Quast et al. 1983
1,2-dichloroethene	45.2	Mouse	0.03	Palmer et al. 1979
cis-1,2-dichloroethene	1.7	Mouse	0.03	Barnes et al. 1985
trans-1,2-dichloroethene	1.7	Mouse	0.03	Barnes et al. 1985
trans-1,3-dichloropropene	2.5	Rat	0.35	Stott et al. 1995
ethane	NA	NA	NA	NA
ethene	NA	NA	NA	NA
ethylbenzene	97.1	Rat	0.35	Wolf et al. 1956
isopropylbenzene	2.1	Mouse	0.03	Marks et al. 1982
p-isopropyltoluene	2.1	Mouse	0.03	Marks et al. 1982
methane	NA	NA	NA	NA
methylene chloride	5.85	Rat	0.35	NCA 1982
4-methyl-2-pentanone	25	Rat	0.35	Microbiological Associates 1986
methyl tert-butyl ether	10	Rat	0.35	Robinson et al. 1990
n-propylbenzene	2.1	Mouse	0.03	Marks et al. 1982
tetrachloroethene	1.4	Mouse	0.03	Buben and O'Flaherty 1985
toluene	26	Mouse	0.03	Nawrot and Staples 1979
trichloroethene	0.7	Mouse	0.03	Buben and O'Flaherty 1985
trichlorofluoromethane	16	Rat	0.35	Alumot et al. 1976a
1,2,4-trimethylbenzene	2.1	Mouse	0.03	Marks et al. 1982

Table 3-5 (continued)

COPEC*	TRV (mg/kg-day)	Species	Body Weight (kg)	Reference
Volatile Organic Compounds (continued)				
1,3,5-trimethylbenzene	2.1	Mouse	0.03	Marks et al. 1982
vinyl chloride	0.17	Rat	0.35	Feron et al. 1981
m-, p-xylene	2.1	Mouse	0.03	Marks et al. 1982
o-xylene	2.1	Mouse	0.03	Marks et al. 1982
xylenes, total	2.1	Mouse	0.03	Marks et al. 1982
Semivolatile Organic Compounds				
bis(2-ethylhexyl)phthalate	18.3	Mouse	0.03	Lamb et al., 1987
di-n-butyl phthalate	550	Mouse	0.03	Lamb et al. 1987
diethyl phthalate	4,583	Mouse	0.03	Lamb et al. 1987
Polynuclear Aromatic Hydrocarbons				
acenaphthene	50	Rat	0.2765	Navarro et al. 1991
acenaphthylene	50	Rat	0.2765	Navarro et al. 1991
anthracene	50	Rat	0.2765	Navarro et al. 1991
benz(a)anthracene	1.31	Mouse	0.0305	Neal and Rigdon 1967
benzo(b)fluoranthene	1.31	Mouse	0.0305	Neal and Rigdon 1967
benzo(k)fluoranthene	1.31	Mouse	0.0305	Neal and Rigdon 1967
benzo(g,h,i)perylene	1.31	Mouse	0.0305	Neal and Rigdon 1967
benzo(a)pyrene	1.31	Mouse	0.0305	Neal and Rigdon 1967
chrysene	1.31	Mouse	0.0305	Neal and Rigdon 1967
dibenz(a,h)anthracene	1.31	Mouse	0.0305	Neal and Rigdon 1967
fluoranthene	1.31	Mouse	0.0305	Neal and Rigdon 1967
fluorene	50	Rat	0.2765	Navarro et al. 1991
indeno(1,2,3-cd)pyrene	1.31	Mouse	0.0305	Neal and Rigdon 1967
2-methylnaphthalene	50	Rat	0.2765	Navarro et al. 1991
naphthalene	50	Rat	0.2765	Navarro et al. 1991
phenanthrene	50	Rat	0.2765	Navarro et al. 1991
pyrene	1.31	Mouse	0.0305	Neal and Rigdon 1967
Pesticides				
4,4′-DDT	0.8	Rat	0.32	Fitzhugh 1948
Metals				
aluminum	1.93	Mouse	0.03	Ondreicka et al. 1966
antimony	0.125	Mouse	0.03	Schroeder et al. 1968b
arsenic	0.32	Rat	0.332	Schroeder et al. 1968a
barium	5.1	Rat	0.435	Perry et al. 1983
beryllium	0.66	Rat	0.35	Schroeder and Mitchner 1975

Table 3-5 (continued)

COPEC*	TRV (mg/kg-day)	Species	Body Weight (kg)	Reference
Metals (continued)				
cadmium	0.06	Mouse	0.0322	Webster 1988
chromium, total	3.28	Rat	0.35	MacKenzie et al. 1958
chromium, hexavalent	3.28	Rat	0.35	MacKenzie et al. 1958
cobalt	1.2	Rat	0.275	Domingo et al. 1985
copper	2.67	Mouse	0.03	Pocino et al. 1991
iron	NA	NA	NA	NA
lead	1	Rat	0.5506	Fowler et al. 1980
manganese	13.7	Mouse	0.0346	Gray and Laskey 1980
mercury	0.25	Rat	0.1875	Khera and Tabacova 1973
molybdenum	0.26	Mouse	0.03	Schroeder and Mitchner 1971
nickel	0.133	Rat	0.2486	Smith et al. 1993
selenium	0.05	Rat	0.1865	Harr et al. 1966
silver	32.86	Rat	0.35	Matuk et al. 1981
thallium	0.48	Rat	0.065	Downs et al. 1960
vanadium	0.21	Rat	0.26	Domingo et al. 1986
zinc	9.6	Mouse	0.0255	Aughey et al. 1977

Note:
* the following chemical surrogates were used:
  hexavalent chromium for total chromium
  naphthalene for acenaphthene, acenaphthylene, anthracene, fluorene, phenanthrene, and 2-methylnaphthalene
  benzo(a)pyrene for benz(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, pyrene
  bromomethane for chloromethane
  1,2-dichlorobenzene for chlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene
  1,2-dichloroethane for chloroethane
  trans-1,2-dichloroethene for cis-1,2-dichloroethene
  tetrachloromethane for trichlorofluoromethane
  xylene – mixed isomers for n-butylbenzene, sec-butylbenzene, tert-butylbenzene, isopropylbenzene, p-isopropyltoluene, n-propylbenzene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, m- and p-xylene and o-xylene

Acronyms/Abbreviations:
COPEC – chemical of potential ecological concern
DDT – dichlorodiphenyltrichloroethane
kg – kilograms
mg/kg-day – milligrams per kilogram per day
NA – not available
TRV – toxicity reference value

Table 3-6
Avian Toxicity Reference Values

COPEC[a]	TRV (mg/kg-day)	Species	Body Weight (kg)	Reference
Volatile Organic Compounds				
acetone	52	Coturnix quail	0.050[b]	Hill and Camardese 1986
benzene	2.636[c]	Mouse	0.03	Nawrot and Staples 1979
bromoform	60	Mouse	0.03	Roe et al. 1979
2-butanone	52	Coturnix quail	0.050[b]	Hill and Camardese 1986
n-butylbenzene	0.21	Mouse	0.03	Marks et al. 1982
sec-butylbenzene	0.21	Mouse	0.03	Marks et al. 1982
tert-butylbenzene	0.21	Mouse	0.03	Marks et al. 1982
chlorobenzene	8.57	Mouse	0.03	NTP 1985
chloroethane	5	Mouse	0.03	Lane et al. 1982
chloroform	6	Mouse	0.03	Roe et al. 1979
chloromethane	0.14	Rat	0.35	Danse et al. 1984
1,2-dichlorobenzene	8.57	Mouse	0.03	NTP 1985
1,3-dichlorobenzene	8.57	Mouse	0.03	NTP 1985
1,4-dichlorobenzene	8.57	Mouse	0.03	NTP 1985
1,1-dichloroethane	17.2	Chicken	1.6	Alumot et al. 1976b
1,1-dichloroethene	3	Rat	0.35	Quast et al. 1983
1,2-dichloroethene	4.52	Mouse	0.03	Palmer et al. 1979
cis-1,2-dichloroethene	0.17	Mouse	0.03	Barnes et al. 1985
trans-1,2-dichloroethene	0.17	Mouse	0.03	Barnes et al. 1985
trans-1,3-dichloropropene	1.52	Bobwhite	NA	U.S. EPA 2000b
ethane	NA	NA	NA	NA
ethene	NA	NA	NA	NA
ethylbenzene	9.71[c]	Rat	0.35	Wolf et al. 1956
isopropylbenzene	0.98	Blackbirds	0.074[d]	Schafer et al. 1983
p-isopropyltoluene	3.16	Blackbirds	0.074[d]	Schafer et al. 1983
methane	NA	NA	NA	NA
methylene chloride	0.585[c]	Rat	0.35	NCA 1982
4-methyl-2-pentanone	2.5[c]	Rat	0.35	Microbiological Associates 1986
methyl tert-butyl ether	1	Rat	0.35	Robinson et al. 1990
n-propylbenzene	0.21	Mouse	0.03	Marks et al. 1982
tetrachloroethene	0.14[c]	Mouse	0.03	Buben and O'Flaherty 1985
toluene	2.6[c]	Mouse	0.03	Nawrot and Staples 1979
trichloroethene	0.07[c]	Mouse	0.03	Buben and O'Flaherty 1985

Table 3-6 (continued)

COPEC[a]	TRV (mg/kg-day)	Species	Body Weight (kg)	Reference
Volatile Organic Compounds (continued)				
trichlorofluoromethane	1.6[c]	Rat	0.35	Alumot et al. 1976a
1,2,4-trimethylbenzene	0.21	Mouse	0.03	Marks et al. 1982
1,3,5-trimethylbenzene	0.21	Mouse	0.03	Marks et al. 1982
vinyl chloride	0.017	Rat	0.35	Feron et al. 1981
m-, p-xylene	0.21[c]	Mouse	0.03	Marks et al. 1982
o-xylene	0.21[c]	Mouse	0.03	Marks et al. 1982
xylenes, total	0.21[c]	Mouse	0.03	Marks et al. 1982
Semivolatile Organic Compounds				
bis(2-ethylhexyl)phthalate	1.1	Ringed dove	0.155	Peakall 1974
di-n-butyl phthalate	0.11	Ringed dove	0.155	Peakall 1974
diethyl phthalate	1	Blackbirds	0.074[d]	Schafer et al. 1983
Polynuclear Aromatic Hydrocarbons				
acenaphthene	1.01	Blackbirds	0.074[d]	Schafer et al. 1983
acenaphthylene	1.01	Blackbirds	0.074[d]	Schafer et al. 1983
anthracene	1.11	Blackbirds	0.074[d]	Schafer et al. 1983
benz(a)anthracene	1.01	Blackbirds	0.074[d]	Schafer et al. 1983
benzo(b)fluoranthene	1.01	Blackbirds	0.074[d]	Schafer et al. 1983
benzo(k)fluoranthene	1.01	Blackbirds	0.074[d]	Schafer et al. 1983
benzo(g,h,i)perylene	1.01	Blackbirds	0.074[d]	Schafer et al. 1983
benzo(a)pyrene	1.01	Blackbirds	0.074[d]	Schafer et al. 1983
chrysene	1.01	Blackbirds	0.074[d]	Schafer et al. 1983
dibenz(a,h)anthracene	1.01	Blackbirds	0.074[d]	Schafer et al. 1983
fluoranthene	1.01	Blackbirds	0.074[d]	Schafer et al. 1983
fluorene	1.01	Blackbirds	0.074[d]	Schafer et al. 1983
indeno(1,2,3-cd)pyrene	1.01	Blackbirds	0.074[d]	Schafer et al. 1983
2-methylnaphthalene	1.01	Blackbirds	0.074[d]	Schafer et al. 1983
naphthalene	1.01	Blackbirds	0.074[d]	Schafer et al. 1983
phenanthrene	1.13	Blackbirds	0.074[d]	Schafer et al. 1983
pyrene	1.01	Blackbirds	0.074[d]	Schafer et al. 1983
Pesticide				
4,4′-DDT	0.009	Pelican	3.5	Anderson et al. 1975
Metals				
aluminum	109.7	Ringed dove	0.155	Carriere et al. 1986
antimony	0.0125[c]	Mouse	0.03	Schroeder et al. 1968b

Table 3-6 (continued)

COPEC[a]	TRV (mg/kg-day)	Species	Body Weight (kg)	Reference
Metals (continued)				
arsenic	5.5	Mallard	1.1722	Stanley et al. 1994
barium	20.8	Day-old chick	0.121	Johnson et al. 1960
beryllium	0.066[c]	Rat	0.35	Schroeder and Mitchner 1975
cadmium	0.078	Mallard	0.7985	Cain et al. 1983
chromium, total	1	Black duck	1.25	Haseltine et al. 1985
chromium, hexavalent	1	Black duck	1.25	Haseltine et al. 1985
cobalt	0.237	Day-old chick	0.153	Diaz et al. 1994
copper	2.3	Broiler chick	0.639	Norvel et al. 1975
iron	NA	NA	NA	NA
lead	0.014	Japanese quail	0.0935	Edens et al. 1976
manganese	77.6	Japanese quail	0.1965	Laskey and Edens 1985
mercury	0.039	Mallard	1	Heinz 1974
molybdenum	3.5	Chicken	1.5	Lepore and Miller 1965
nickel	1.38	Mallard	0.61375	Cain and Pafford 1981
selenium	0.23	Mallard	1.1077	Heinz et al. 1989
silver	178	Mallard	1	U.S. EPA 1997a
thallium	0.35	Starling	0.074	Schafer 1972
vanadium	11.4	Mallard	1.17	White and Dieter 1978
zinc	17.2	Mallard	0.955	Gasaway and Buss 1972

Notes:

[a] the following chemical surrogates were used:
- trivalent chromium for total chromium and hexavalent chromium
- acenaphthene for acenaphthylene, benz(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, 2-methylnaphthalene, naphthalene, pyrene
- bromomethane for chloromethane
- 1,2-dichlorobenzene for chlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene
- 1,2-dichloroethane for chloroethane and 1,1-dichloroethane
- tetrachloromethane for trichlorofluoromethane
- trans-1,2-dichloroethene for cis-1,2-dichloroethene
- xylene – mixed isomers for n-butylbenzene, sec-butylbenzene, tert-butylbenzene, isopropylbenzene, p-isopropyltoluene, n-propylbenzene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, m- and p-xylene and o-xylene

[b] Coturnix quail body weight from Fu et al. 2000

[c] avian TRV estimated from mammal TRV * 0.1

[d] red-winged blackbird body weight from Beletsky 1996

Acronyms/Abbreviations:
- COPEC – chemical of potential ecological concern
- DDT – dichlorodiphenyltrichloroethane
- kg – kilograms
- mg/kg-day – milligrams per kilogram per day
- NA – not available
- TRV – toxicity reference value

Table 3-7
Exposure Factors for Representative Vertebrate Wildlife Receptor Species

Exposure Factor	Deer Mouse	California Ground Squirrel	Alameda Song Sparrow	American Robin	Red-Tailed Hawk
Minimum body weight, kg	0.0109[a]	0.321[b]	0.0199[c]	0.0635[d]	0.957[e]
Maximum ingestion rate, kg/day	0.0044[f]	0.047[g]	0.00587[h]	0.01493[i]	0.10614[j]
Fractional intake, soil	0.05[k]	0.05[k]	0.093[l]	0.104[m]	0.0035[n]
Fractional intake, plant	0.5[o]	0.8[o]	0.5[o]	0.17[p]	0[o]
Fractional intake, invertebrate	0.5[o]	0.2[o]	0.5[o]	0.83[p]	0[o]
Fractional intake, small mammal	0[o]	0[o]	0[o]	0[o]	1[o]

Notes:

[a] Morton et al. 1995 (as cited in Cal/Ecotox), minimum of range of adult males and females
[b] Tomich 1962 (as cited in Cal/Ecotox), minimum adult female
[c] Dunning 1993 (as cited in TtEMI 2003), minimum of adult males and females
[d] Clench and Leberman 1978 (as cited in U.S. EPA 1993), minimum of adult males and females, breeding and non-breeding
[e] Steenhof 1983 (as cited in U.S. EPA 1993), minimum of adult males and females
[f] Nagy 2001 (omnivorous mammals; grams of food per day dw = $0.432*BW_{(g)}^{0.678}$ using maximum body weight 30.2 grams Stebbins et al. 1980)
[g] Nagy 2001 (omnivorous mammals; grams of food per day dw = $0.432*BW_{(g)}^{0.678}$ using maximum body weight 1,009 grams Tomich 1962
[h] Nagy 2001 (passerines; grams of food per day dw = $0.630*BW_{(g)}^{0.683}$ using maximum body weight 26.25 grams Smith et al. 1986
[i] Nagy 2001 (passerines; grams of food per day dw = $0.630*BW_{(g)}^{0.683}$ using maximum body weight 103 grams Clench and Leberman 1978)
[j] Nagy 2001 (carnivorous birds; grams of food per day dw = $0.849*BW_{(g)}^{0.663}$ using maximum body weight 1,455 grams Preston and Beane 1993)
[k] Beyer et al. 1994, midpoint of two prairie dog values
[l] Beyer et al. 1994, for wild turkey
[m] Beyer et al. 1994, for American woodcock
[n] Pascoe et al. 1996, 0.35 percent for bald eagle
[o] assumed
[p] Wheelwright 1986 (as cited in U.S. EPA 1993), spring-conservative, western United States

Acronyms/Abbreviations:

$BW_{(g)}$ – body weight as grams
Cal/Ecotox – California Wildlife Biology, Exposure Factor, and Toxicity Database
dw – dry weight
kg – kilograms
kg/day – kilograms per day

Table 3-8
Refined Exposure Factors for Representative Vertebrate Wildlife Receptors

Exposure Factor	Deer Mouse	California Ground Squirrel	Alameda Song Sparrow	American Robin	Red-Tailed Hawk
Mean body weight, kg	0.0184[a]	0.562[b]	0.0235[c]	0.0804[d]	1.13[e]
Mean ingestion rate, kg/day-dw	0.0031[f]	0.0316[g]	0.00544[h]	0.01261[i]	0.08976[j]
Fractional intake, soil	0.05[k]	0.05[k]	0.093[l]	0.104[m]	0.0035[n]
Fractional intake, plant	0.5[o]	0.8[o]	0.5[o]	0.17[p]	0[o]
Fractional intake, invertebrate	0.5[o]	0.2[o]	0.5[o]	0.83[p]	0[o]
Fractional intake, small mammal	0[o]	0[o]	0[o]	0[o]	1[o]
Home range, ha	0.091[q]	0.2[r]	0.0143[s]	11[t]	100[u]
Site-use factor	1[v]	1[v]	1[v]	0.92[v]	0.1[v]

Notes:

[a] Hayes 1989 (as cited in Cal/Ecotox), mean adult both sex
[b] Holekamp and Nunes 1989 (as cited in Cal/Ecotox), mean female data
[c] Smith and Arcese 1988 (as cited in Cal/Ecotox), mean adult male & female
[d] Clench and Leberman 1978, Wheelwright 1986 (as cited in U.S. EPA 1993), mean of adult males and females, breeding and nonbreeding
[e] Craighead and Craighead 1956, Steenhof 1983, Springer and Osborne 1983 (as cited in U.S. EPA 1993), mean male and female adult values
[f] Nagy 2001 (omnivorous mammals; grams of food per day dw = $0.432*BW_{(g)}^{0.678}$ using mean body weight 18.4 grams Hayes 1989)
[g] Nagy 2001 (omnivorous mammals; grams of food per day dw = $0.432*BW_{(g)}^{0.678}$ using mean body weight 562 grams Holekamp & Nunes 1989)
[h] Nagy 2001 (passerines; grams of food per day dw = $0.630*BW_{(g)}^{0.683}$ using mean body weight 23.5 grams Smith & Arcese. 1988)
[i] Nagy 2001 (passerines; grams of food per day dw = $0.630*BW_{(g)}^{0.683}$ using mean body weight 80.4 grams Clench & Leberman 1978; Wheelwright 1986)
[j] Nagy 2001 (carnivorous birds; grams of food per day dw = $0.849*BW_{(g)}^{0.663}$ using mean body weight 1,130 grams Craighead & Craighead 1956)
[k] Beyer et al. 1994, midpoint of two prairie dog values
[l] Beyer et al. 1994, for wild turkey
[m] Beyer et al. 1994, for American woodcock
[n] Pascoe et al. 1996, 0.35 percent for bald eagle
[o] assumed
[p] Wheelwright 1986 (U.S. EPA 1993) spring-conservative, western United States
[q] Storer et al. 1944, mean of male and female adult values
[r] Evans and Holdenreid 1943, Boellstorf and Owings 1995, Owings et al. 1977 (as cited in Cal/Ecotox), median value
[s] Haliburton and Mewaldt 1976, mean of male and female adult values
[t] mean of 5 values: 0.48 ha (Weatherhead and McRae 1990, deciduous forest), 2 ha (Haldeman et al. 1973, ponderosa pine forest), 4.4 ha (Gaines 1974, riparian), 20 ha (Haldeman et al. 1973, fir-pine-aspen forest), and 28.3 ha (Knupp et al. 1977, forest)
[u] U.S. EPA 1993, ">few hundred ha;" Zeiner et al. 1990, >1 km^2
[v] ratio of home range to site area

Acronyms/Abbreviations:

$BW_{(g)}$ – body weight as grams
Cal/Ecotox – California Wildlife Biology, Exposure Factor, and Toxicity Database
dw – dry weight
ha – hectares
kg – kilograms
kg/day-dw – kilograms of food per day as dry weight
km^2 – square kilometers

Table 3-9
Exposure Factors for Representative Aquatic Vertebrate Wildlife Receptors

Exposure Factor	Harbor Seal	California Brown Pelican	California Least Tern	Western Snowy Plover
Minimum body weight, kg	76 [a]	3.3[b]	0.030[c]	0.034[d]
Maximum ingestion rate, kg /day dw	2.8[e]	0.276[f]	0.0112[g]	0.0119[h]
Fractional intake, invertebrate	0.25[i]	0[j]	0[j]	1[j]
Fractional intake, fish	0.75[i]	1[j]	1[j]	0[j]

Notes:

[a] Ashwell-Erickson and Elsner 1981 (as cited in U.S. EPA 1993), minimum adult males and females

[b] Schreiber 1976 (as cited in Cal/Ecotox), minimum adult

[c] Thompson et al. 1997, minimum adult

[d] Page et al. 1995, minimum adult males and females

[e] Ashwell-Erickson and Elsner 1981 (as cited in U.S. EPA 1993), maximum of adult values (lactating or gestating adult female), 0.10 kg/kg_{BW}-day ww as ingestion rate normalized to body weight; converted here to standard units of kg/day dw by multiplying by maximum female body weight 112 kg (Ashwell-Erickson and Elsner 1981) and multiplying by ww-dw conversion factor (0.25 kg dw/kg ww) based on fish moisture content 75 percent (U.S. EPA 1993)

[f] Nagy 2001 (Pelicaniformes; grams of food per day dw = $0.279*BW_{(g)}^{0.845}$ using maximum body weight 3,500 grams Schreiber 1976)

[g] Nagy 2001 (Charadriiformes; grams of food per day dw = $0.522*BW_{(g)}^{0.769}$ using maximum body weight 54 grams Thompson et al. 1997)

[h] Nagy 2001 (Charadriiformes; grams of food per day dw = $0.522*BW_{(g)}^{0.769}$ using maximum body weight 58 grams Page et al. 1995)

[i] estimate based on Pitcher 1980 (as cited in U.S. EPA 1993)

[j] assumed

Acronyms/Abbreviations:

BW – body weight
$BW_{(g)}$ – body weight as grams
dw – dry weight
kg – kilograms
kg/day dw – kilograms of food per day as dry weight
ww – wet weight

Table 3-10
Refined Exposure Factors for Representative Aquatic Vertebrate Wildlife Receptors

Exposure Factor	Harbor Seal	California Brown Pelican	California Least Tern	Western Snowy Plover
Mean body weight, kg	80.55[a]	3.4[b]	0.045[c]	0.0418[d]
Mean ingestion rate, kg/day dw	1.41[e]	0.269[f]	0.00975[g]	0.00921[h]
Fractional intake, invertebrate	0.25[i]	0[j]	0[j]	1[j]
Fractional intake, small mammal	0.75[i]	1[j]	1[j]	0[j]
Home range, ha	7,850[k]	125,664[l]	7,850[m]	707[n]

Notes:

[a] Pitcher and Calkins 1979, (as cited in U.S. EPA 1993), mean male and female adult

[b] Dunning 1993, mean adult

[c] Thompson et al. 1997, mean adult

[d] Page et al. 1995, mean male and female adult

[e] Ashwell-Erickson and Elsner 1981 (as cited in U.S. EPA 1993), mean of male and female adult values, 0.07 kg/kg_{BW}-day ww as ingestion rate normalized to body weight; converted here to standard units of kg/day dw by multiplying by body weight (80.55 kg) and multiplying by ww-dw conversion factor (0.25 kg dw/kg ww) based on fish moisture content 75 percent (U.S. EPA 1993)

[f] Nagy 2001 (Pelicaniformes; grams of food per day dw = $0.279*BW_{(g)}^{0.845}$ using mean body weight 3,400 grams Dunning 1993)

[g] Nagy 2001 (Charadriiformes; grams of food per day dw = $0.522*BW_{(g)}^{0.769}$ using mean body weight 45 grams Thompson et al. 1997)

[h] Nagy 2001 (Charadriiformes; grams of food per day dw = $0.522*BW_{(g)}^{0.769}$ using mean body weight 41.8 grams Page et al. 1995)

[i] estimate based on Pitcher 1980 (as cited in U.S. EPA 1993)

[j] assumed

[k] U.S. EPA 1993, 5 km radius

[l] Gress et al. 1980, 20 km radius

[m] Atwood and Minsky 1983, 5 km radius

[n] Zeiner et al. 1990, 1.5 km radius

Acronyms/Abbreviations:

$BW_{(g)}$ – body weight as grams
dw – dry weight
ha – hectares
kg – kilograms
kg/day dw – kilograms of food per day as dry weight
kg/kg_{BW}-day ww – kilograms of food per kilogram of body weight per day as wet weight
km – kilometer
U.S. EPA – United States Environmental Protection Agency
ww – wet weight

ATTACHMENT F

OU-2C DATA GAPS AND REGULATORY AGENCY CONCERNS: FOLLOW-ON TO DRAFT REMEDIAL INVESTIGATION REPORT FOR OU-2C BY SULTECH

TABLE OF CONTENTS

COMMENTS FROM U.S. EPA ON DRAFT REMEDIAL INVESTIGATION REPORT FOR OU-2C BY SULTECH

COMMENTS FROM DTSC-GSU ON DRAFT REMEDIAL INVESTIGATION REPORT FOR OU-2C BY SULTECH

Attachment

1 OU-2C – SOLID WASTE MANAGEMENT UNIT SUMMARY

COMMENTS FROM DTSC-HERD ON DRAFT REMEDIAL INVESTIGATION REPORT FOR OU-2C BY SULTECH

TABLE

Table

F-1 OU-2C Data Gaps and Regulatory Agency Concerns

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COMMENTS FROM U.S. EPA ON DRAFT REMEDIAL INVESTIGATION REPORT FOR OU-2C BY SULTECH

Review of the Draft Remedial Investigation Report for Operable Unit 2C, Sites 5, 10, and 12, Alameda Point

GENERAL COMMENTS

1. EPA commends the Navy for performing a risk assessment that closely follows the criteria we have specified over the last two years. We appreciate that all chemicals were taken through to the end of the assessment and that the calculations were all made easily available on CD with links for the regulators to verify how risk was calculated.

   However, we do not feel it is appropriate to use 47 acres as an exposure area for calculating risk for Site 5. Since the reuse plan calls for possible residential use of the property, a smaller decision area similar to that used for EDC-5 and for the Coast Guard Housing should be used.

2. Many buildings and SWMUs have inadequate or no soil and groundwater sampling. Past activities at many buildings are likely to have generated or resulted in spills and releases and soil and groundwater in the vicinity of oil water separators, floor drains and USTs that held waste oil and solvents in or near these building have not been adequately investigated. This lack of characterization and sampling information renders the RI report incomplete and precludes the development of a meaningful FS.

3. Radiological issues are not included in this RI report, including detailed information on the removal actions that have been performed at Site 5 and 10. In addition, all radiological issues associated with Site 26 need to be addressed in the OU 2C RI and FS. Please revise the RI to included all relevant information on the radiological removal actions at Sites 5 and 10, the remaining risk associated with radiological contamination (and add this risk to the risk already calculated for soil and groundwater at OU 2C), and carry the unremediated portions of radiologically contaminated storm sewer lines and surrounding soil, included that associated with Site 26, forward into the FS.

4. Groundwater flow variations in the Second Water Bearing Zone (SWBZ), depicted in Figures 2-14 through 2-19 and described in Appendix B, are not adequately explained in the text. The Navy states, "groundwater flow variability in the SWBZ is likely due to tidal effects or seasonal variability in groundwater flow patterns." It is not clear, however, if the historical groundwater elevation data presented on the figures supports the Navy's statement. In some cases, it appears that the limited number of wells gauged impacted the apparent flow direction. Also, Figures 2-15 (June 2001) and 2-19 (June 2004) show groundwater flowing in opposite directions in the eastern part of the OU, which may be the result of the limited number of wells gauged, tidal influence, or some other factor like measurement error. Furthermore, the RI Report does not adequately discuss variations in groundwater flow due to tidal influence. For example, the discussion in Appendix B

states that tidal influence usually decrease with increasing distance from the shore, however, the Tidal Study found that a monitoring well in Site 5 (D05-02) responded to the tides one hour before a well at Site 10 (D10A-01), indicating variations in hydraulic conductivity exist in the SWBZ and/or a conduit to Site 5 exists. Please discuss the results of the Tidal Study at OU-2C in detail; specifically addressing the effects of tidal influence on groundwater monitoring (e.g., gauging wells at low tide and reporting the time of measurements). Please also discuss the impact of gauging only selected wells on groundwater elevations in the SWBZ.

5. There are data gaps associated with several of the solid waste management units (SWMUs) recommended for no further action (NFA) at Site 5. Based on a review of Appendix H, it appears that several SWMUs were placed on the status list as NFA based on visual observation rather than on analytical data. Some SWMUs in Table H3-1 indicate that NFA is recommended because the site was paved and staining was not observed by site inspectors. However, the lack of staining does not mean that there were no spills, since standard Navy procedures would have resulted in cleaning up and repainting areas with visible spills. Solvents and polychlorinated biphenyls (PCBs) can penetrate concrete. Also, although secondary containment is described for many SWMUs it is likely that these SWMU areas were in use prior to designation of these areas as SWMUs and prior to the requirement for secondary containment. Sampling was not done in the vicinity of most SWMUs or was done 25 to 50 feet from the SWMU. In addition, sampling near Generator Accumulation Point (GAP 20) did not include the contaminant of concern. Other SWMUs where sampling was not done include above ground storage tank (AST) 005H, M-01, M-02, M-03, M-04, M-05 (nearby floor drain), GAP 02, GAP 03, GAP 04, GAP 05, GAP 08, GAP 10, GAP 11, GAP 12, GAP 13, GAP 14, GAP 16, GAP 17, GAP 18,(samples not analyzed for lead), GAP 27 (include PCBs), GAP 31 (include PCBs), GAP 57 (include chromium VI [CrVI] and cyanide), GAP 70 (include CrVI and cyanide), NAS GAP 01, NAS GAP 05, OWS 005, OWS 615, SWMU 005, SWMU 614, and SWMU 615. Please acknowledge these data gaps in the text and discuss how they will be addressed.

Other data gaps associated with Site 5 include:

- Soil sampling beneath the industrial wastewater drains (shown as purple rectangles or squares in the figures) inside the buildings has not been done. Groundwater samples were not collected beneath or adjacent to some of the industrial wastewater drains.
- Hazardous waste including drummed hydraulic fluid and lubricating oils were stored in the hazardous waste storage area outside Building 5 in the southwest corner, but samples from this area were not analyzed for PCBs.
- Building 405 was a storage area for hazardous materials and waste including, hydraulic fluids but samples were not analyzed for PCBs or metals.
- Similarly, sampling for PCBs has not been done in the vicinity of the electrical substations (Buildings 560, 34 etc.).

- Although soil samples collected between wings 1 and 2 of Building 2 because of dry cleaning operations were below the screening criteria,, additional soil sampling was recommended beneath the perchloroethane recovery unit in Wing 2. This additional soil sampling could not be completed inside the building so groundwater sampling was recommended. Elevated concentrations of compounds associated with dry cleaning were detected in the groundwater samples, but the extent of contamination has not been delineated.
- Soil sampling was not done in and around Buildings 102, 505, 43, 44, 281, and 346. Paint, petroleum hydrocarbons, solvents, and radioactive materials, were used and/or stored in some of these buildings, so the extent of contamination has not been determined.
- Although Building 347 was a general purpose manufacturing and repair facility, soil samples were not collected near the building. The closest soil sample was about 20 feet to the west; PAHs and vinyl chloride were above the screening criteria.
- Building 500 was a chemical and equipment storage area (oil, stains, paints, solvents, and glues), but soil samples were not collected beneath this building.
- Building 32 was a metal treatment shop; some deep samples were collected, but the analyses did not include cyanide. The extent of contamination beneath this building is also a data gap.
- Building 6 was a repair shop, steam cleaning, electromotor shop, and storage area but the only analyses were for metals and total petroleum hydrocarbons (TPH). The extent of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and PCBs is a data gap.
- Based on Figure 4-4, it appears that sampling has not been done in the vicinity of Building 282, which was a diesel and gasoline station constructed in 1944.

6. In Site 12, SWMU NAS GAP 02, where waste oil was managed, was recommended for NFA based on a single groundwater sample, but the detection limits for several VOCs were greater than the screening values and groundwater samples were not analyzed for TPH or PCBs. In addition, it is likely that the secondary containment was an addition after 1987, when this location was formerly identified as a GAP, so soil sampling should have been done in this area southwest of Building 10. In addition, OWS 10 was located in the southwest corner of Building 10, but soil and groundwater samples were not collected beneath or adjacent to this OWS. Further, although there were 16 transformers, an electrical substation, and Building 10 was a power plant facility, the extent of potential PCB contamination has not been determined because few samples were analyzed for PCBs. Since the purpose of the investigation in Site 12 was "to determine if industrial sewer lines were a conduit for contaminant migration," sampling was not done in the vicinity of transformers and the electrical substation. Please include the lack of soil and groundwater samples in the vicinity of NAS GAP 02 and OWS 10 as data gaps and discuss how these data gaps will be filled. Please also discuss how and when the extent of potential PCB contamination will be evaluated.

7. It is unclear why there are discrepancies between the maximum of the data set used in the risk assessment and the maximum discussed in the text. A cursory review of selected chemicals in Site 5 soil results and groundwater results revealed the following:

Chemical	**Maximum in Text/ Summary Tables**	**Maximum of Risk Assessment Data Set**
Site 5 Soil	(mg/kg)	(mg/kg)
Benzene	6	0.001 / 0.002
Benzo(a)pyrene	16*	0.95 / 1.5
Vinyl Chloride	0.08	OMITTED
Groundwater	(mg/l)	(mg/l)
1,1,1-Trichloroethane	0.36	2,500
1,1-Dichloroethane	95	280
1,1-Dichloroethene	65	89
1,2-Dichlorobenzene	0.22	0096
1,2-Dichloroethane	0.57	0.42
1,3,5-Trimethylbenzene	0.014	0.06
1,4-Dichlorobenzene	0.059	0.016
2-Butanone	0.043	7.6
Benzene	11.5	0.11
Carbon Tetrachloride	4.6	0.13
Chloroethane	43	32.3
Cis1,2-Dichloroethene	85	230
Ethylbenzene	0.13	0.12
Tetrachloroethene	0.23	2.8
Trichloroethene	130	580
Vinyl Chloride	11	31

* Analytical result for BaP is from Appendix C.

It is unclear why higher groundwater concentrations were sometimes used in the HHRA than were reported in the text, but in other cases, the concentrations used in the HHRA were lower than those reported in the text. These discrepancies make it very difficult to evaluate the actual site risk. Please verify that all of the concentrations reported and discussed in the text are correct and verify that all of the maximum concentrations used in the HHRA are consistent with the maximum concentrations detected and reported in the text. If a maximum concentration used in the HHRA is higher or lower than the maximum overall concentration, please explain each occurrence.

8. Some of the conclusions of the 1999 RI Report (Tetra Tech EM Inc. 1999) differ from this RI. In particular, the 1999 RI Report concludes that the soil of Site 5 poses an ecological risk, while the 2005 RI Report blanket-dismisses all risk to terrestrial ecological receptors. For example, Section 8.2.1.3 Ecological Risk Assessment Soil Results (Site 5, OU-2 Central) in the 1999 RI Report states:
"IR Site 5 is currently occupied by a building that covers over 75 percent of IR Site 5, and most of the remaining area is paved and supports no vegetation. Therefore, this site is not readily accessible to ecological receptors and none were observed at IR Site 5 during site reconnaissance conducted in June 1995 and June 1997. However, the ecological risk assessment was based on the conservative assumption that future uses could result in the removal of the pavement resulting in increased exposure to ecological receptors."

Section G2.1.2.2 Exposure Pathways and Exposure Routes in the 2005 RI Report makes a contradictory statement: "Because the sites are completely paved with little or no bare ground present, as shown on Figures G-1, G-2, and G-3, the soil exposure pathway was considered incomplete and therefore not evaluated at OU-2C; for the same reason, the air exposure pathway (windblown dust) was not evaluated at OU-2C."

Please explain why it is valid to dismiss the assumption made in the 1999 RI Report, and if a valid reason is presented, please explain why the 1999 RI Report chose to ignore this reason. Please explain how ignoring the conclusions and recommendations of the 1999 RI Report meets EPA standards for conservative assumptions in Screening-Level Ecological Risk Assessments (SLERAs). Also, please include justification and substantiation for why soil exposure pathways were deemed incomplete as this is not clear in the RI Report. For example, if the site is going to be redeveloped, then explain why future use of the site would not result in terrestrial exposure to surface and subsurface soil.

9. The term "aquatic receptors" is too vague for use in the SLERA because the specific types of aquatic receptors addressed in the SLERA (i.e., macrobenthic community, aquatic invertebrates, aquatic vertebrates, etc.) should be specified. The single assessment

endpoint given in the SLERA, "protection of populations of benthic invertebrates and other aquatic receptors" (page G-5) is too broad unless the phrase "aquatic receptors" is replaced with "aquatic life" to refer to ecological receptors that actually inhabit the water and not to terrestrial receptors that may forage adjacent or in the bay. Please clarify the assessment endpoint. As this is a SLERA and not a baseline ERA, the assessment endpoint need not be a specific species or group of species, but it needs greater specificity. Also, this section must describe the measurement endpoint that corresponds to the assessment endpoint. One possibility is:
Assessment Endpoint - Survival, growth and reproduction of aquatic life species inhabiting within the Bay adjacent to the site.
Measurement Endpoint – Comparison of surface water and sediment data to USEPA approved literature-derived ecotoxicity benchmark values (i.e. National Ambient Water Quality Criteria for the protection of aquatic life, etc.)

The phrase "populations of benthic invertebrates and other aquatic receptors" is used again in the second paragraph of G2.1.3 on page G-6. This is too broad unless the words "aquatic receptors" are replaced with "aquatic life".

10. The conclusions and risk management recommendation of the SLERA are made without substantiation or justification. Please summarize the reason that further evaluation is required using statements like "because over 20 chemicals exceed the groundwater screening criteria, several by multiple orders of magnitude." Please either change the recommendation to a baseline ERA, or provide clear justification and substantiation for recommending re-evaluation, specifying precisely which assumptions will be changed and which data will be "refined".

11. It is clear that the primary exposure pathway of concern is the discharge of contaminated groundwater to surface water however there is very limited nature and extent discussion for groundwater contaminants. It is important to understand whether groundwater is discharging to the Bay and at what concentrations. It is unclear why a simplistic Domenico model was not presented at this stage to predict the concentrations in groundwater at the point of discharge. Alternatively groundwater data from the most downgradient well or a well near the point of discharge could be used. Please clearly define this pathway in the RI Report to clarify how the data were used to represent exposure concentrations at receptor points.

SPECIFIC COMMENTS

1. **Executive Summary, Page ES-2:** The fifth bullet on page ES-2, Screening-Level Ecological Risk Assessment (SLERA), states that "exposure pathways for terrestrial receptors were considered potentially complete to provide a conservative estimate of risk". That is not true. The SLERA eliminates all exposure pathways for terrestrial receptors. Please include exposure pathways for terrestrial receptors in the entirety of the

SLERA, or provide a valid reason not to include such pathways and change this section of the Executive Summary appropriately.

2. **Executive Summary, Page ES-3:** These comments address the table, "Chemicals Exceeding Screening Criteria in Soil at Site 5". Please clarify that the "Exceeds Screening Criteria?" refers to human-health screening criteria (2004 EPA PRGs) by modifying Note "a" to read "Human health screening criteria, identified in Section 4.0" or something similar. Please include a Data Gap section in this RI Report that addresses the data gaps presented in this table as Section 4.0 does not adequately do so.

   In addition, n-nitroso-di-n-propylamine should be added to this table. Although it is recognized that analytical detection limits for this compound exceed risk-based screening criteria, n-nitroso-di-n-propylamine is a risk driver based on the quantitative risk assessment. The elevated detection limit should be considered a data gap, which can be addressed in the feasibility study (FS) by conducting confirmation sampling with a more sensitive detection limit to ascertain whether this compound actually contributes to a quantitative risk greater than 10^{-6}.

3. **Executive Summary, Site 5 - Aircraft Rework Facility, Baseline Human Health Risk Assessment, Page ES-4:** It is stated that arsenic and thallium are considered to be consistent with background at Site 5. However the extent of thallium in soil at the Battery Storage Area is a data gap. Therefore, since thallium is a risk/hazard driver at Site 5, it does not seem appropriate to characterize thallium as consistent with background until this data gap has been filled. It is understood that one elevated thallium concentration is skewing the exposure point concentration high, based on the current data set, and this . However, until the data gap at the Battery Storage Area is filled, it cannot be definitively shown that thallium across Site 5 is consistent with background.

4. **Executive Summary, Page ES-4:** The Screening-Level Ecological Risk Assessment paragraph includes contradictory sentences: "¼exposure pathways for terrestrial receptors were considered potentially complete to provide a conservative estimate of risk. Results of the SLERA determined that no complete exposure pathways are present for terrestrial ecological receptors¼" Further, the SLERA did not adequately substantiate that incomplete exposure pathways are present. Please modify these sentences to (1) agree, and (2) provide an accurate description of how the decision was reached.

5. **Executive Summary, Page ES-4:** Please include text to explain how the bullets in Data Gaps will be addressed and reference that information in this section.

6. **Executive Summary, Page ES-5:** Please clarify that the "Exceeds Screening Criteria?" refers to human-health screening criteria (2004 EPA PRGs) by modifying Note "a" to read "Human health screening criteria, identified in Section 5.0" or something similar.

7. **Executive Summary, Page ES-6 and ES-7:** As requested in Specific Comment 3, please modify the sentence, "Results of the SLERA determined that no complete exposure pathways are present for terrestrial ecological receptors," to include clear substantiation and justification for their exclusion in the remainder of the SLERA. Similarly, please modify the sentence on Page ES-7 that reads, "Results of the SLERA determined that no complete exposure pathways are present for terrestrial ecological receptors." Please include substantiation and justification for their exclusion in the remainder of the SLERA.

8. **Executive Summary, Page ES-7:** Several other potential sources of contamination to groundwater (i.e., more than floor drains, sanitary sewer and fuel lines, underground storage tanks [USTs], and ASTs) are identified in Section 7. Please revise the discussion of potential sources of contamination in OU-2C groundwater to include the additional sources identified in Section 7.

9. **Section 2.4, Hydrology, Page 2-7:** The last sentence states that Appendix B presents the results of OU-2B hydrogeological investigations, however, the Appendix B results are for OU-2C. Please cite the correct OU.

10. **Section 2.4.3, Existing Uses of Groundwater, Page 2-13**: The logic used regarding TDS and its relation to domestic use is faulty. In the FWBZ TDS ranges from 110 mg/l to 5,100 mg/l and these levels are flagged as too high to be considered for domestic use. Apart from the fact that some bottled water sold to consumers has TDS of 500 mg/l, there are parts of the country that make use of groundwater with higher TDS levels than those given here. Hence the federal criteria of protection of groundwater with TDS of anything less than 10,000 mg/l. Please remove the opinion that this water would not be considered for domestic use.

11. **Section 2.5.2, Alameda Point Ecology, Page 2-14:** Since the RI Report concludes there may be potential risk to aquatic receptors in Seaplane Lagoon and Oakland Inner Harbor, it would be helpful if this section includes at least some description of the ecology of these water bodies. Please expand this section to include information on the aquatic communities of Alameda Point and, specifically, list the species that are known to occur in Seaplane Lagoon and Oakland Inner Harbor (and thus those species that may be affected by the contaminated groundwater)

12. **Figure 2-5, Operable Unit 2C Cross-Section A-A':** It is unclear why 42 feet below mean lower low water (ft below MLLW) was selected as the elevation of the top of the Merritt Sand in M05-01/REF-S05-01 rather than selecting the top of the silty sand unit at 36 feet below MLLW. This silty sand unit appears to be similar to the unit selected as the top of the Merritt Sand in D05-02. Please verify the elevation of the top of the Merritt Sand in M05-01/REF-S05-01 and discuss how the elevation of this unit was chosen.

13. **Figure 2-6, Operable Unit 2C Cross-Section B-B':** The depiction of CPT S05-04/M05-

04 is inaccurate; the logs indicate that CPT S05-04 ended at 33 ft below ground surface (bgs) or at about 20 ft below MLLW, but the cross-section indicates that this boring extended to 30 feet below MLLW. In addition, the depths and lengths of the lithologic units does not match the log. Please revise the cross-section to match the boring log.

14. **Figure 2-15, Potentiometric Surface Contour Map, Second Water Bearing Zone, Summer Quarter June 2001; and Appendix B, Section B3.1 Hydrostatigraphy, Page B-3 :** The statement that groundwater flowed to the east in June 2001 and September 2003 is not consistent with Figure 2-15 which indicates that groundwater flowed to the south in June 2001. Please resolve this discrepancy.

15. **Figure 2-19, Potentiometric Surface Contour Map, Second Water Bearing Zone, Summer Quarter June 2004:** The direction of groundwater flow was misinterpreted, since the arrow depicting flow direction points upgradient rather than downgradient. Please correct this figure.

16. **Section 3.0, Remedial Investigation Approach, Page 3-1:** The last paragraph states that the evaluations of the SWMUs in Appendix H, are based on analytical results. However, the tables in Appendix H indicate that most of the evaluations were not based on analytical results but on visual observation. Soil and groundwater sampling was not done in the vicinity of several of the SWMUs. Please revise the text to describe how the evaluations were conducted.

17. **Section 3.7, Screening-Level Ecological Risk Assessment Approach, Page 3-23:** The last paragraph in this section lists two options if the site fails the SLERA: further evaluation in a Tier II (baseline) ecological risk assessment (Step 3 of the EPA and Navy ERA processes) or an interim cleanup action, but the actual recommendation given in Section G5.0 includes neither of these options. Please include the actual recommendation (Step 3a reevaluation) to be consistent. Similarly, the text on page 3-24 has the sentence: "If the SLERA determines that potential risk is posed to ecological receptors, then a baseline ecological risk assessment or further evaluation in an FS is necessary". Please also revise this sentence to be consistent.

18. **Figure 3-1, Initial Conceptual Site Model:** The inhalation of volatile emissions in indoor air is not identified as a potentially complete exposure pathway for a Future On-Site Worker (Commercial/ Industrial), although this appears to be a potentially complete exposure pathway based on information in the RI Report text. Please revise Figure 3-1 to include the inhalation of volatile emissions in indoor air as a potentially complete exposure pathway for a Future On-Site Worker at Alameda Point.

19. **Section 4.1, Site 5 Background:** The history of several strips of land included in OU-2C were not discussed on included in the summary table. These strips include the rectangular strip of land to the southwest of Site 5 that runs east and west (Parcels 29A,

50B, and 51B), the strip of land that extends from the western central portion of the site, and land associated with the storm drain line that extends to Outfall F. Some sampling was done in the eastern portion of the east-west strip, but it is unclear if the sampling was appropriate since the history of the strip of land was not discussed. Please summarize the historic uses of these three strips of land that are included as part of Site 5 on various figures.

In addition, the history of radiological release of Building 5 does not appear to meet current requirements. The last release was apparently given by the California Department of Health Services in 1988, prior to the discovery of extensive radiological contamination within Building 5 in the sinks, floor drains and storm sewer. A more recent, i.e. post radiological removal action, certification of unrestricted public use needs to be obtained and presented.

20. **Section 4.1, Site Background, Table, Pages 4-2 though 4-4:** This table does not discuss all of the buildings on Figure 4-1, Site 5 Features. It appears that the Table is missing Building 505, Building 281 (removed), an unnumbered building (removed) northwest of Building 347, an unnumbered building south of Building 347, an unnumbered building west of Building 589, two unnumbered buildings (removed) north of Building 405, one unnumbered structure adjacent to the southwest corner of Building 5, three unnumbered structures (one square and two circles) (removed) south of Building 5 (near the southwest corner), one building southwest of 348 (Site 10), four unnumbered buildings(removed) east of Building 615, two unnumbered buildings in area CAA-5A, Building 171 (removed), Building 534-1 (removed), and one unnumbered building southwest of Building 62. The former use of these buildings and structures is important for the site conceptual model. Please include these buildings in the table on pages 4-2 though 4-4.

21. **Section 4.1, Site Background, Table, Page 4-3 and Figure 4-1, Site Features:** There is a discrepancy between the Table and Figure 4-1; Figure 4-1 indicates that Building 415 was removed but the Table does not indicate that this building was demolished. Please resolve this discrepancy.

22. **Section 4.1, Site Background, Table, Pages 4-3 though 4-4 and Figure 4-1, Site 5 Features:** Some of the buildings discussed in the table on pages 4-2 though 4-4 could not be located on Figure 4-1. Building 193 and Building 415 in Parcel 57 could not be located, although Building 415 in Site 12 (Parcel 69) is included on Figure 4-1. Since the table includes parcel numbers to help locate the buildings, Figure 4-1 should include the parcel numbers. Please include all of the buildings listed in the table on Figure 4-1. In addition, please include the parcel numbers on Figure 4-1.

23. **Section 4.2.1, Conceptual Site Model, Pages 4-8 through 4-10:** It is unclear why PCB contamination is not considered in the Conceptual Site Model (CSM). The CSM descriptions of Building 34 and other electrical substations should include PCBs. Even

though equipment containing oil with a PCB concentration over 40 parts per million was been removed in 2001, PCB-containing equipment may have leaked prior to that date. At other sites, PCB contamination has been found in concrete and soil beneath and adjacent to transformers. Since the presence of PCBs in concrete would impact disposal requirements, concrete in the vicinity of former PCB-containing equipment should be tested. The absence of visual staining should not be considered indicative because surfaces could have been cleaned and/or repainted. Please revise the CSM to include PCBs and discuss how the data gaps associated with PCBs will be addressed.

24. **Section 4.2.1, Conceptual Site Model, Page 4-10:** The text states that Buildings 2 and 43 are not considered potential sources of contamination, but the table on pages 4-2 through 4-4 states that Building 2 had a dry cleaning facility and solvents and petroleum were stored/used in Building 43. The text also states that buildings 51A, 53A and 67 are not considered potential sources of contamination, but these designations are parcel numbers for open spaces. Please include Buildings 2 and 43 in the CSM as areas where hazardous substances were stored/used and correct the text to refer to 51A, 53A and 67 as Environmental Baseline Survey (EBS) parcels.

25. **Section 4.2.1, Conceptual Site Model, Page 4-10:** It is unclear why AST 2-1 is not included as a potential source of solvents in the bullet 6 list, since this AST was near the portion of Building 2 where dry cleaning was done. It is likely that this AST contained dry cleaning solvents or wastes. Please include AST 2-1 in bullet 6.

26. **Section 4.2.2, Data Quality Assessment, Table (chemicals in Site 5 soil with at least 5 percent of their reporting limit exceeding the PRG), Page 4-11:** The embedded table on page 4-11 states that mercury is not related to former Site 5 activity, but mercury was used in gauges, dials, and is associated with sand blasting waste. Because these activities occurred at Site 5 it is likely that mercury is related to former Site 5 activities. Please change the table on page 4-11 to state that mercury is related to former Site 5 activities or explain why mercury is not related to Site 5 activities.

    Similarly, arsenic was used as a pesticide, so given the maximum concentration of 329 milligrams/kilogram (mg/kg), it is likely that it was used at the site. Please revise the table to indicate that arsenic may have been used at the site.

27. **Section 4.2.4, Nature and Extent, Pages 4-14 and 4-14:** There are some inconsistencies between the data presented in the embedded table on these pages (Chemicals in Site 5 Soil Exceeding Screening Criteria), the data presented on Site 5 figure, and the data in Appendix C. For example, the table indicates that the maximum concentration of 1,1-dichloroethane was 20 micrograms per kilogram (ug/kg), but Figure 4-7 and Appendix C indicate that the maximum was 20 mg/kg (i.e., 20,000 ug/kg). Similarly, based on Appendix C, maximum concentration of benzene was 6,000 ug/kg, the maximum concentration of tetrachloroethene (PCE) was 110,000 ug/kg, the maximum concentration

of trichloroethene (TCE) was 260,000 ug/kg, and the maximum concentration of vinyl chloride was 80 ug/kg. It appears that there were systematic errors of three orders of magnitude when VOC data was transcribed to this table. Please resolve these discrepancies and verify that all of the concentrations listed in the table are correct.

There are errors in the range of benzo(a)pyrene (BaP) equivalent concentrations presented in this table, based on the analytical results in Appendix C. The analytical data in Appendix C indicate that the BAP equivalent concentration of 030-MOD-181 is 22.7 mg/kg, but the maximum concentration in the table is 2 mg/kg. Please resolve this discrepancy.

28. **Section 4.2.4, Nature and Extent, Metals in Soil, Page 4-14:** The text dismisses the maximum arsenic concentration of 329 milligrams per kilogram (mg/kg) in the surface sample collected from location 054-001-007 (grid G-5), which exceeded the screening criteria (0.39 mg/kg) and the maximum background concentration for arsenic (15.6 mg/kg). Although the text states that the statistical comparison indicated "the absence of concentration patterns that might indicate potential release sources of arsenic or hot spots of arsenic," is unlikely that this concentration, which is more than 20 times the maximum background concentration, is consistent with background concentrations; this maximum was not included in the statistical comparisons in Appendix D. In addition, historically, arsenic was used as a pesticide and has been detected at high concentrations at other California Navy Bases. Therefore, it is likely that arsenic was used at the site. Since only a single surface sample was collected at sample location 054-001-007 and there are no other samples within about 95 feet of sample location 054-001-007, the extent of arsenic is not vertically or horizontally bound. It is not acceptable to state that "an extremely low probability exists that additional sampling at this location would yield data exceeding the screening criteria for arsenic." Additional sampling is needed to evaluate the extent of arsenic. Thallium was also detected at an extremely high concentration (335 mg/kg) in the same sample and the text states on page 4-17 that thallium at location 054-001-007 represents a data gap. Please revise the text to delete the text quoted above, discuss the data gap associated with arsenic, and discuss how this data gap will be addressed.

29. **Section 4.2.4, Nature and Extent, Metals in Soil, Page 4-15**: It is likely that the spill of 3000 gallons of wastewater containing hexavalent chromium in Building 348 is responsible for the soil contamination in this area. This extent of the soil and groundwater contamination from this spill is a data gap that warrants further investigation. In addition, the objective of the cadmium soil removal action at the Building 5 plating shop being the final soil action in this area was contingent on the results of confirmation sampling, including chromium and lead analyses in addition to the cadmium. However, although the waste manifests for the soil excavated from the plating shop show the presence of hazardous levels of chromium, the confirmation sampling only checked for cadmium levels. So it is unknown to what extent lead and chromium are still present in soil around the plating shop and this data gap will need to be addressed prior to

the FS.

30. **Section 4.2.4, Nature and Extent, Metals in Soil, Page 4-17:** It is unclear why a data gap was not identified for vanadium and thallium in the vicinity of the metal work shop. The extent of iron in the vicinity of sample locations 054-002-012 and 054-003-020, which are located in the former metal work shop area, is considered a data gap for iron. Both these locations have vanadium concentrations above the screening criteria and at location 054-002-012, thallium also is above the screening criteria. Please include vanadium and thallium in the data gap associated with the metal work shop.

31. **Section 4.2.4, Nature and Extent, VOCs in Soil, Page 4-18:** The text states that the trichloroethene (TCE) and tetrachloroethene (PCE) concentrations exceeded their respective screening criteria at locations 057-001-001 and 057-001-002 are bound by several other samples with concentrations below screening criteria. However, it appears the PCE and TCE concentrations are bound to the south by location 057-006-015 and 55 feet to the north by locations 057-003-008, 057-006-016, and 057-003-007. The TCE and PCE concentrations at 057-001-001 and 057-001-002 do not appear to be bound to the east and west or vertically. Given the high concentrations and the lack of contaminant delineation in an area where degreasing and corrosion control activities were conducted, this area should be considered as a data gap for TCE and PCE in the soil. Please acknowledge the data gap for TCE and PCE in the vicinity of soil sample locations 057-001-001 and 057-001-002.

    In addition, there is a discrepancy in the cited screening criteria for TCE; the value in the first partial paragraph is different than the value cited in the text of the first complete bullet. Please resolve this discrepancy.

32. **Section 4.2.4, Nature and Extent, VOCs in Soil, Page 4-18:** The discussion of TCE detected in B05-11 states that TCE has migrated to groundwater and "this TCE contamination is not present in soil," but no quantitative information is given on the VOC hits in soil at the adjacent B05-14 and M05-07. Figure 4-7 shows that there are hits above the PRG at all three locations which points to a source in the soil.

33. **Section 4.2.4, Nature and Extent, PAHs in Soil, Page 4-20:** The discussion of the extent of BaP appears to be incomplete and the text is inconsistent. The first paragraph states that only four BaP-equivalent samples exceed screening criteria, but 12 BaP-equivalent samples are discussed in the bulleted discussion. Figure 4-8 has four BaP-equivalent sample locations that exceed screening criteria, of which two (C3S005B003 and C3S005B048) were not discussed in the text. Appendix A (page A-17) states that 18 soil samples exceeded the BaP-equivalent screening criteria. Please discuss and post all data in the text and on Figure 4-8 and revise the text to eliminate discrepancies.

34. **Section 4.2.4, Nature and Extent, PCBs in Soil, Page 4-20:** It is unclear if sampling for

PCBs was done in the vicinity of former PCB-containing equipment (e.g., transformers, hydraulic lifts, etc.) at Site 5. Although all PCB-containing equipment with high levels of PCB was changed out or removed in 2001, spills that occurred prior to that date may have contaminated concrete and/or soil in the vicinity of this equipment. In addition, a figure showing the locations of all the former PCB-containing equipment and sampling locations has not been provided. Please provide more information describing the location of PCB-containing equipment and a figure showing the locations of the PCB-containing transformers, hydraulic lifts, etc. and sampling locations. If PCB sampling has not been done in the vicinity of each piece of PCB-containing equipment, please discuss this data gap and how it will be addressed in the text.

35. **Section 4.2.6.1, Surface Soil, Page 4-25; and Section 4.3.1, Conclusions and Section 4.3.2, Recommendations, Pages 4-28 and 4-29:** These sections state that arsenic and thallium are attributed to background soil at OU-2C, but the concentration of arsenic is 21 times greater than background and the concentration of thallium is 64 times greater than the screening criteria at sample location 054-001-007. These concentrations are not consistent with background levels. Please delete every statement that attributes arsenic and thallium solely to background concentrations, acknowledge the data gap in the vicinity of 054-001-007, and discuss how this data gap will be addressed.

36. **Figure 4-4, Soil Sample Locations:** Two of the BaP-equivalent sample locations (NPS-S05-02 and NPS-S05-03) that exceeded the screening criteria could not be found on Figure 4-4. In addition, locations 54-02-12 and B05PS-01 could not be located on this figure. Please post all sample locations on Figure 4-4. In addition, please include an outline of the cadmium removal action and use a unique symbol to designate sample locations that were removed by excavation.

37. **Figure 4-5 (1 of 3) and (3 of 3), Arsenic Concentration Exceeding Screening Criteria In Site 5 Soil:** Figures 1 of 3 and 3 of 3 for Figure 4-5 are missing from the CD-ROM. Please include all figures on the next version of the CD-ROM.

38. **Figure 4-6, Other Metals Concentrations Exceeding Screening Criteria In Site 5 Soil and Figure 4-7, VOC Concentrations Exceeding Screening Criteria In Site 5 Soil:** On Figures 4-6 and 4-7 some locations are shown with red dots indicating that a soil sample collected from the location exceeded a screening criteria, but the location is not included in the tables on the figures or discussed in the text. Examples on Figure 4-6 include M05-02 and M05-03. On Figure 4-7 049-IW-001, B05-08, 261-S7, 057-005-012, M05HW-01, B05-14, M05-07, and 045-002-003 do not have associated data. Please resolve this discrepancy.

39. **Section 5.1, Site 10 Background, Page 5-2:** One unnumbered building north of Building 400 was not discussed in the text. Please discuss the historical use of this structure.

40. **Section 5.1, Site 10 Background, Solid Waste Management Units, Page 5-3:** The text states that the SWMUs in Site 10 should be considered "a low risk to soil," but soil and groundwater samples were not collected beneath or adjacent to SWMUs that were used to store wastes and liquids. Visual observation is insufficient because the Navy would have repainted areas with stains. Similarly, secondary containment was probably not practiced before the 1980s. Since sampling was not done beneath or adjacent to M-08, GAP 36, GAP 37, or GAP 38, these SWMUs should be identified as data gaps. Please identify the data gaps associated with M-08, GAP 36, GAP 37, or GAP 38 and discuss how and when they will be addressed.

41. **Section 5.2.1, Conceptual Site Model, Page 5-4:** It is unclear why the CSM does not include former PCB containing equipment (e.g., transformers, hydraulic lifts, etc.) or the industrial drains shown with Building 400. In addition, since Building 400 was a missile rework facility, perchlorate, which was used as a missile fuel, should be considered a potential contaminant of concern. Please include former PCB-containing equipment and the industrial drains in the CSM and discuss how data gaps associated with these features will be addressed. Also, please include perchlorate as a potential contaminant and discuss how this data gap will be addressed.

42. **Section 5.2.4, Nature and Extent**: The CSM states that the hangar floor was a potential source of VOCs and TPH, but samples were not analyzed for TPH or lead, which was an additive in aviation fuel. Please discuss how this data gap will be addressed.

43. **Section 5.2.4, Nature and Extent, Chemicals Exceeding Screening Criteria, Page 5-9:** The text discusses corrective action "north of Building 400, in CAA-5A and CAA-5B," but CAA-5C is associated with Site 10. Please resolve this discrepancy.

44. **Section 6.1, Site 12 Background, Page 6-1:** The first paragraph in this section states that Building 10 represents 25 percent and that paved open space represents another 25 percent of Site 12, but does not account for the remaining 50 percent of the site. Please describe the remaining 50 percent of Site 12 in the text.

45. **Section 6.1, Site 12 Background, Storm Sewers Page 6-2:** The text states that the storm sewer lines located on the north and southern sides of Building 10 were not cleaned, but does not discuss future plans for the storm sewer lines. Please clarify whether these storm sewer lines will be cleaned.

46. **Section 6.2.1, Conceptual Site Model, Page 6-3:** It is unclear why TPH as gasoline (TPH-g), TPH as diesel (TPH-d), lead, and methyl tert butyl ether (MTBE) are not included as potential contaminants of concern. UST 10-6 contained unleaded gasoline and AST 010J contained diesel. Since all gasoline was originally leaded, lead should also be included as a contaminant of concern for the USTs and ASTs. Please add TPH-g, TPH-d, lead, and MTBE as possible sources of contamination for USTs and ASTs.

47. **Section 6.2.4, Nature and Extent, Page 6-6:** The text on page 6-5 states that "Some uncertainties and potential soil data gaps associated with the presence of PCBs in Site12 soil were identified and are discussed in detail in Sections 6.2.4 and 6.2.5," but this promised discussion was omitted from the text. The text states that 16 transformers were present at Site 12 (page 6-1), Building 34 was an electrical substation with transformer oils (page 4-4) and Building 10 was a former power plant facility but it appears that few samples other than those from the monitoring well borings were analyzed for PCBs. This is insufficient to evaluate the extent of potential PCB contamination. Please discuss this data gap in the text.

48. **Section 6.2.4, Nature and Extent, Chemicals Exceeding Screening Criteria, Page 6-8:** The last paragraph in this section states that "Site 12 meets the Water Board criteria for low-risk fuel site closure, and further action is not recommended for soil at Site 12," but soil sampling was not done in the vicinity of most of the USTs and ASTs located on Site 12. Please acknowledge this data gap and discuss how and when it will be addressed.

49. **Section 7.2, Conceptual Site Model, Storm Sewers., Page 7-4:** The text states that sections of the storm sewer between manholes 15G and 13G are below the groundwater, but Figure 4-2 show that storm sewer between manholes 15G and 14G is below the groundwater. Please resolve this discrepancy.

50. **Section 7.5.1.1, Metals in OU-2C Groundwater, Pages 7-9 and 7-10:** It is unclear why soil sample results were not correlated with groundwater results. It appears that most of the areas where arsenic was detected above the screening criterion in groundwater were also areas where the screening criterion for arsenic was exceeded in soil. Please correlate all of the metals detected above background in groundwater with soil sample results and discuss any patterns that are found.

51. **Section 7.10, Recommendations, Pages 7-27 and Section 8.4, Conclusions and Recommendations for OU-Wide Groundwater, Pages 8-3 through 8-5:** The text on page 7-10 acknowledges that the extent of contamination downgradient is a data gap and that further investigation is needed, but this data gap is not included in Section 7.10 or in Section 8.4. It appears that the extent of several chemicals, including, but not limited to 1,1-Dichloroethane, 1,2-Dichloroethane, TCE, and vinyl chloride has not been delineated. Please discuss this data gap and how and when it will be addressed in the recommendations in Sections 7.10 and 8.4.

52. **Section 8.0, Remedial Investigation Conclusions and Recommendations:** All data gaps should be acknowledged and discussed in Section 8. Please include the data gaps identified in these comments and a brief discussion of how and when they will be addressed in the appropriate subsection.

53. **Section 8.1, Conclusions and Recommendations for Site 5, Page 8-1:** The text states, "No further action was recommended for TPH at Site 5," but in Section 4 it was concluded that Site 5 does not meet Water Board criteria for low-risk fuel site closure due to indications of floating product and TPH fractions of xylene exceeding remediation criteria. As a result, further action is recommended for TPH in soil at Site 5. Please resolve this discrepancy.

54. **Section 8.1, Conclusions and Recommendations for Site 5, Page 8-2:** The text states that arsenic and thallium are attributed to naturally background concentrations and are not recommended for further evaluation in a FS, but at sample location 054-001-007 the concentration of arsenic is 21 times greater than background and the concentration of thallium is 64 times greater than the screening criteria. These concentrations are not consistent with background levels. Since the extent of arsenic and thallium has not been determined, please identify this as a data gap.

55. **Section 8.1, Conclusions and Recommendations for Site 5, Page 8-3:** The text states, "No further action is recommended for Site 12 soil," but soil sampling was not performed in the vicinity of most of the USTs and ASTs located on Site 12 and there a data gap for PCBs at Site 12. This recommendation for further action for Site 12 soil is premature. Please revise the text to acknowledge these data gaps and delete the recommendation for no further action.

56. **Appendix A, Environmental Investigations, Pages A-1 though A -39:** Parcel numbers are frequently referenced but are not provided on the figures. In addition, most of the figures have a grid, but the grid numbers of named locations are not provided in the text. This information would help the reader locate specific locations discussed in the text. Please provide include the parcel numbers on the figures and provide the grid numbers of specific locations discussed in the text.

57. **Appendix A, Environmental Investigations, Section A2.2.2, Selective Plating Shop, Page A-5:** The text discusses one subsurface soil sample, but the text does not include the sample location name. Please provide the name of the location of the sample.

58. **Appendix A, Environmental Investigations, Section A3.3.1, Site 5, Parcel 51, Page A-26:** The text discusses 23 samples with 10 subsurface soil samples and 13 HydroPunch_ groundwater samples, but the text does not include the sample location names. Please include the sample location names in the text.

59. **Appendix A, Environmental Investigations, Section A3.4.2, Storm Sewer Investigations, Page A-30:** This section states that approximately 1,785 feet storm sewer lines, all within the vicinity of Sites 5, 10, and 12, are in an unknown condition and are in groundwater chemical plumes that are above potential ecological concern. These sewer lines are part of outfall system F to Seaplane Lagoon. The text further emphasizes that

the sewer lines are subject to the radiological program and beyond the scope of this RI Report. However, the agencies asked during the scoping of the RI to have all radiological information included in this report and Site 26 has deferred any radiological issues associated with that site to be addressed with the Site 5 radiological remedial work. Please revise the RI to included all information on the radiological removal action at Sites 5 and 10, the remaining risk associated with radiological, and carry the unfinished portions of radiologically contaminated storm sewer lines and surrounding soil forward into the FS.

60. **Appendix A, Section A3.5.1.1, Underground Storage Tank Summary for Site 5, Page A-31; and Figure 4-4 Soil Sampling Locations:** It is not clear why soil at UST 2-1 was sampled for TPH-g since the text states that the tank was used for diesel storage. The statement, "TPH-contaminated soil was excavated," should be deleted or clarified since it is not clear whether soil contaminated with TPH-d remains. Because TPH-d was not analyzed, the extent of contamination was not characterized; this should be identified as a data gap. Further, the text refers to Table A-19 for post excavation TPH results, but this table is a statistical summary of soil analysis lacking detail. Please explain why soil samples from the UST 2-1 area were analyzed for TPH-g only, and discuss whether a data gap exists since there are no results for TPH-d. Please delete or clarify the statement that contaminated soil was excavated. Also, please reference Appendix C for analytical results instead of Table A-19.

61. **Appendix A, Section A3.5.1.1, underground Storage Tank Summary for Site 5, Page A-31:** It is not clear why soil at UST 5-1 was not analyzed for PCBs and chlorinated solvents since the text states it was used to store waste oil. Additionally, the text refers to analytical results in Table A-19, but this table lacks the necessary detail for reviewing the results of the investigation. Please explain PCBs and chlorinated solvents were not included in the analytical suite for sample location 5C-1, and evaluate whether a data gap for these analytes exists at former UST 5-1. Please also reference Appendix C for analytical results instead of Table A-19.

62. **Appendix A, Section A3.5.1.1, Underground Storage Tank Summary for Site 5, Page A-32:** Given the statement that a jet fuel release to the soil and groundwater had occurred at UST 5-2, it is not clear why JP-5 range TPH was not analyzed in soil samples. Please discuss whether a data gap exists at former UST5-2 since JP-5 range TPH was not analyzed in soil samples.

63. **Appendix A, Section A3.5.1.1, Underground Storage Tank Summary for Site 5, Page A-32; and Appendix C, Table C-8 Complete Analytical Results for OU-2C Water:** The discussion of groundwater results at former UST 5-2 lacks detail. The statement, "Groundwater samples collected from these monitoring wells contained SVOCs, VOCs, lead, and TPH up to 96,400 ug/L," appears to indicate that TPH was measured at 96,400 ug/L. Cross checking the results in Appendix C indicated that this is

likely a VOC measurement at M05-07. Please be more specific when discussing groundwater results.

64. **Appendix A, Section A3.5.1.1, Underground Storage Tank Summary for Site 5, Page A-32:** It is not clear why PCB analysis was not conducted at UST 5-3, since the text states that it was used to store waste oil and solvents. In addition, this discussion is too general Please explain why PCB analysis was not done, and include this omission as a data gap. Please also expand the discussion to clarify maximum concentrations and to specify the media sampled.

65. **Appendix A, Section A3.5.1.1, Underground Storage Tank Summary for Site 5, Page A-32:** It is not clear whether adequate analysis has been performed at UST 6-1 and UST 6-2 since the text does not state specifically which petroleum solvent was stored in the former USTs. Furthermore, no basis is given for the statement that contaminated soil was removed. Please identify which petroleum solvent was stored in the tanks. Please explain how analytical results had confirmed that contaminated soil was removed.

66. **Appendix A, Section A3.5.1.1, Underground Storage Tank Summary for Site 5, Page A-32:** The discussion of maximum analyte measurements in soil and groundwater at UST 62-1 lacks detail. Furthermore, results for PAHs and metals discussed in the text appear to be incorrect. Please check the results and identify the maximum measured concentration of the specific analyte in the analytical group.

67. **Appendix B, Section B3.5, Tidal Influence, Page B-6; and Section 9 References, Page 9-1:** The discussion of tidal influence at Parcel OU-2C lacks detail and does not focus on specific data acquired in the Tidal Study that supports the Navy's explanation of variations in groundwater flow direction in the SWBZ Please add detail to the discussion of tidal influence at OU-2C and present the data from the Tidal Study to support the discussion of groundwater flow variations due to tidal influence.

68. **Appendix B:** The Logs for D05-04 and D05-07, which were used for the cross-sections in Section 2 are missing from Appendix B. Please provide logs for all borings that were used in the cross-sections.

69. **Appendix E, Total Petroleum Hydrocarbon Screening, Section E5.1, Soil Screening Results For Site 12, Page E-13, and Section E5.3, Conclusions and Low-Risk Closure Assessment, Page E-14:** Step 5: Conduct Additional Investigation, states "Additional sampling at Site 12 is not warranted" and further action is not recommended in Section E.5.3, but soil samples were not collected near the majority of the USTs and ASTs at Site 12. Please acknowledge this data gap and discuss when it will be addressed.

70. **Table H3-1: Profiles For Solid Waste Management Units In Operable Unit 2C (Sites 5, 10, And 12) Integrated With CERCLA Program, UST(R)-19, Page 59 of 70:** In the

Data Analysis section it is stated that USTs 615-1 and 615-2 served as spill control for sprinklers in Building 615. From this statement it is assumed that the sprinklers mostly, if not completely, contained potable water, however, it is unknown if the water contained additional constituents (e.g., fire retardant, corrosion preventative) that could be a possible contaminant if it reached the soil or groundwater. Please state if there were additional substances mixed with the water for the sprinklers in Building 615. If the sprinklers in Building 615 only contained potable water then the NFA is appropriate for USTs 615-1 and 615-2, however, if substances were added to the water, USTs 615-1 and 615-2 will need to be reevaluated for NFA.

COMMENTS ON THE SLERA (APPENDIX G)

1. **Section G2.1, Step 1: Problem Formulation and Ecological Effects, Pages G-2 to G-6:** This section requires some reformatting to present the information in the five bulleted items as the next five main subheaders. These five items are critical to the SLERA and follow Navy and EPA format for the problem formulation step. For example, G2.1.2 should be "Completed Exposure Pathways" within which a conceptual side model (CSM) is then described. G2.1.3 should be Fate and Transport, G2.1.4 should be Ecotoxicity, and G2.1.5 should be Selection of Measurement and Assessment Endpoints. Please reformat Section G2.1.

2. **Section G2.1.2, Conceptual Site Model, Pages G-3 to G-6:** This section does not include a subsection on ecotoxicity and potential receptors as recommended in the EPA guidance for SLERA (EPA 1997). Please include a subsection that describes the toxic mechanisms of contaminants found at OU-2C and lists species that are potential receptors.

3. **Section G2.1.2.3, Fate and Transport, Page G-5:** This section is too vague and needs to be more site-specific. It is unclear in this section if there any groundwater trends were observed downgradient from the site. While SLERA requires the use of maximum detected concentrations, site contaminant distribution and movement should be presented to evaluate the significance of concentration trends to understand if ecological risks at the point of discharge may increase or decrease over time. Information on the level of dilution that would be expected is important. The presence of dense non-aqueous phase liquid (DNAPL) indicates a continuing source of contamination and implies that there will be ongoing risks. This information is needed in the SLERA to provide a perspective on the risk results. Please include more site-specific information to better understand the CSM, since some readers of this section may not read the remainder of the RI Report. Please also discuss low solubility and heavier molecular weight compounds settling into bay sediments, since the transport of chemicals at this site will determine the exposure pathways that need to be evaluated.
4. **Section G2.1.2.4, Assessment and Measurement Endpoints, Page G-5:** Please expand, clarify, and correct the first sentence of the assessment endpoint. In addition, there is a

typographic error in the bold-faced sentence that states the assessment endpoint. The two words "Protection of" are repeated. Please delete the duplicate text.

5. **Section G2.1.2.4, Assessment and Measurement Endpoints, Page G-5:** The second sentence of the assessment endpoint is "Aquatic receptors play an important role in the food web at OU-2C," but there is no surface water in OU-2C. The contaminated groundwater in OU-2C poses a potential risk to aquatic receptors in Seaplane Lagoon (which is in OU-4B) and Oakland Inner Harbor (which is in OU-4C). If the sentence means the terrestrial food web in OU-2C, please clarify. Otherwise, please amend the sentence to say "Aquatic receptors play an important role in the food web at Alameda Point" or something similar.

6. **Section G2.1.2.4, Assessment and Measurement Endpoints, Page G-5:** Due to the presence of chlordane and mercury in groundwater, food chain modeling is required. Thus, an additional assessment endpoint needs to be added to address the effects of aquatic predators and water fowl that may ingest aquatic life that has bioaccumulated site contaminants as follows: Assessment Endpoint – Survival, growth and reproduction of aquatic life species residing and foraging within surface water bodies within and adjacent to the site. Measurement Endpoint – Comparison of exposure concentration levels to literature-derived benchmark values.

7. **Section G2.1.2.4, Assessment and Measurement Endpoints, Page G-5:** Due to the presence of bioaccumulative compounds as well as heavy molecular weight compounds (i.e., PAHs), sediment exposure needs to be evaluated. At a minimum groundwater concentrations can serve as pore water concentrations and converted to sediment concentrations and compare these data to ecotoxicity benchmarks for sediment dwelling organisms.

8. **Section G2.2.1, Selection of Chemicals of Potential Ecological Concern, Page G-7:** The third sentence in this section states: "The data were filtered for the metal analyses". Please clarify what this means, why it was done, and how it is important to the SLERA.

9. **Section G2.2.2, Methodology for Evaluating Exposure and Effects on Ecological Receptors, Page G-7:** This section does not include all available screening criteria that Navy ERA and USEPA guidance recommends to use as a minimum start when screening surface water and sediment data. Revisit the screening of the data and include a screen against any additional values identified in the following references. The available criteria include but are not limited to:
EPA Ambient Water Quality Criteria (AWQC) (applicable to fresh- and marine waters only; not applicable to sediment)
Effects Range-Low values for sediment developed by Long et al. (1995)
NOAA Screening Quick Reference Table (SQuiRT) Guidelines (Buchman 1999)
EPA EcoTox Thresholds (see http://www.epa.gov/superfund/resources/ecotox/)

1997, Suter and Tsao 1996, (see
http://www.hsrd.ornl.gov/ecorisk/reports.html)
Chronic screening values developed by EPA Region 4.

10. **Section G2.2.2, Methodology for Evaluating Exposure and Effects on Ecological Receptors, Page G-7:** This section does not include a sediment screen. Currently the document has not evaluated sediments. At a minimum sediments should be modeled assuming the groundwater concentrations are pore water and convert to a sediment concentration especially since there are bioaccumulative compound detected in groundwater.

11. **Section G2.2.2, Methodology for Evaluating Exposure and Effects on Ecological Receptors, Page G-7:** This section needs to include a screen for bioaccumulative compounds. The presence of persistent, bioaccumulative and toxic (PBT) compounds such as chlordane and mercury, implies a significant ecological exposure pathway that requires evaluation. Please revise the SLERA to screen for bioaccumulative compounds.

12. **Appendix G, Section G.2.2.2, Methodology for Evaluating Exposure and Effects on Ecological Receptors, Page G-7:** The second-to-last sentence on this page has a typographic error. Please strike the words "will be used" from the end of the sentence.

13. **Section G4.2, Detection Limits Exceeding Screening Criteria, Page G-9:** The last sentence in this paragraph says: "Fate and transport modeling for these chemicals would help address the uncertainty associated with the nondetected chemicals for which the reported detection limits exceeded screening criteria". Please conduct fate and transport modeling for chemicals with detection limits exceeding screening criteria and include this section in the SLERA. Chemicals that still pose a potential risk should be included in the exposure estimate and risk calculation.

14. **Section G4.4, Ecological Point of Exposure, Page G-10:** In this paragraph, the phrases "aquatic receptors" and "benthic invertebrates" are used interchangeably, though they do not necessarily mean the same thing. Once the assessment endpoint has been clearly defined (see General Comment 3), please modify this section for clarity.

15. **Figure G-4, Conceptual Site Model:** Given that the only assessment endpoint in the SLERA is "protection of populations of benthic invertebrates and other aquatic receptors", it is unclear why this figure should concentrate on and expand on only the terrestrial receptors, which have been dismissed at the beginning of the SLERA. Please change the focus of this figure to aquatic receptors and include groundwater/aquatic exposure paths to aquatic plants (benthic and suspended) and animals (benthic, suspended, and open-water). Also, G-4 needs to be revisited based on previous comments. Exposure to sediment is a potentially completed pathway as are potential exposure to higher trophic levels feeding on aquatic life inhabiting the surface water and

sediments.

16. **Section G5.0, Risk Assessment Conclusions and Risk Management Recommendations, Page G-10:** This section summarizes information that was not presented in the SLERA. The third paragraph in this section indicates that food chain modeling was done; however, this modeling was not located in the document reviewed. The current SLERA only compared groundwater concentrations to ecotoxicity benchmarks; no food chain modeling was presented. Chlordane and mercury were detected in groundwater; thus, food chain modeling is required for this SLERA. Please revisit this conclusion and include food chain modeling in the SLERA as it was not included in this version of the document.

17. **Attachment G1: Groundwater Screening Criteria for OU-2C at Alameda Point:** This section requires a thorough technical editorial review. Many letters are missing from words in the Notes section (such as all capital and lowercase "w" letters, capital "R"s, and capital "J"s) and, in some places, there are very long spaces between words, parts of words, or individual letters. This table also needs to reference each value as Section G2.2.2 does not explain what the values are in the table.

COMMENTS FROM DTSC-GSU ON DRAFT REMEDIAL INVESTIGATION REPORT FOR OU-2C BY SULTECH

Alan C. Lloyd, Ph.D.
Agency Secretary
Cal/EPA

Department of Toxic Substances Control

8800 Cal Center Drive
Sacramento, California 95826-3200

Arnold Schwarzenegger
Governor

MEMORANDUM

TO: Marcia Liao, Project Manager
Office of Military Facilities
700 Heinz Avenue, Suite 200
Berkeley, California 94710

FROM: Michelle Dalrymple, PG
Engineering Geologist
Geologic Services Unit

REVIEWED BY: Stewart W. Black, PG
Senior Engineering Geologist
Geologic Services Unit

DATE: September 30, 2005

SUBJECT: **REVIEW OF THE DRAFT REMEDIAL INVESTIGATION REPORT FOR OPERABLE UNIT 2C, SITES 5, 10, AND 12, ALAMEDA POINT, ALAMEDA, CALIFORNIA DATED JULY 1, 2005**

ACTIVITY REQUESTED

Per your request the Northern California Geological Services Unit (GSU) has reviewed the *Draft Remedial Investigation Report for Operable Unit 2C, Sites 5, 10, and 12, Alameda Point, Alameda, California* dated July 1, 2005. The draft Remedial Investigation (RI) was prepared by SulTech and Tetra Tech EM Inc. for the U.S. Department of the Navy (Navy), Naval Facilities Engineering Command, Southwest Division. GSU has reviewed the document with respect to the geologic and hydrogeologic interpretations, the characterization of nature and extent of contamination, and the conclusions and recommendations presented. Review activities consisted of reading the document and reviewing the DTSC project file for background issues.

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PROJECT SUMMARY

The RI report presents the results, conclusions, and recommendations of the RI conducted for OU-2C at Alameda Point. The following CERCLA sites comprise OU-2C: Site 5 – Building 5 (Aircraft Re-work Facility); Site 10 – Building 400 (Missile Re-Work Facility); and Site 12 – Building 10 (Power Plant). The purpose of the RI report is to document the approach used to conduct the RI for Sites 5, 10, and 12, the results of the investigations, and recommend further evaluation in an FS, if necessary. The specific objectives of this RI were to:

- Collect soil and groundwater data for characterization of the sites and in support of an FS, if necessary;
- Evaluate each site's physical setting, geology, hydrogeology, and ecology;
- Conduct a background comparison for metals detected in soil and groundwater at each site;
- Assess the nature and extent and fate and transport of those chemicals detected above screening criteria at each site; and
- Conduct a baseline human health risk assessment and a screening level ecological risk assessment for each site.

GENERAL COMMENTS AND RECOMMENDATIONS

A. GSU found numerous errors, omissions, and inconsistencies in tables, text, and figures throughout the document, some of which are noted in specific comments below. These errors, inconsistencies, and omissions made it very difficult for GSU to review the document. Due to the abundance of errors and inconsistencies noted in the document, GSU questions the accuracy and defensibility of the interpretations presented. GSU cannot concur with interpretations and conclusions presented in the report until the errors, inconsistencies, and omissions are corrected.

Recommendation

GSU requests that the tables, text, and figures are corrected to reflect accurate information. GSU requests that depths of groundwater samples collected are included in Appendix C. GSU also requests that a more thorough quality control check is performed on future documents prior to submittal to the agencies.

B. Several potential sources and site features that may have contributed to soil and groundwater contamination are identified for each of the OU-2C sites in the conceptual site models. However, the RI does not provide a logical and systematic description of how each potential source area and site feature was investigated, and how it was determined that site characterization was complete. The RI also lacks pertinent information regarding the methods and procedures that were used to conduct the field and analytical work. Because this information is not available, GSU cannot determine whether the sites have been adequately characterized.

Recommendation

GSU requests that the RI includes a map showing the locations of each potential source and site feature that was identified for each of the sites based on the conceptual site models. GSU requests that the RI includes a summary of the rationale for investigation of each area and how it was determined that site characterization was complete. GSU also requests that the rationale are provided for soil and groundwater sampling locations, depths of samples collected, and installation of permanent monitoring wells. Finally, GSU requests that the methods and procedures used to perform the RI field work are provided.

C. A great deal of effort and expense has been put forth to collect a large amount of soil and groundwater data in the source areas at Site 5. However, GSU feels that the RI lacks a rigorous and thorough evaluation of the analytical data. As a result, it appears that the distribution of volatile organic compounds (VOCs) in soil and groundwater, and the possible locations and extent of dense nonaqueous phase liquid (DNAPL) in the source areas, are not well understood. GSU understands that a DNAPL removal action using six-phase heating technology was recently implemented at Site 5 and that an estimate of the extent and volume of DNAPL has been made. However, GSU did not find the results of these evaluations in the RI report (see Specific Comment 53).

Recommendation

GSU recommends that the RI present a rigorous and thorough evaluation of soil sources, including DNAPL sources. GSU requests that depth-discrete isoconcentration contour maps and vertical profiles of chemical concentration data are prepared and included in the RI report (see Specific Comments 35 and 36). GSU further requests that additional information regarding the six-phase heating removal action is provided in the RI report including the data that were used to determine the volume and extent of DNAPL (see Specific Comments 52 and 53).

D. Based on the information presented in the draft RI report, GSU has identified the following additional data gaps. Note that a comprehensive list of data gaps could not be prepared because GSU could not determine if the sites have been adequately characterized as discussed in General Comment B. Data gaps identified by GSU include, but may not be limited to:

- **Delineation of elevated levels of arsenic and thallium in soil in the vicinity of sample 054-001-007 (see Specific Comment 15).**
- **Delineation of elevated levels of chromium in soil in the vicinity of former Building 348 and the plating shop. Because there is a history of chromium plating operations and discharge of wastewater containing hexavalent chromium, GSU requests that soil samples are analyzed for total and hexavalent chromium (see Specific Comment 16).**
- **Evaluation of contaminant sources in soil (including DNAPL) in the vicinity of the former plating shop, and delineation of the extent of VOCs in soil in this area (see Specific Comment 18).**
- **Delineation of the vertical extent of VOCs in soil in the vicinity of former Building 348 (see Specific Comment 18).**
- **Evaluation of soil sources contributing to elevated levels of VOCs in soil boring B05-11, and delineation of VOCs in soil in this area (see Specific Comment 18).**
- **Evaluation of the source of elevated levels of metals and cyanide groundwater, and delineation of the extent (see Specific Comments 33 and 34).**
- **Delineation of the lateral extent of VOCs in the SWBZ, and the vertical extent of VOCs in groundwater (see Specific Comments 35 and 37).**
- **Determination of the possible presence of 1,4-dioxane, a solvent stabilizer commonly associated with 1,1,1-trichloroethane (1,1,1-TCA), at Site 5, and the possible presence of perchlorate, a component of explosives at Site 10 (see Specific Comments 23 and 37).**
- **Investigation of OWS-006A and OWS-006B (see Specific Comment 9) and OWS-010 (see Specific Comment 26).**
- **Evaluation of the potential for data gaps associated with OWS-005, OWS-615, and the dry cleaning facility in Building 2 (see Specific Comment 9).**
- **Evaluation of the potential for data gaps associated with possible PCB contamination related to transformers located at Site 12 (see Specific Comment 25).**
- **Construction of permanent monitoring in and downgradient of each of the VOC source areas to determine concentration trends and plume movement over time. Wells should be screened across the interval most likely to be impacted by VOCs and metals.**

E. Because geological and hydrogeological site characterization is an important component of the RI, GSU does not consider this information appropriate for an appendix. Cross-referencing between figures in Section 2 and site-specific geologic and hydrogeologic information in Appendix B is cumbersome and is not recommended (see Specific Comments 2 and 4). GSU would prefer to have site-specific geological and hydrogeological interpretations and information provided in Section 2.

Recommendation

GSU recommends that all geologic and hydrogeologic information (cross-sections, groundwater figures, tables, and narrative) is either presented in Section 2 or in Appendix B.

F. The fate and transport discussions contained in Sections 4 through 7 of the RI report do not provide a comprehensive analysis of site-specific fate and transport mechanisms occurring at OU-2C. Appendix I presents a general description of fate and transport tendencies for specific metals and broad categories of other chemicals, but does not describe the site-specific fate and transport mechanisms occurring at OU-2C.

Recommendation

GSU requests that the relevant information from Appendix I is combined with site-specific information to present a comprehensive discussion of fate and transport for site-specific chemicals in soil and groundwater at OU-2C.

G. GSU questions why the maximum concentrations presented in Table 7-1 *OU-Wide Statistical Summary of Groundwater Analyses* are not consistent with the maximum concentrations for individual constituents presented on Table F-3.7 which shows the data used to calculate the groundwater exposure point concentrations (EPCs) for the human-health risk assessment. **Please clarify and ensure that the correct data are being used to calculate EPCs.**

SPECIFIC COMMENTS

1. Executive Summary. On the table on page ES-10, it is shown that the risk drivers for soil at Site 10 are total petroleum hydrocarbons (TPH). While TPH are the predominant soil contaminants found at Site 10, they were not found to be risk drivers. Arsenic was determined to be a risk driver at Site 10 but is not included on the table. **Please correct the information on the table.**

2. Section 2.3.2 – Alameda Point Geology. It is the opinion of GSU that a description of site-specific geology should be added to this section and expanded beyond the information presented in Appendix B. The information presented in Appendix B is not sufficient to adequately characterize the site geology for the purposes the site conceptual model that will be the basis for the feasibility study and remedial design. The site-specific cross-sections included in Section 2 are useful visual tools, but these illustrations require a narrative interpretation of site conditions. **GSU recommends that the discussion of site-specific geology is expanded to interpret the lithologic information presented on cross-sections, and that particular attention is given to source areas, such as the area beneath the plating shop and the eastern side of Building 5 where DNAPL sources are suspected. GSU requests that all site-specific geologic information is either presented in Section 2 or in Appendix B (see General Comment E).**

3. Section 2.3.2 – Alameda Point Geology. It is unclear why only selected borings were used to compile geologic cross-sections A-A' and B-B'. There are several nearby borings (within 50 to 100 feet of the cross-section lines) that could be projected onto the cross-sections to present a more thorough picture of the subsurface conditions. Additional borings should be projected to the cross-section lines, particularly in the areas where extensive contamination and DNAPL are present. Also, GSU questions the location of soil boring M05-10 presented on Figures 2-4, 2-5, and 4-4. Monitoring well M05-10 is an abandoned well that is located in the plating shop area. **Please revise cross-sections A-A' and B-B' to include other nearby borings. Please clarify and/or correct the location of well M05-10. Also, GSU requests the preparation and inclusion of a third cross-section that transects the eastern source area and the plating shop since these are important features at Site 5.**

4. Section 2.4.2 – Alameda Point Hydrogeology. It is the opinion of GSU that a description of site-specific hydrogeology should be added to this section and expanded beyond the information presented in Appendix B. The information presented in Appendix B is not sufficient to adequately characterize the site-specific hydrogeology for the purposes the feasibility study and remedial design. The site-specific potentiometric surface maps included in Section 2 are useful visual tools, but these illustrations require a narrative interpretation of hydrogeologic conditions. A series of maps is presented which illustrate seasonal changes in groundwater flow directions and gradients but there is no discussion of these maps or of the seasonal changes that are observed with respect to vertical and horizontal groundwater flow.

   GSU recommends that the discussion of site-specific hydrogeology is expanded to include an interpretation of the historical and seasonal changes in hydrogelogic conditions including water table elevations, groundwater-flow directions, horizontal and vertical hydraulic gradients,

and average linear groundwater flow velocities. GSU requests that hydrographs are prepared for all wells using all available groundwater elevation data. GSU also requests that the following information is included in tabular format:

- **monitoring well construction details,**
- **historical water table elevation data,**
- **hydraulic conductivity values obtained from aquifer tests and geotechnical laboratory analysis.**

GSU requests that all hydrogeologic information is either presented in Section 2 or in Appendix B (see General Comment E).

5. Section 2.4.2 – Alameda Point Hydrogeology.

   GSU questions why the groundwater elevation data presented on the potentiometric surface maps in the RI report is not consistent with the data presented in the basewide groundwater monitoring reports for the same sampling rounds. **Please provide correct water level elevation data for each well and modify the interpretations presented on the figures, as necessary.**

6. Section 4.1 – Site 5 Background, Storm Sewer. **GSU requests that sections of the storm sewers extending beneath Building 5 are added to Figure 4-2. GSU also requests that the sanitary and industrial waste sewers are included on a figure in the RI report, as these may also be sources of contamination.**

7. Section 4.1 – Site 5 Background, Removal Actions. **GSU requests that the location and approximate dimensions of the cadmium soil removal action are shown on a figure.**

8. Section 4.2.1 – Conceptual Site Model. It is the opinion of GSU that a map should be provided showing the locations of important physical site features and activities identified in the conceptual site model. Figure 4-1 shows building locations but does not show the specific locations within Building 5 where significant activities were performed.

   GSU requests a figure showing the historical useage of Building 5 including the locations of the southern and northern (Building 5A) portions of the building, and the locations of various activities and storage areas, (such as the paint shop, plating shop, battery storage area, metal working shop, former aircraft maintenance line, hazardous waste storage area, etc.). Please also provide the location of the dry cleaning facility in Building 2 on a figure in the RI report.

9. Section 4.2.1 – Conceptual Site Model. The following comments pertain to the conceptual site model for Site 5:

   a. It is unclear why the buildings/potential sources listed on Figure 4-3 (Site 5 Conceptual Site Model) are not consistent with those listed in the text on page 4-9 of this section (Conceptual Site Model). It is very difficult to understand what the conceptual site model is if the information presented is not consistent.

      Please provide consistent and accurate information for the conceptual site model. Also, for each "potential source" listed in the conceptual site model, please clarify if any sampling (soil, groundwater, wipe, etc.) was performed to evaluate whether releases occurred from that area. If not, please clarify the rationale for not performing such work.

   b. It is stated that no chemical information is available for Buildings 6 and 32. However, page 4-4 of the RI report provides a list of chemicals reportedly stored and/or used in these buildings. GSU also questions why oil-water separators OWS-006A and OWS-006B are not discussed in this section. Appendix A of the RI report states that these oil-water separators were recommended for further investigation (see Section A3.5.1.3 of Appendix A).

      Please clarify the information regarding chemicals used and/or stored at Buildings 6 and 32 in the conceptual site model. Also, GSU requests that OWS-006A and OWS-006B are included in the conceptual site model. GSU further requests that investigation of OWS-006A and OWS-006B is included as a data gap pursuant to the recommendation presented in Appendix A. GSU also requests that other oil water separators at Site 5 (OWS-005 and OWS-615) are discussed in the conceptual site model and evaluated with respect to potential data gaps.

   c. It is unclear why Buildings 10 and 415 are discussed in the conceptual site model for Site 5. These building are located at Site 12. **Please move this information to Section 6.**

   d. It is unclear why Buildings 261 and 614 are not discussed in the conceptual site model. According to Section 4.1, Building 261 was a naval aviation depot storage area that reportedly stored chromium, cyanide, and kerosene. Elevated levels of chromium and cyanide have both been found in groundwater at Site 5. Building 614 was used as a paint storage facility which stored paints, organic compounds, corrosives, and petroleum products. **Please include these buildings in the conceptual site model. Please also explain why building 261 was not investigated for metals and cyanide.**

e. GSU questions the information on page 4-10 that states that Buildings 2 and 43 are "not considered potential sources of contamination because historical records neither identify nor suggest any chemical use or storage activities in these buildings." Building 2 contained a dry cleaning facility and may be a source of solvents as noted in Section 7.1 of the RI report. Building 43 was an ammunition overhaul and rework shop constructed in 1941. Hazardous materials reportedly stored and/or used include solvents and petroleum products as indicated on page 4-2. **GSU requests that the information regarding chemical use and/or storage at Buildings 2 and 43 is clarified, and that these buildings are included in the conceptual site model as potential sources.**

10. Section 4.2.2 – Data Quality Assessment. Several errors with respect to values listed for preliminary remediation goals (PRGs) were noted on Table 4-1. For example, the PRG for arsenic should be 0.062 mg/kg not 0.39 mg/kg. This and other errors related to PRGs occur throughout the document. **Please check and correct the PRG values reported on Table 4-1 and throughout the document.**

11. Section 4.2.3 – Background Comparison. GSU questions why chromium, arsenic, and thallium are not listed as site-related metals in soil. In the discussion of nature and extent of metals in soil (page 4-15 of the RI report), elevated levels of chromium in soil are attributed to site-related activities, and known sources of chromium exist at Site 5. In addition, GSU disagrees that elevated levels of arsenic and thallium can be attributed to background. Arsenic was detected in a sample collected near the battery storage area at a concentration two orders of magnitude above the 95% UCL Alameda Point background value for arsenic in soil, and a background value for thallium in the "pink" area has not been established. **GSU requests that chromium, arsenic, and thallium are listed in this section as metals in soil that are not attributed to background.**

12. Section 4.2.4 – Nature and Extent. In the first paragraph it is stated that the four elements of the nature and extent evaluation listed in this paragraph are described in Section 3.4. However, GSU did not find a description of each of these elements in Section 3.4. **Please clarify and/or describe how each of the four elements was implemented.**

    In addition, at the end of this paragraph, the reference to Table 4-2 is incorrect. This error also occurs throughout Appendix A. **Please correct this reference.**

13. Section 4.2.4 – Nature and Extent, *Chemicals Exceeding Screening Criteria*. Due to the large volume of information presented on the sample location map (Figure 4-4), GSU found this very important map difficult to use. **GSU requests separate maps of sample locations that are chemical specific. Please**

consider creating at least two sample location maps for different analytical suites. For example, one map could show polynuclear aromatic hydrocarbon (PAH) and semivolatile organic compound (SVOC) sample locations and the other could show metals, VOCs, TPH, and pesticide sample locations. Also, GSU requests the use of different symbols and/or colors to identify different types of sample points (monitoring wells, soil borings, surface locations, soil punch, etc.) rather than acronyms.

14. Section 4.2.4 – Nature and Extent, *Chemicals Exceeding Screening Criteria*. The screening value listed for benzo(a)pyrene equivalents in the table on page 4-14 is not a residential soil PRG as indicated in the footnote. Also, check the units listed for the various chemical groups. VOCs are stated to be in micrograms per kilogram but actually, the results are presented in milligrams per kilogram (mg/kg). Finally, as noted in Specific Comment 10, there are errors in the PRG values listed, including but not limited to the PRG value for arsenic. **Please correct the information on the table on pages 4-13 and 4-14 with respect to screening values and units.**

15. Section 4.2.4 – Nature and Extent, *Chemicals Exceeding Screening Criteria*, Metals in Soil. It is stated that the statistical results for arsenic are consistent with the absence of concentration patterns that might indicate potential release sources or hot spots of arsenic in soil at Site 5. However, the figure illustrating concentration pattern of arsenic is presented relative to the PRG not the background. The distribution of arsenic above the 95% UCL Alameda Point background value would need to be provided to support the argument that hot spots are not present. In addition, GSU disagrees that the unbounded arsenic concentration of 329 mg/kg does not represent a data gap. This arsenic concentration is collocated with an elevated thallium concentration (335 mg/kg) that has been determined to be a data gap (as stated on page 4-17 of the RI report). Elevated levels of arsenic have also been found in groundwater and appear to be site-related (see Specific Comment 34). **Please revise the figure to indicate sample locations where arsenic exceeds the 95% UCL Alameda Point background value. GSU requests that arsenic in soil in the vicinity of sample 054-001-007 is considered a data gap and is investigated for horizontal and vertical extent.**

16. Section 4.2.4 – Nature and Extent, *Chemicals Exceeding Screening Criteria*, Metals in Soil. Elevated chromium was found in surface soil samples at the location of former Building 348 and the plating shop. It appears that the extent of elevated chromium in these samples is unbounded. Based on the information presented in the RI report GSU could not determine if the elevated chromium found in soil in the plating shop and at Building 348 is hexavalent chromium.

GSU requests that elevated chromium in soil at Building 348 and the plating shop is considered a data gap and is fully investigated for horizontal and vertical delineation. In addition, because there is a history of chromium plating operations and discharge of wastewater containing hexavalent chromium, GSU requests that soil samples are analyzed for hexavalent chromium. GSU requests an analysis of chromium concentrations relative to the 95 % UCL Alameda Point background chromium concentration and the residential soil PRG for hexavalent chromium to determine if there are other areas at the site (hot spots) that may warrant additional investigation for chromium and/or hexavalent chromium (i.e. data gaps).

17. Section 4.2.4 – Nature and Extent, *Chemicals Exceeding Screening Criteria*, VOCs in Soil. GSU disagrees that PRG comparisons for VOCs are appropriate for the evaluation of nature and extent. VOCs present in soil at concentrations much lower than the residential soil PRGs can act as continuing sources to further degrade groundwater. **GSU requests that the analysis of VOC data includes all detected concentrations of VOCs.**

    In addition, GSU found what appear to be several errors on Figure 4-7, *VOC Concentrations Exceeding Screening Criteria in Site 5 Soil.* Some of the locations that are identified using red dot symbols indicating screening level exceedances are not included on the table in the margin which presents the analytical results. GSU questions the omission of analytical data for the following soil boring locations: 049-IW001, B05-08, 261-S7, B05-14, and M05-07. **Please clarify and correct the figure.**

18. Section 4.2.4 – Nature and Extent, *Chemicals Exceeding Screening Criteria*, VOCs in Soil. The following comments pertain to data gaps associated with VOCs in soil at Site 5:

    a. GSU disagrees that a data gap for VOCs does not exist in soil in the vicinity of the plating shop. 1,1-DCE and 1,1,1-TCA were detected at elevated concentrations (4 and 2 mg/kg, respectively) in a sample collected from 22 feet below ground surface (bgs). Elevated VOCs in soil are not bounded horizontally or vertically in this area. In addition, this is an area where DNAPL is suspected to be present to a depth of up to 26 feet bgs based on dissolved concentrations of 1,1,1-TCA in groundwater samples.
    GSU requests that an evaluation and investigation of elevated levels of VOCs in soil in the vicinity of the former plating shop is included as a data gap. GSU further requests that the delineation of soil sources that exist below the water table (including DNAPL) is included as a data gap.

b. GSU disagrees that a data gap does not exist for VOCs in soil in the vicinity of former Building 348. Trichloroethylene (TCE) and tetrachloroethylene (PCE) were reported in soil samples at levels exceeding their respective residential PRGs in shallow soil samples collected from this area. Elevated levels of VOCs in these samples are not bounded vertically. In addition to exceeding the PRGs, PCE and TCE detected in these samples will likely act as a continuing source of groundwater contamination. It should also be noted that elevated detection limits were present in these samples which may have masked the presence of other VOCs. **GSU requests that the delineation of VOCs in soil in the vicinity of former Building 348 is included as a data gap.**

c. GSU disagrees that a data gap does not exist for VOCs in soil in the area east of Building 5 at the location of soil boring B05-11. TCE and 1,1,1-TCA were detected at elevated concentrations (2 and 39 mg/kg, respectively) in the sample collected from 14 feet bgs. Deeper samples were not collected. It should also be noted that elevated detection limits were present this sample which may have masked the presence of other VOCs.

It is stated in the RI report that this sample is bounded by five locations where soil samples were collected at depths ranging from 1 to 14 feet bgs, and VOCs were not detected above screening levels. However, soil analytical data contained in Appendix C for the five soil boring locations indicate that samples were not analyzed from depths greater than 5 feet bgs.

A dissolved concentration of TCE in a nearby location indicates that DNAPL may be present to a depth of approximately 48 feet bgs in this location. The source of VOCs found in soil at 14 feet bgs in boring B05-11 and in groundwater at 48 feet bgs has not been identified and is a data gap. The horizontal and vertical extent of elevated VOCs in this area has not been delineated.

GSU requests that an evaluation and investigation of soil sources contributing to the elevated levels of VOCs in soil boring B05-11 is included as a data gap. GSU further requests that the delineation of VOCs in soil in this area is also included as a data gap.

19. Section 4.2.4 – Nature and Extent, *Chemicals Exceeding Screening Criteria*, PCBs in Soil. **In the first sentence of this section on page 4-20, please remove the phrase "or less than 1 percent."**

20. Section 4.2.5 – Fate and Transport. It is the opinion of GSU that this section should include a description of the fate and transport of DNAPL in the vadose zone and saturated soil. At Site 5, residual and/or pooled DNAPL is thought to be present within the saturated soil column. Lithology and gravity are the

dominant factors that influence the migration of DNAPL in the subsurface. DNAPL dissolution rates are slow, and DNAPL is expected to act as a long-term continuing source of groundwater contamination. **Please include a discussion of the fate and transport of DNAPL in soil in this section.**

21. Section 4.2.5.2 – Persistence in the Environment. **Please note in this section that 1,1-DCA is also a daughter product resulting from the anaerobic reductive dechlorination of 1,1,1-TCA.**

22. Section 4.2.5.3 – Migration Evaluation. VOCs in the vadose zone will partition between the soil organic carbon, soil vapor, and soil moisture. VOCs will migrate within the soil environment under a concentration gradient in an attempt to reach equilibrium among the three phases. VOCs in the saturated soil column will also continue to leach into groundwater under a concentration gradient until soil sources are depleted. **GSU requests that this section evaluate the migration potential for VOCs in soil in both the saturated and unsaturated subsurface environments. Please use available site data and chemical properties to evaluate the potential for three- and four-phase partitioning and contaminant migration in the subsurface at Site 5.**

    GSU further questions the statement that the migration of these chemicals in groundwater does not appear to have been aided by horizontal conduits such as underground utility lines in the area of Site 5. This statement discusses the migration evaluation of groundwater and should be moved to Section 7. Also, this statement needs to be supported with an evaluation of site-specific data. **Please move this discussion to Section 7 and expand it to include site-specific details to support the statement.**

23. Section 5.2.1 – Conceptual Site Model. It is the opinion of GSU that perchlorate should be considered in the conceptual site model for Site 10 based on the history of the site as a "missile rework facility" from 1957 until 1972. **GSU requests that possible perchlorate contamination is investigated as a data gap for Site 10.**

24. Section 5.2.4 – Nature and Extent. In the first paragraph it is stated that the four elements of the nature and extent evaluation listed in this paragraph are described in Section 3.4. However, GSU did not find a description of each of these elements in Section 3.4. **Please clarify and/or describe how each of the four elements was implemented.**

    In addition, GSU cannot evaluate whether site characterization is complete because the rationale for placement of soil borings and depths of investigation are not specified. **Please describe the rationale for the sampling locations and analytical methods in relation to historical site activities (see General Comment B).**

25. Section 6.1- Site 12 Background. GSU questions whether the transformer oils contained in the 16 transformers at Site 12 may have contained PCBs. **Please add the locations of the transformers to Figure 6-1 and provide information regarding the potential for PCB contamination to be a data gap at Site 12.**

26. Section 6.2.1 – Conceptual Site Model. The railroad track is identified as a possible source of contamination at Site 12. GSU questions why this possible source was not considered for Site 5 which contains a segment of the same railroad track that terminates at Building 5. **Please consider adding this feature to the conceptual site model for Site 5. Please discuss how this feature was evaluated to determine whether contamination is present.**

    GSU also questions why Building 415, OWS-010, and sewers are not included in the conceptual site model as possible sources of contamination. Appendix A of the RI report states that OWS-10 was recommended for further investigation (see Section A3.5.3.3 of Appendix A). **GSU requests Building 415, OWS-010, and sewers are added to the conceptual site model for Site 12 as possible sources of contamination and are evaluated for possible data gaps. GSU further requests that investigation of OWS-010 is included as a data gap pursuant to the recommendation presented in Appendix A.**

27. Section 6.2.4 – Nature and Extent. In the first paragraph it is stated that the four elements of the nature and extent evaluation listed in this paragraph are described in Section 3.4. However, GSU did not find a description of each of these elements in Section 3.4. **Please clarify and/or describe how each of the four elements was implemented.**

    In addition, GSU cannot evaluate whether site characterization is complete because the rationale for placement of soil borings and depths of investigation are not specified. **Please describe the rationale for the sampling locations and analytical methods in relation to historical site activities (see General Comment B).**

28. Section 7.1 - OU-Wide Groundwater Chemical Use History and Sources of Contamination. **GSU requests that the physical features discussed in this section as the probable primary sources of soil and groundwater contamination are shown on a figure. Specifically, include the plating shop, battery storage area, hazardous waste storage area, solvent tank, and dry cleaning operations.**

29. Section 7.5 – Nature and Extent. Figure 7-2, *Groundwater Sampling Locations*, shows the locations where groundwater samples were collected at OU-2C. GSU finds this map to be difficult to use because all groundwater sampling locations indicated on this map are identified with the same symbol regardless of type of sampling location and depth. GSU had difficultly finding key sampling locations

on this figure. **GSU requests that the information on this map is divided into two maps, one showing the first water-bearing zone (FWBZ) sampling locations and the other showing the second water-bearing zone (SWBZ) sampling locations. GSU further requests that monitoring wells are distinguished from discrete grab samples by the use of different symbols and/or colors.**

30. Section 7.5.1 – Chemicals Exceeding Screening Criteria. The maximum concentration reported for arsenic in the table on page 7-8 is inconsistent with the information on Figure 7-3 and in the first paragraph on page 7-10. Also, the maximum concentration reported for manganese in the table on page 7-8 is inconsistent with the information on Figure 7-3, and the first paragraph on page 7-10 contradicts itself with respect to this information. **Please correct the information regarding the maximum concentrations of arsenic and manganese in groundwater.**

31. Section 7.5.1 – Chemicals Exceeding Screening Criteria. It is unclear how detection limits elevated above the screening criteria were accounted for in the table on pages 7-8 and 7-9. **Please add a column to this table showing the number of samples with detection limits exceeding the screening criteria. GSU also requests that this table is divided into two tables: one showing the results for the FWBZ and the other showing the results for the SWBZ consistent with the sampling location maps requested in Specific Comment 29).**

32. Section 7.5.1 – Chemicals Exceeding Screening Criteria. It is the opinion of GSU that MCLs should be added to the tables on page 7-8 and 7-9 for comparison purposes. Some chemicals (for example cyanide) have an MCL that is lower than the PRG. **Please add the MCLs to the above referenced table.**

33. Section 7.5.1 – Chemicals Exceeding Screening Criteria. GSU questions why cyanide, which was detected at elevated levels (up to 4,550 μg/L) in groundwater samples collected beneath the former plating shop, is not discussed in Section 7 or included on the statistical summary table. Cyanide in groundwater appears to be site related. It is the opinion of GSU that the extent of cyanide in groundwater beneath the plating shop has not been delineated. **Please include a discussion of cyanide in groundwater in Section 7. GSU requests that the extent of elevated cyanide in groundwater is included as a data gap.**

34. Section 7.5.1.1 – Metals in OU-2C Groundwater. It is the opinion of GSU that the distribution of arsenic and manganese in groundwater indicates that elevated levels of these metals are site-related. **GSU requests that the source of elevated arsenic and manganese in groundwater is identified, and that the extent of elevated metals in groundwater is included as a data gap. In addition, GSU requests that the distribution of other site-related metals is**

presented and discussed, in particular, thallium, cadmium and hexavalent chromium. Thallium and cadmium were found to be soil contaminants at Site 5 and have been reported above background levels in the basewide groundwater monitoring reports for Site 5. GSU requests that data gaps are evaluated regarding the source and distribution of all site-related metals found at levels above background in OU-wide groundwater.

35. Section 7.5.1.2 – Volatile Organic Compound in OU-2C Groundwater. It is the opinion of GSU that data gaps exist with respect to the lateral and vertical extent of VOCs in groundwater at OU-2C. GSU cannot concur with interpretations regarding the lateral and vertical extent of contamination without additional analysis of the data. **GSU requests that depth-discrete isoconcentration contour maps of the VOC data are prepared to assist with the determination of lateral and vertical extent. Maps similar to those presented at the BCT meeting on August 16, 2005 should be used. However, GSU would prefer to see chemical specific maps rather than total VOCs along with the actual values that were used for contouring. In addition, GSU requests that groundwater analytical data are included on cross-sections and presented in Section 7.**

36. Section 7.5.1.2 – Volatile Organic Compound in OU-2C Groundwater, 1,1,1-Trichloroethane in Groundwater. The first paragraph on page 7-13 reports conflicting information regarding the maximum concentration of 1,1,1-TCA in groundwater. **Please clarify.**

    Also, it is unclear why it was not determined whether the maximum concentration of 1,1,1-TCA was found in the FWBZ or the Bay Sediment Unit (BSU). A great deal of lithologic data has been obtained from this area and should be evaluated to determine the hydrostratigraphic unit in which DNAPL may reside. **GSU requests that lithologic data is used in combination with chemical data to determine how lithology affects the chemical concentration profile in the vicinity of the former plating shop and the area east of Building 5. This information may be useful in determining what hydrostratigraphic units may contain DNAPLs beneath Building 5, and the depth of DNAPL migration. GSU requests that a cross-section is prepared which is aligned west to east through the former plating shop area and the area east of Building 5 where DNAPL was confirmed (see Specific Comment 3), and that chemical concentration data are included on the cross-section (see Specific Comment 35).**

37. Section 7.9.1 – Nature and Extent Conclusions. It is the opinion of GSU that the lateral and vertical extent of certain metals and VOCs in groundwater has not been delineated (see Specific Comments 33, 34, and 35). **GSU requests that Section 7.9.1 includes information regarding these data gaps. In addition**

GSU requests that the possible presence of 1,4-dioxane is included as a data gap for groundwater at Site 5.

38. Section 7.10 – Recommendations. **Please include further investigation of metals and 1,4-dioxane in groundwater as recommendations in this section.**

39. Appendix A - General Comment. GSU does not find references to Tables A-12 and A-13 to be useful in the context of describing groundwater contamination at each of the individual OU-2C sites because all of the data from OU-2C are combined on these tables. **GSU requests that the groundwater data are separated by site to facilitate this discussion.**

40. Appendix A - General Comment. **GSU requests that the number of soil samples collected from each soil boring, and depths of soil and groundwater samples are added to the discussions in Appendix A. Without this information, GSU cannot evaluate the adequacy of the site characterization.**

41. Appendix A - General Comment. GSU noted several errors with respect to table and figure references in Appendix A. GSU finds these errors to be very distracting. The prevalence of errors makes difficult to review the appendix. Please check to make sure that all figure and table references are correct and that they actually demonstrate the points that are being discussed. **GSU requests that a thorough QA/QC of figure and table references is performed prior to the submittal of future documents. Please ensure that not only are the references correct but that they demonstrate the points that are being discussed.**

42. Section A.2.1.1 – Site 5. It is stated that a total of 58 soil samples were collected during the 1991 Phase 2B and 3 Investigation. However, Table A-1 which presents the statistical summary of soil analyses indicates that 79 samples were analyzed. **Please clarify.**

43. Section A.2.1.1 – Site 5. It is stated that groundwater samples collected from wells M05-01 through M05-5 were analyzed for metals and cyanide, but the results for metals and cyanide are not discussed. **Please include a discussion of the results for metals and cyanide in groundwater samples collected from these wells during the Phase 2B and 3 Investigation.**

44. Section A.2.1.1 – Site 5. It is stated that the suite of SVOCs is typical of solvents used in paint stripping and metal parts cleaning and references Table A-13. GSU questions whether this statement is intended to describe VOCs not SVOCs. Also, the correct table reference is Table A-12 not Table A-13. **Please clarify.**

45. Section A2.2 – Additional Work at Sites 4 and 5, 1992. GSU questions why Site 4 is listed in this section. Do the analytical results presented in this section include data from Site 4 as well as Site 5? **Please clarify.**

46. Section A.2.2.1 – Plating Shop. The references to Tables A-1 and A-2 in this section are incorrect. **Please correct the table references.**

47. Section A2.2.1 – Plating Shop. It is stated that 12 discrete wipe samples were collected from the plating shop and analyzed for metals, hexavalent chromium, and cyanide, and references Table 4-2 (should be Table 4-1) of the RI report. Table 4-1 of the RI report presents the results only for soil samples. Are soil samples and wipe samples reported together in this table? Section 4 of the RI report does not discuss the results of wipe samples. **Please clarify. Also, please include a discussion of the results of the wipe samples in Section 4.**

48. Section A2.2.1 – Plating Shop. It is stated that cyanide was detected in soil samples collected beneath the plating shop. However, statistical summary tables in Appendix A and Section 4 of the RI indicate that cyanide was not detected in soil samples collected from Site 5. The numbers of samples collected and analyzed for cyanide are not consistent between Appendix A and Section 4. GSU questions whether this inconsistency is due to the inclusion of wipe samples in the statistical summary table in Section 4. **Please clarify.**

49. Section A2.5 – Geochemical Profiling to Define Chlorinated Solvent Plumes, 1997 and 1998. GSU questions the determination of the northeastward migration of solvent plumes since the groundwater flow direction at OU-2C is predominantly northwest. GSU also questions the statement that the "assorted solvents appear to be 'ponded' on top of the Bay sediments, with minimal downward migration." How was it determined that the solvents were "ponded," and what is the basis for the determination of limited downward migration? It is stated that the depth of the geochemical profiling investigation was 20 feet bgs. Other investigations revealed that DNAPL may be present to depths of at least 26 to 48 feet bgs beneath and near Building 5, and elevated levels of VOCs have been found as deep as 60 feet bgs. There is an apparent contradiction between the findings of this investigation and other investigations performed at Site 5. **Please clarify.**

50. Section A2.8 – Supplemental Remedial Investigation Data Gaps Sampling, 2001. The first paragraph on page A-15 discusses soil gas sampling performed at Site 5 to support the vapor intrusion modeling for the Site 5 risk assessment. This section references Tables 5-4 and 5-5 of the RI report. However, these tables do not support the discussion presented in this section. The reviewer could not find a discussion of the analytical results of soil gas sampling or the raw analytical data in the RI report. **Please include a discussion of soil gas sampling in Section 5 of the RI report. Include depths and locations of soil gas**

samples. Also, GSU requests that the analytical data for soil gas are included in an appendix.

Finally, based on information contained in Appendix F, it appears that soil gas data were not used for the vapor intrusion modeling. **Please clarify.**

51. Section A2.8 – Supplemental Remedial Investigation Data Gaps Sampling, 2001. It is stated that elevated metals concentrations have not been detected in groundwater at the plating shop; therefore no further action is required for groundwater. This statement refers to Table A-8. However, Table A-8 does not support this statement. Also, cyanide was detected in groundwater at elevated levels but was not discussed in Section 7 of the RI report nor was the data for cyanide included on Table 7-1. Table 7-1, however, does indicate hexavalent chromium concentrations up to 9,400 μg/L and cadmium concentrations up to 983 μg/L. Based on this information, GSU cannot concur with the recommendation of no further action for metals in groundwater. **GSU requests clarification of the determination that elevated metals have not been detected in groundwater at the plating shop. GSU also requests that a discussion of cyanide is included in Section 7 along with a summary of the analytical results.**

52. Section A2.9 – Chlorinated Solvent Plume Definition and Nonaqueous-Phase Liquid Treatability Studies. It is stated that a DNAPL volume was estimated from soil core samples collected throughout the study area and Figure 4-4, Figure 7-2 and Appendix C are referenced. These figures and Appendix C do not provide an estimate of DNAPL volume. **Please provide the DNAPL volume estimate and how it was derived in the RI report.**

53. Section A2.9 – Chlorinated Solvent Plume Definition and Nonaqueous-Phase Liquid Treatability Studies. **GSU requests additional information regarding the six-phase heating removal action being performed at Site 5. Specifically, how was the lateral and vertical extent of DNAPL determined? How was the extent of "mobile" DNAPL determined? Why was a maximum depth of 20 feet bgs chosen when dissolved concentrations of 1,1,1-TCA and TCE in groundwater indicate that DNAPL may be present at depths of up to at least 26 to 48 feet bgs? How was the system designed to preclude lateral (outward) and downward movement of contaminants? Also, GSU requests that the target areas and depths for DNAPL removal are illustrated on a figure in the RI report.**

54. Appendix H – General Comment. GSU does not agree with the no further action recommendations for many of the SWMUs in OU-2C without additional information (see Attachment 1). It is unclear why maps of analytical data were only included for 9 of the 66 SWMUs recommended for the CERCLA program at OU-2C. **GSU requests that available soil and/or groundwater analytical**

data is summarized for all 66 SWMUs at OU-2C. Maps similar to those presented in Appendix H should be prepared for each SWMU in OU-2C. If appropriate sampling has not been performed near a SWMU, GSU may require sampling depending on the location and condition of the SWMU. In addition to maps of analytical data, GSU may request a site visit to determine what type of sampling is needed. GSU also questions the recommendation of waste oil tank UST(R)-01 in the TPH program and requests that the Navy provide the closure information for this tank. For the remainder of the tanks in the TPH program, GSU requests that the Navy contact RWQCB for the closure determination.

If you have any questions, please feel free to contact me at (510) 540-3926 or at mdalrymp@dtsc.ca.gov.

ATTACHMENT 1

OU-2C - SOLID WASTE MANAGEMENT UNIT SUMMARY

SWMU Identifier	Location	Description	Navy Recommendation	DTSC Recommendation
AOC 005	East of Bldg. 5	UST 5-2 (JP-5) and UST 5-3 (waste oil & solvents)	Further Action	Concur
AOC 261	South of Bldg. 261	UST 261-1, 2, and 3 (kerosene & stoddard solvent)	Further Action	Concur
AST 005A	East of Bldg. 5	Water and glycol (8K)	NFA	Disagree – pending groundwater sampling for ethylene glycol
AST 005B	East of Bldg. 5	Water and glycol (8K)	NFA	Disagree – pending groundwater sampling for ethylene glycol
AST 005C	East of Bldg. 5	Water and glycol (8K)	NFA	Disagree – pending groundwater sampling for ethylene glycol
AST 005D	East of Bldg. 5	Liquid argon (5K)	NFA	Concur (If always used for liquid argon)
AST 005E	West of Bldg. 5	Liquid nitrogen (2K), installed 1973	NFA	Concur (If always used for liquid nitrogen)
AST 005F	West of Bldg. 5	Liquid nitrogen (capacity unknown)	NFA	Concur (If always used for liquid nitrogen)
AST 005G	East of Bldg. 5	Waste oil (40 gal)	Further Action	Concur
AST 005H	Building 5	1010 oil (1.3K)	NFA	Concur
AST 032	Building 32, 2nd floor	Propane	NFA	Concur (2nd floor)
AST 261	South of Bldg. 261	Liquid argon	NFA	Concur (If always used for liquid argon. Also, near further action AOC 261)
AST 500	NE of Bldg. 500	Propane	NFA	concur
M-01	Building 5	50 gal solvent distillation unit	NFA	Disagree - pending additional information
M-02	Building 5	50 gal solvent distillation unit	NFA	Disagree - pending additional information

ATTACHMENT 1

OU-2C - SOLID WASTE MANAGEMENT UNIT SUMMARY

M-03	Building 5	Portable 15 gal solvent distillation unit	NFA	Disagree - pending additional information
M-04	Building 5	Portable 15 gal solvent distillation unit	NFA	Disagree - pending additional information
M-05	Building 5	Portable 15 gal solvent distillation unit	NFA	Disagree - pending additional information
M-09	Building 5	Coolant Recovery System (4-500 gal tanks)	NFA	Disagree - pending additional information
NADEP GAP 02	Building 5	Poly paint, thinner, naptha	NFA	Disagree - pending additional information
NADEP GAP 03	Building 5	MEK, Freon, oil	NFA	Disagree - pending additional information
NADEP GAP 04	Building 5	Battery acid, nickel-cadmium solution	NFA	Disagree - pending additional information
NADEP GAP 05	Building 5	Poly paint, thinner, aerosol paint	NFA	Disagree - pending additional information
NADEP GAP 08	Building 5	Hydraulic fluid, JP-5, engine oil	NFA	Disagree - pending additional information
NADEP GAP 10	Building 5	Oil, MEK, PD-680	NFA	Disagree - pending additional information
NADEP GAP 11	North of Bldg. 405	Various oils, Freon, JP-5, paint	NFA	Disagree – pending additional information
NADEP GAP 12	Building 5	Paint, thinner, MEK	NFA	Disagree - pending additional information
NADEP GAP 13	Building 5	Primer, thinner, acetone (55-gal drums)	NFA	Disagree - pending additional information
NADEP GAP 14	Building 5	Hydraulic fluid, JP-5, stripper, oil, fuel (55-gal drums)	NFA	Disagree - pending additional information
NADEP GAP 16	Building 5	Hydraulic oil, batteries, contaminated wash water	NFA	Disagree - pending additional information
NADEP GAP 17	Building 5	Coolant with nickel, chromium, cadmium, Al oxide, Si carbide (55-	NFA	Disagree - pending additional information

ATTACHMENT 1

OU-2C - SOLID WASTE MANAGEMENT UNIT SUMMARY

		and 30-gal drums)		
NADEP GAP 18	Building 5	Coolant, heavy metal grindings (55- and 30-gal drums)	NFA	Disagree - pending additional information
NADEP GAP 20	NW of Bldg. 500	Lead-contaminated items	NFA	Disagree – Soil and groundwater sampling for metals is required
NADEP GAP 21	Building 5	Lead dust	NFA	Disagree - pending additional information
NADEP GAP 22	Building 5	Asbestos (55-gal drums)	NFA	Concur
NADEP GAP 23	Building 5	Ethyl acetate (55-gal drums)	NFA	Disagree - pending additional information
NADEP GAP 24	Building 5	Blasting grit (large bags)	NFA	Concur
NADEP GAP 25	Building 5	Ethyl acetate, aluminum oxide, blasting grit, 55-gal drums of unknown waste	NFA	Disagree - pending additional information
NADEP GAP 26	Building 5	Blasting grit (large bags)	NFA	Concur
NADEP GAP 27	West of Bldg. 5	Hydraulic oil (55-gal drums)	NFA	Disagree – Soil and groundwater sampling is required
NADEP GAP 27A	Building 5	Blasting grit (large bags)	NFA	Concur
NADEP GAP 29	Building 5, 2nd floor	Aerosol paints	NFA	Concur (2nd floor)
NADEP GAP 30	Building 5, 2nd floor	Hydraulic oil and Freon 113	NFA	Concur (2nd floor)
NADEP GAP 31	Building 5	Various oils, solvents, paint (55- and 30-gal drums)	NFA	Disagree - pending additional information
NADEP GAP 57	Building 5	Plating and cadmium solutions	NFA	Disagree - pending additional information
NADEP GAP 70	Building 5	Cyanide, chromic acid plating solutions, sulfuric acid, nickel chloride	NFA	Disagree - pending additional information

ATTACHMENT 1

OU-2C - SOLID WASTE MANAGEMENT UNIT SUMMARY

NAS GAP 01	South of Bldg. 6	Oily liquids	NFA	Disagree – Soil and groundwater sampling is required
NAS GAP 05	Building 2	Perchloroethene and used dry cleaner filter elements	NFA	Disagree – Soil and groundwater sampling is required
OWS 005	South of Bldg. 5	Unfiltered waste	NFA	Disagree – Soil and groundwater sampling is required
OWS 006A	South of Building 6	Residue from steam cleaning bay	Further Action	Concur
OWS 006B	NW of Bldg. 6	Unspecified	Further Action	Concur
OWS 615	West of Bldg. 615	Runoff from RCRA hazardous waste storage unit	NFA	Disagree – Soil and groundwater sampling is required
SWMU 005	Building 5	VV-L-800, rust remover, PD-680, Freon, and alkaline solvent	NFA	Disagree - pending additional information
SWMU 614	Building 614	Acids, bases, adhesives, paint	NFA	Disagree - pending additional information
SWMU 615	Building 615	Acids, bases, adhesives, paint	NFA	Disagree - pending additional information
UST(R)-02	Building 6	Texaco petroleum solvents	Further Action	Concur
UST(R)-19	South of Bldg. 615	Waste oil/waste diesel tank (UST 615-4 80-gal) and spill control tanks for sprinklers (UST 615-1, 2)	NFA	Disagree – Soil and groundwater sampling is required for UST 615-4
M-08	Building 400	Portable 15-gal solvent distillation unit	NFA	Disagree - pending additional information
NADEP GAP 36	Building 400	Aerosol paint, mixed solvents	NFA	Disagree - pending additional information
NADEP GAP 37	Building 400	Aerosol paint, hydraulic and lube oils, 1,1,1-TCA	NFA	Disagree - pending additional information

ATTACHMENT 1

OU-2C - SOLID WASTE MANAGEMENT UNIT SUMMARY

		and Freon		
NADEP GAP 38	Building 400	Primer, paints, thinner, alcohol, and MEK	NFA	Disagree - pending additional information
NADEP GAP 39	Building 400, 2nd floor	Paints, lacquer, Freon, stripper sludge, zinc chromate primer, oils, PD-680, naphtha, thinners	NFA	Concur (2nd floor)
NADEP GAP 42	Building 400, 3rd floor	Batteries, beryllium, paint, oils, PCBs, mercury, oil solvents, Freon, radioactive waste	NFA	Concur (3rd floor)
AST 010L	North of Bldg. 10	Brine solution (8.8K)	NFA	Concur
NAS GAP 02	South of Bldg. 10	Waste oil (55-gal drums)	NFA	Disagree – Soil and groundwater sampling is required
OWS 010	Building 10	Unspecified	Further Action	Concur

COMMENTS FROM DTSC-HERD ON DRAFT REMEDIAL INVESTIGATION REPORT FOR OU-2C BY SULTECH

Alan C. Lloyd, Ph.D.
Agency Secretary
Cal/EPA

Department of Toxic Substances Control

1011 North Grandview Avenue
Glendale, California 91201

Arnold Schwarzenegger
Governor

MEMORANDUM

TO: Marcia Liao, DTSC Project Manager
OMF Berkeley Office
700 Heinz Street, Second Floor
Berkeley, CA 94704

FROM: James M. Polisini, Ph.D.
Staff Toxicologist, HERD
1011 North Grandview Avenue
Glendale, CA 91201

DATE: August 25, 2005

SUBJECT: DRAFT REMEDIAL INVESTIGATION REPORT, OPERABLE UNIT 2C, SITES 5, 10, AND 12, NAVAL AIR STATION ALAMEDA (ALAMEDA POINT)
[SITE 201209-18 PCA 18040 H:35]

BACKGROUND

HERD reviewed the document titled *Draft Remedial Investigation Report for Operable Unit 2C, Sites 5, 10, and 12, Alameda Point, Alameda, California,* dated July 1, 2005. This document was prepared by SulTech, A Joint Venture of Sullivan consulting Group and Tetra Tech EM Inc. of San Diego, California. This review is in response to your review schedule for July, 2005 and August, 2005 forwarded by Groupwise on July 28, 2005.

Site 5, approximately 47 acres in size, is located in the central portion of Naval Air Station Alameda (NASA) north of the Seaplane Lagoon. Building 5, the largest building of 23 buildings on Site 5, was used for aircraft cleaning, reworking and manufacturing metal pars, plating activities, painting operations and radioluminescent painting of aircraft dials. Site 10 is south of West Tower Avenue, between Buildings 11 and 12, approximately 750 feet north of Seaplane Lagoon. Site 10 contains Building 400, the Missile Rework Facility, and one former Underground Storage Tank (UST) and associated fuel lines, storm water lines, and industrial waste water lines. Site 12 contains Building 10, the Power Plant Facility, and surrounding area. Activities at Site 12 included generation of steam and compressed air. Little documentation exists on

past uses of Building 10. Site 12 also includes 6 USTs and associated fuel lines, 11 Above Ground Storage Tanks (ASTs), 9 transformers, storm water and industrial waste water lines and an oil-water separator. The most probable future use for Sites 5, 10 and 12 include commercial or light industrial activities (Section 2.1.2, page 2-4).

NASA was an active naval facility from 1940 to 1997. Base operations included aircraft, engine, gun and avionics maintenance; fueling activities; and metal plating, stripping and painting.

GENERAL COMMENTS

HERD does not accept the 95th percentile limit on a 10 μg/dl blood lead concentration as protective of the child receptor. The 99th percentile limit on 10 μg/dl blood lead should be used for residential soil or the residential soil lead concentration compared to an acceptable 150 mg/kg soil lead for children in the event groundwater is not considered a source of drinking water by the SFRWQCB and the Leadspread calculation is not performed.

California Human Health Risk Assessment (HHRA) parameters must be used where the California values are more health protective. Revisions of the HHRA, to include California risk assessment parameters, should be resolved in the RI process.

SPECIFIC COMMENTS

1. The double-crested cormorant is a California Species of Special Concern (http://www.dfg.ca.gov/hcpb/cgi-bin/read_one.asp?specy=birds&idNum=15). Even though the listing of Special-Status Species (Table 2-1) refers to rookeries, the Status should be changed from 'Not Listed' to 'C' which the footnotes indicate as a 'State Species of Concern'.

2. It is stated that OU 2 C Sites recommended solely for RCRA or TPH further action will leave the CERCLA Program (Section 3.2.5, page 3-7). Please clearly identify any OU 2C sites fitting these criteria in the recommendations.

3. Soil concentrations for Site 5, 10 and 12 are compared to the 'pink area' background data set (Section 3.3.2, page 3-9) to determine whether site soil concentrations are in excess of unimpacted soil 'background'. As a point of record, HERD never agreed with the values developed for 'ambient' concentrations at NAS Alameda, whether represented as the pink, blue or yellow background data set. (Appendix D). For example, HERD does not agree that 'pink area' background concentrations of antimony can range to 8.6 mg/kg, chromium background maximum can range to 66.7 mg/kg, silver background maximum can range to 5.64 mg/kg, nor a non-detected limit of 10 mg/kg selenium is adequate to define a reasonable background selenium concentration (Appendix D, Table D-4, page 1 of 2). Please forward the

'pink area' data set in electronic format for HERD review. Lacking access to an electronic copy of the proposed 'pink area' background data set, it can only be stated that risk and or hazard estimates in the OU 2C Site 5, 10 and 12 Human Health Risk Assessment (HHRA) should actually be higher, by some unknown amount.

4. The U.S. EPA Region 9 Preliminary Remediation Goals (PRGs) for soil and tap water do not include ingestion of homegrown produce or inhalation of indoor or outdoor volatile compounds as an exposure pathway (Section 3.4.1, page 3-10). Evaluation of all potential exposure pathways for a residential use scenario will require separate calculation of the homegrown produce intake and risk or hazard associated with ingestion of homegrown produce (Section 3.6.3.3, page 3-16, first bulleted scenario) and inhalation risk and/or hazard to provide a summed total intake and risk or hazard estimate for the residential use scenario.

5. The most conservative (i.e., health protective) Toxicity Equivalency Factor (TEF) for polycyclic aromatic hydrocarbons (PAHs), whether listed as 'Cal modified' in the PRG table or as released by the CalEPA Office of Environmental Health Hazard Assessment (OEHHA) should be used in evaluating incremental cancer risk for PAHs. The CalEPA approved TEFs for polycyclic aromatic hydrocarbons (PAHS) are:

Polycylic Aromatic Hydrocarbon	CalEPA TEF	TEF Listed
Benz(a)pyrene	1.0	1.0
Benzo(a)anthracene	0.1	0.1
Benzo(b)fluoranthene	0.1	0.1
Benzo(k)fluoranthene	0.1	0.01
Dibenz(a,h)anthracene	0.34	1.0
Indeno(1,2,3-c,d)perylene`	0.1	0.1
Chrysene	0.01	0.001

The difference from CalEPA TEFs for dibenz(a,h)anthracene is health protective and therefore complies with the TEF requirement. However, the CalEPA TEF for benzo(k)fluoranthene and chrysene is ten times higher, and therefore more protective, than the TEF listed for the HHRA (Section 3.4.1, page 3-11). Please use the more protective CalEPA TEFs in the Draft Final RI Report for these two PAHs.

6. In addition to the PAH issues outlined above, naphthalene was originally designated a carcinogen via the inhalation route by the CalEPA OEHHA with a cancer slope factor of 1.2×10^{-01} $(mg/kg\text{-}day)^{-1}$ (http://www.oehha.ca.gov/air/hot_spots/naphth.html), and is now considered by OEHHA as carcinogenic via the oral exposure route (**http://www.oehha.ca.gov/risk/ChemicalDB/cancerpotency.asp?name=Naphthalene&number=91203**) . Naphthalene is included as a carcinogen via inhalation in the HHRA current calculations (Appendix F, Table F-6.1, page 4 of 5), but naphthalene should be

assessed as a carcinogen by both inhalation and oral exposure routes and described as such in the text of this section.

7. The results of sampling for PAHs prior to the 2003 sampling event (Section 3.6.1, page 3-14) need not be completely discarded simply because there were elevated detection limits for PAHs in earlier investigations. PAH concentrations listed as detected remain verified detected concentrations even if a majority of the samples are reported as non-detected with elevated detection limits due to analytical interferences. Please present a data summary, similar to that presented for PAH results from the 2003 sampling, which indicates the number of samples listed as detected and the PAH concentration of those samples in support of excluding all PAH data prior to the 2003 sampling results.

8. The San Francisco Regional Water Quality Control Board (SFRWQCB) should be contacted to ascertain the currently defined beneficial use of the groundwater at Operable Unit (OU) 2C, Sites 5, 10 and 12 in addition to consideration of groundwater use based on U.S. EPA criteria (Section 3.6.3.2, page 3-16). Please include the SFRWQCB designation of groundwater in this area of NASA in this section of the text and include that designation in evaluation of the groundwater exposure pathways.

9. The sources of toxicity criteria (Section 3.6.4, page 3-18) are acceptable. However, toxicity values released by the Office of Environmental Health Hazard Assessment (OEHHA), whether for carcinogenic or non-carcinogenic Contaminants of Potential Concern (COPCs), should be used in the risk characterization step where the OEHHA values are more protective than those available from other sources. Although the data base contains a few errors, most current OEHHA toxicity values for carcinogens or non-carcinogens can be found at http://www.oehha.ca.gov/risk/ChemicalDB/index.asp. Please contact HERD for reconciliation of any apparent contradictions or errors. I can be reached at jpolisin@dtsc.ca.gov.

10. HERD does not accept the proposed 95th percentile limit on a 10 μg/dl blood lead concentration as protective of the child receptor (Section 3.6.5.3, page 3-20). The 99th percentile limit on 10 μg/dl blood lead should be used for residential soil or the residential soil lead concentration compared to an acceptable 150 mg/kg soil lead for children in the event groundwater is not considered a source of drinking water by the SFRWQCB and the Leadspread calculation is not performed.

11. Please state explicitly the exposure scenario in which sediments from storm drains contribute to exposure (Section 3.6.6.3, page 3-22).

12. The outline for data selection (Figure 3-2) indicates only soil from zero (0) to 2 feet below ground surface (bgs) for the HHRA, and does not include the soil data from 0

to 10 feet below ground surface (bgs) or to groundwater whichever is encountered first. At OU 2C Sites 5, 10, and 12 groundwater is expected to be encountered at eight feet bgs. Please include these soil samples from depths greater than 2 feet bgs in the figure.

13. Please present the chromium speciation data for chromium in OU 2C soil which indicates that evaluation of chromium in soil using the PRG based on a 1:6 ratio of hexavalent to trivalent chromium is protective (Section 4.2.4, page 4-13).

14. The units listed for Site 5 soil Volatile Organic Compound (VOC), Semivolatile Organic Compound (SVOC) and polychlorinated biphenyl (PCB) data as micrograms per kilogram (Section 4.2.4, page 4-13) appear to be in error for both the detected concentration and the soil screening criteria (i.e., U.S. EPA Region 9 residential use soil PRGs). A subset of the screening criteria were checked and found to be arithmetically correct if considered as mg/kg rather than μg/kg. Please correct the table.

15. Footnote number 2 in the Conceptual Site Model (CSM) for Site 10 (Figure 5-3) mistakenly refers to Wind Erosion/Resuspension of Air Particles in the Secondary Release Mechanism column in addition to a correct reference to groundwater in the Pathway column. Please correct this error.

16. While not a strictly risk-based evaluation, HERD would agree that sampling locations which exceed 'floating product screening criteria' (Section 5.2.4, page 5-8) should be candidates for further action as recommended at Site 10 (Section 5.3, page 5-13) north of Building 400. This comment is intended for the DTSC Project Manager and no response is required from the Navy or Navy contractors.

17. Please provide some rationale in the text for the proposal to close in place ten Above Ground Storage Tanks (ASTs) (Section 6.1, page 6-2), formerly used for storage of fuel oils and diesel. The text now states that the use of fuel oil was discontinued in the early 1970s and replaced with natural gas with diesel fuel as a backup (Section 6.1, page 6-1).

18. The storm drain lines from Site 12 to the Seaplane Lagoon through outfall F (Section 6.1, page 6-2) were not cleaned during the 1991 or 1997 storm water line cleanup program. Seaplane Lagoon sediments in the northwestern and northeastern corners are currently in the Feasibility Study (FS) phase, while other sediment locations in the Seaplane Lagoon (e.g., deposited material along the middle of the northern boundary). The Site 12 storm water lines must be inspected and cleaned if necessary prior to remediation of the Seaplane Lagoon sediments.

19. Railroad tracks are listed as a possible source of contamination at Site 12 (Section 6.2.1, page 6-3). The preceding text makes no indication of any railroad tracks

although they are indicted on one figure (Figure 6-1). Please indicate the rail connection for the tracks at Site 12, past rail deliveries to Site 12, current physical condition of the rail tracks and projected future use of the rail tracks in the Site 12 history. Also please indicate the rationale for railroad tracks being listed as a potential source of lead, but no other inorganic elements.

20. The categories of chemicals listed as used or stored in Building 10 (Section 6.2.1, page 6-4) provide on information useful to a Human Health Risk Assessment (HHRA). Plant treatment chemicals could include hundreds of chemicals depending on the treatment being performed and hexavalent chromium and tributyl tin were commonly used as biocides in industrial piping to reduce or eliminate biological growth in piping. Please include the specific chemicals 'historically used or stored' associated with each of the listed categories.

21. Carrying a chemical, which was detected in a single sample, forward in the HHRA (Section 6.2.2, page 6-5) is protective. However, there must be some grammatical error in the following sentence stated as:

    "The chemicals detected only once or a few times, but with a high percentage of their detection limits exceeding the PRGs, conservatively estimate the risk of that particular chemical."

    A chemical concentration based on a chemical which is detected once but all other samples are reported as non-detect for that chemical with detection limits exceeding (i.e., higher than) the Preliminary Remediation Goal (i.e., posing a non-cancer hazard or representing a $1x10^{-6}$ cancer risk) is not protective. This hypothetical chemical could, possibly, be present at concentrations above the PRG in all the samples reported as non-detect. The process would be health protective in cases where a chemical is carried forward based on a single detected concentration while all non-detected results were at concentrations less than the PRG concentration. Please correct the text and reference the table listing the minimum and maximum reporting limits (Table 6-1) which also presents the U.S. EPA Region 9 residential PRG.

22. Site 12 is the location of a former power plant which used biocides (Section 6.2.1, page 6-4). Hexavalent chromium is a commonly-used biocide. The results of chromium speciation tests must be presented in support of using the U.S. EPA residential PRG of 211 mg/kg which is based on a 1:6 ratio of hexavalent chromium to trivalent chromium. Lacking the results of such testing the U.S. EPA Region 9 hexavalent chromium residential PRG of 30 mg/kg should be used for Site 12, especially as the hexavalent chromium tap water PRG is used for groundwater to screen for human health impacts (Section 7.5.1, page 7-8).

23. Please explain why the incremental cancer risk and noncancer hazard for Site 10 is presented for Site 12 (Table 6-3, page 1 of 1) or correct the column heading.

24. Please identify or provide a listing of the elements or compounds detected in groundwater which are not consistent with the historical activities at Sites 5, 10 and 12 as most of the chemicals detected in groundwater are consistent with historical activities (Section 7.1, page 7-1).

25. A subset of the U.S. EPA Region 9 tap water PRGs were checked (Section 7.5.1, page 7-8) and found to be arithmetically correct. This comment is meant for the DTSC Project Manager and no response is required from the Navy or Navy contactors.

26. Please include the number of groundwater samples analyzed when concluding that inorganic elements are not risk drivers because there were fewer than ten detected concentrations reported exceeding the screening criteria (Section 7.9.1 , page 7-25). This information is available elsewhere (Section 7.5.1, page 7-8), but should be referenced in the conclusions.

27. There appears to be a disconnect between the text for the Screening Level Ecological Risk Assessment (SLERA) (Section 7.8, page 7-23) and the associated table (Table 7-1). A list of groundwater twenty one chemicals exceeding the concentrations contained in the California Toxics Rule or the National Recommended Water Quality Criteria is provided (Section 7.8, page 7-24). However, the only table presenting water criteria which might be associated with either the California Toxics Rule or the National Ambient Water Quality Criteria (NAWQC) contains a heading (Table 7-1) of 'AWQC Saltwater Concentration' where the majority of entries are 'NA'. For example, copper is listed in the text as exceeding criteria, NA is indicated for both filtered and unfiltered copper (Table 7-1) while the California Toxics Rule saltwater Criterion Continuous Concentration (CCC) for copper is 3.1 μg/l and the AWQC CCC for marine water is 1.9 μg/l (http://www.epa.gov/waterscience/criteria/copper/draftupdatefs.htm). Please provide a reference in the text to the correct presentation of the aquatic criteria and correct the table (Table 7-1).

28. Please provide a table analogous to the HHRA summary (Table 8-1) summarizing the exceedance of aquatic criteria by the measured groundwater concentrations.

Appendix F – Baseline Human Health Risk Assessment

29. HERD defers to the U.S. EPA regarding the completeness and accuracy of the U.S. EPA Risk Assessment Guidance for Superfund (RAGS) part D tables (Appendix F).

30. Groundwater is not considered a potential drinking water source in this HHRA (Appendix F, Section F5.1.1, and page F-9). The conclusions of this HHRA would need to be reevaluated in the event the SFRWQCB does not rule out residential use as one beneficial use of the groundwater at OU 2C. This comment is meant for the DTSC Project Manager and no response is required from the Navy or Navy contractors.

31. There would seem no logical reason for concluding that inhalation of VOCs in outdoor air is not a complete exposure pathway for the residential use scenario (Appendix F, Figure F5-1). This pathway should be included in the residential use scenario or, if the intent is to substitute the indoor air concentration for all inhalation exposure, that intention must be explicitly stated and indicated in the figure.

32. The construction worker scenario assumes that there will be no dermal contact with groundwater (Appendix F, Section F5.2.3, page F-13) because the groundwater depth is greater than 5 feet below ground surface (bgs). The physical plan for OU 2C utilities should be checked to verify that no utility lines are located at depths deeper than the 6 feet to 8 feet bgs specified as the depth to groundwater (Appendix F, Section F4.2, page F-7) in support of excluding dermal exposure to groundwater for the construction worker scenario.

33. A subset of the Reasonable Maximum Exposure (RME) exposure parameters (Appendix F, Table F-4.1) were checked and found to generally agree with HERD HHRA guidelines. However, the indoor air concentration (CA) (e.g., Table F-4.1, page 5 of 5) should be estimated using the Johnson and Ettinger model as modified by HERD. This version of the Johnson and Ettinger model is available at http://10.39.0.144/AssessingRisk/#Human_Risk_Assessment.

34. HERD could not locate a listing of the Dermal Absorption Factors (DAFs) applied to the calculation of intake via the dermal route. HERD guidance for DAFs is contained in the Preliminary Endangerment Assessment (PEA) Manual (DTSC, 1999) appendix of these values (http://www.dtsc.ca.gov/SiteCleanup/SMP_REP_PEA_appendix.pdf). The DAFs contained in the PEA Manual should be used where more protective than U.S. EPA DAFs:

TABLE 2: SCREENING LEVEL DERMAL ABSORPTION FRACTIONS (ABS) FROM SOIL

Compound Class	Absorption Fraction[1]	References
Chlorinated Insecticides	0.05	Wester, et al., 1990a; Wester, et al., 1992a
Polynuclear Aromatic Hydrocarbons	0.15	Wester, et al., 1990a
Organophosphates	0.25	Cal/EPA Office of Environmental Health Hazard
		Assessment
Pentachlorophenol	0.25	Wester, et al., 1993b
Polychlorinated Dibenzo-p-dioxins and	0.03	USEPA, 1992
Dibenzofurans		
Polychlorinated Biphenyls (PCB)	0.15	Wester, et al., 1993c
Other Organic Chemicals	0.10	SCAQMD, 1988
Cadmium	0.001	Wester, et al., 1992b
Arsenic	0.03	Wester, et al., 1993a
Hexavalent Chromium	0%	Not shown to be a systemic carcinogen via
		dermal exposure
Other metals and complexed cyanides	0.01	SCAQMD, 1988
Free Cyanide	0.10	SCAQMD, 1988

1. Dermal absorption values from soil are based on, in order of preference: in vivo, animal studies on dermal absorption from soil; in vivo, animal studies on dermal absorption from an applicable cosolvent; in vitro, human skin dermal absorption studies; in vitro, animal skin dermal absorption studies. Actual dermal absorption from soil may vary from these estimates due to exposure conditions or soil chsracteristics which differ from the experimental conditions.

35. A subset of the oral Cancer Slope Factors (CSFs) (Appendix F, Table F-6.1) were compared to the OEHHA CSFs (http://www.oehha.ca.gov/risk/ChemicalDB/). The CSFs presented and used in the HHRA, for the majority of the subset compared, were as protective or more protective than the CSFs recommended by OEHHA. However, the OEHHA CSFs for a portion of those compared (i.e., arsenic at 9.45 $(mg/kg\text{-}day)^{-1}$ rather than 1.5 $(mg/kg\text{-}day)^{-1}$; and vinyl chloride at 12 $(mg/kg\text{-}day)^{-1}$ rather than 0.72 $(mg/kg\text{-}day)^{-1}$) were more protective. While the basis for and the differences inherent in the OEHHA and U.S. EPA toxicity values are discussed (Appendix F, Section F8.3.3, pages F-43 through F-47) HERD is required to direct that the OEHHA CSFs be used where those values are more protective.

36. While it is true that use of 'California-recommended toxicity values" would most likely not change the current recommendation that most of OU 2C proceed to Feasibility Study (FS) (Appendix F, Section F8.3.3.3, page F-47), such a HHRA must be prepared at some stage. Merely proceeding to FS, despite the differences in California guidance for a HHRA, ignores the reality that estimates or risk and/or hazard will be used to assess remedial alternatives in the FS. HERD recommends that the HHRA be amended during the Remedial Investigation (RI) process.

CONCLUSIONS

The soil 'background' data set for the IR Site 1 Area 3 fill episode (i.e., the pink data set) must be forwarded for HERD review prior to use of 'background' concentrations in risk assessment.

The soil lead evaluation criterion for the child in a residential use scenario should be 150 mg/kg unless site-specific calculations are performed.

OEHHA Cancer Slope Factors, DTSC Toxicity Equivalency Factors for polycyclic aromatic hydrocarbons, Dermal Absorption Factors and use of a 'pink' fill episode 'background' data set which has not been approved are several examples where DTSC requirements for a HHRA would result in estimates of risk and/or hazard higher than those presented. HERD recommends these HHRA issues be resolved in the RI process.

HERD agrees that the sites and media recommended to proceed to FS should proceed to FS. Revisions of the HHRA, to include California risk assessment parameters, may increase, or leave unchanged, the sites and/or media recommended for FS.

REFERENCES

Department of Toxic Substances Control. 1999. Preliminary Endangerment Assessment Guidance Manual. Sacramento, California.

HERD Internal Review: Michael Wade, Ph.D., DABT
Senior Toxicologist

cc: Sophia Serda, Ph.D.
U.S. EPA Region IX (SFD-8-B)
75 Hawthorne Street
San Francisco, CA 94105

Ned Black, Ph.D., BTAG Member
U.S. EPA Region IX (SFD-8-B)
75 Hawthorne Street
San Francisco, CA 94105

Ms. Beckye Stanton, BTAG Member
California Department of Fish and Game
1700 K Street, Room 250
Sacramento, CA 94244-2090

Charlie Huang, Ph.D., BTAG Member
California Department of Fish and Game
1700 K Street, Room 250
Sacramento, CA 94244-2090

Laurie Sullivan, M.S., BTAG Member
National Oceanic and Atmospheric Administration
c/o U. S. EPA Region 9 (H-1-2)
75 Hawthorne Street
San Francisco, CA 94105-3901

Naomi Feger, BTAG Member
Judy Huang, BTAG Member
San Francisco Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

Voice 818-551-2853
Facsimile 818-551-2841
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Table F-1
OU-2C Data Gaps and Regulatory Agency Concerns[a,b]

Data Gap No.	Issue	Comment[c]	Data Available	Data Gap	Navy Recommendation[d]
EVALUATION AREA 1 – GROUNDWATER-RELATED ISSUES					
1	Tidal study at OU-2C	• impact of tidal influence inadequately explained • flow direction and tidal influence in SWBZ • impact of tidal influence on water level measurements and therefore horizontal flow directions	Tidal influence studies: • PRC 1995 (FWBZ; three wells at IR Site 10) • PRC 1997 (SWBZ; one well at IR Site 10 and one well at IR Site 5) • 2006 tidal influence study under the BGMP	Minimal OU-2C–specific data. Coordinated monitoring of tidal influence in both FWBZ and SWBZ wells; water level measurements conducted at low tide in order to determine flow directions with respect to Seaplane Lagoon.	Collect data (Evaluation Area 1): • Install piezometers and conduct tidal influence study. • Measure water levels in existing wells at low tide (completed in spring 2006 under BGMP) and review and interpret results.
2	Potential discharge of contaminated groundwater to surface water	There is limited nature-and-extent discussion in the draft RI Report (SulTech 2005) for groundwater contaminants that potentially may be discharged to surface water.	Extensive historical water quality data available from existing wells; BGMP ongoing monitoring of limited number of wells.	Potentially inadequate characterization of flow direction; flow in FWBZ appears to be toward the northwest; apparent FWBZ groundwater sink in vicinity of north-south drain corridor at western margin of OU-2C.	Collect data (Evaluation Area 1): • Install additional wells in upper and lower FWBZ at western margin of OU-2C. • Analyze groundwater samples from new wells for VOCs plus full suite of parameters (see Appendix A1 of SAP). • Analyze groundwater samples from existing wells for 1,4-dioxane, hexavalent chromium, and cyanide.
3	Delineation of VOCs	Several chemicals (including but not limited to 1,2-DCA; 1,1-DCA; TCE; and vinyl chloride) have not been delineated.	Extensive historical water quality data from existing wells; BGMP ongoing monitoring of limited number of wells.	No data gap exists.	No supplemental RI sampling.
4	Elevated cyanide in groundwater	The extent of cyanide at elevated concentrations in groundwater is included as a data gap. Evaluation of the source of elevated levels of metals and cyanide in groundwater and delineation of the extent.	37 groundwater samples analyzed for cyanide; cyanide is listed in Table 7-1 of the draft RI Report (SulTech 2005) and maximum concentration is 4,600 µg/L compared to MCL of 150 µg/L. Highest concentration at location north of plating shop, beneath Building 5.	No cyanide distribution map has been prepared. BGMP does not include analysis for cyanide. Analysis for cyanide in monitoring wells has not been conducted since 1995. Some data available from DGS (TtEMI 2002). No monitoring well is located immediately downgradient from the plating shop.	Collect data (Evaluation Area 1): • Install wells in upper and lower FWBZ within Building 5. • Analyze groundwater samples from new wells for cyanide plus full suite of parameters (see Appendix A1 of SAP). • Analyze groundwater samples from existing wells for cyanide.
5	Lateral extent of VOCs in SWBZ; vertical extent	Delineation of the lateral extent of VOCs in the SWBZ and the vertical extent of VOCs in groundwater .	VOCs in FWBZ characterized at two depths (0 to 15 ft bgs and 15 to 35 ft bgs) as part of DGS for OUs 1 and 2 (TtEMI 2002). VOCs plume limited at 15 to 35 ft; however, some concentrations exceed MCLs. VOC data collected from additional, deeper samples from eight SWBZ wells (60 to 70 ft bgs) and more than 20 Hydropunch sampling locations (40 to 70 ft bgs). BGMP FWBZ wells are screened from 0 to 15 ft bgs. BGMP SWBZ wells are screened from 60 to 70 ft bgs. Most recent results for SWBZ are generally ND. Two areas of DNAPL undergoing removal actions will provide confirmation of reduction of VOC concentrations both vertically and horizontally.	Existing SWBZ wells at the periphery of VOC plume and one well (D05-04 beneath Building 5) characterize the horizontal extent of VOCs in the SWBZ and demonstrate the limits of the vertical extent of VOCs. Confirmation sampling as part of the DNAPL removal will characterize the nature and extent of VOCs in groundwater in the areas of DNAPL Plumes 5-1 and 5-3.	No supplemental RI sampling. Collect data through routine BGMP monitoring and DNAPL removal action confirmation sampling.
6	Elevated arsenic and manganese in groundwater	The source of elevated arsenic and manganese in groundwater is not identified. The extent of elevated metals in groundwater is included as a data gap. Evaluation of the source of elevated levels of metals and cyanide in groundwater, and delineation of the extent.	Elevated levels of arsenic likely related to presence of VOCs and other hydrocarbons in groundwater. General water chemistry (Eh, pH, etc.) impacted by microbial activities results in mobilization of arsenic from soil into groundwater.	No data gap exists.	No supplemental RI sampling.

Table F-1 (continued)

Data Gap No.	Issue	Comment[c]	Data Available	Data Gap	Navy Recommendation[d]
7	1,4-dioxane	The possible presence of 1,4-dioxane should be included as a data gap for groundwater at IR Site 5. Determination of the possible presence of 1,4-dioxane (a solvent stabilizer commonly associated with 1,1,1-TCA) at IR Site 5, and the possible presence of perchlorate (a component of explosives) at IR Site 10.	1,4-dioxane does not appear on draft RI Report Table 7-1 (SulTech 2005) and is not on the BGMP list of VOCs. Explosives not handled at IR Site 10; perchlorate not an issue (DeLong, pers. com. 2006).	No 1,4-dioxane analyses have been conducted.	Collect data (Evaluation Area 1): • Analyze groundwater samples from any new wells for 1,4-dioxane plus full suite of parameters (see Appendix A1 of SAP). • Analyze groundwater samples from existing wells for 1,4-dioxane.
8	Permanent wells in and downgradient of plumes	Construction of permanent monitoring wells in and downgradient of each of the VOC source areas to determine concentration trends and plume movement over time. Wells should be screened across the interval most likely to be impacted by VOCs and metals.	Plotted VOC data suggest four plumes: • Plume 5-1 east of Building 5; DNAPL removal completed • Plume 5-2 east of Building 5 and south of Plume 5-4; no DNAPL found east of building • Plume 5-3 beneath Building 5 originating near plating shop; DNAPL currently undergoing removal • Plume 5-4 east of Building 5 and south of Plume 5-1; no DNAPL found east of building, but possible DNAPL under building	• Within plume source areas – BGMP monitoring, one FWBZ well within Plume 5-3 (2MW8S; M05-10 reportedly demolished during removal action activities), but no FWBZ wells are located within Plumes 5-1 and 5-2/5-4. – no deeper FWBZ wells (15 to 35 ft) to monitor vertical migration within limits of FWBZ – no SWBZ well is located within Plume 5-3 or 5-2. BGMP is monitoring SWBZ wells (D05-04 and D05-05) at Plume 5-1. • Downgradient of plume source areas – BGMP monitoring at least five FWBZ wells downgradient of plume source areas: M05-01, M05-02, M05-05, M05-06, M05-09. All FWBZ wells are screened from 0 to 15 ft bgs. – no deeper FWBZ wells (15 to 35 ft) – no SWBZ wells downgradient of Plume 5-3 – BGMP monitoring SWBZ well downgradient of Plumes 5-1 and 5-2 (D05-04)	Collect data (Evaluation Area 1): • Install wells in upper and lower FWBZ, as needed, east of Building 5. • Install well in SWBZ west of Building 5. • Analyze groundwater samples from new wells for VOCs plus full suite of parameters (see Appendix A1 of SAP).
9	Groundwater – DNAPL	Beneath and east of Building 5: DNAPL in FWBZ	Extensive DNAPL delineation completed beneath and east of Building 5 for four plume areas with possible DNAPL. See Data Gap #8.	DNAPL delineation being addressed under removal action.	No supplemental RI sampling.
10	Groundwater – Water Board criteria for fuel site closure	Groundwater at IR Sites 5 and 10 exceeds Water Board criteria for low-risk fuel site closure. Groundwater at IR Site 12 meets the criteria.	Existing TPH data compared to other criteria as part of TPH screening in Appendix E of draft RI Report (SulTech 2005)	Review existing TPH data and any additional TPH data collected to address specific data gap areas or SWMUs against Water Board ESL criteria. See Data Gaps #25, 26, 32, 35, 39, and Table A1-18 in Appendix A1 of the SAP.	No supplemental RI sampling.
	EVALUATION AREA 2 – Building 2				
11	VOCs in groundwater at Building 2	Elevated concentrations of compounds associated with dry cleaning in groundwater near Building 2, but extent of contamination has not been delineated.	1,2-DCE and vinyl chloride exceeding MCLs in 1995; EBS Hydropunch samples, FWBZ (IT 2001)	No monitoring at or downgradient of this location. Insufficient characterization of possible soil source for VOCs in groundwater (NAS GAP 05).	Collect data (Evaluation Area 2): • Conduct soil and discrete groundwater sampling for VOCs. • Install wells if VOCs reported at concentrations exceeding screening criteria.
12	IR Site 5 CSM	Include Building 2 in the CSM.	EBS soil and groundwater samples: PCE in soil (PCE recovery unit for dry cleaning operations located in Building 2); five VOCs reported in groundwater	See Data Gap #11.	Collect data (Evaluation Area 2): See Data Gap #11.
13	Building 2	Evaluation of the potential for data gaps associated with the dry cleaning facility in Building 2.	See Data Gap #11.	See Data Gap #11.	Collect data (Evaluation Area 2): See Data Gap #11.

Table F-1 (continued)

Data Gap No.	Issue	Comment[c]	Data Available	Data Gap	Navy Recommendation[d]
BUILDING 5 ISSUES INCLUDING SOIL GAS AND EVALUATION AREAS 3, 4, 5, AND 6					
14	Soil gas sampling	The vapor pathway risk is seen as potentially high to a hypothetical worker – collect soil gas and indoor air samples to validate the model.	DGS (TtEMI 2002) collected three subslab soil gas samples beneath Building 5 and four other soil gas samples in the vicinity of Building 5.	Minimal OU-2C– specific data.	Collect data (Evaluation Areas 3 and 4): • Subslab soil gas sampling at Building 5.
EVALUATION AREA 3 – Building 5 Plating Shop, Foundry, Heat Treatment Shop, etc.					
15	Industrial wastewater lines	Soil and groundwater sampling beneath the industrial wastewater drains inside the building.	Constructed in 1970s, 30 years after Building 5, the industrial wastewater sewer lines that discharged to EBMUD collected treated wastewater from IWTP #5 at Building 5 and appear to also have received untreated wastewater from floor drains at locations adjacent to the plating shop area. An engineering diagram shows industrial wastewater lines and drains within Building 5 (including chrome and cyanide waste lines). Three EBS soil sampling locations in EBS Parcel 54 (054I-002 through -004); no significant levels of chemicals detected. One soil sample in EBS Parcel 53, three soils samples in EBS Parcel 49, four soil samples in EBS Parcel 186.	The draft RI Report (SulTech 2005) shows 22 "industrial waste drains" in south central and southeastern portion of building (including plating shop) and 9 industrial waste drains near west margin of building. For areas outside the former plating shop, these industrial waste drains in Building 5 are not floor drains that discharged to building drain lines. Rather, they are the locations of aboveground piping that carried storm waters from the roof to the storm drain system. Known floor drains (industrial wastewater lines or storm drain lines) are located in the southern portion of Building 5 and are within the footprint of the VOC groundwater plume.	Collect data (Evaluation Area 3): • Conduct vadose-zone soil sampling along industrial wastewater drains originating from former plating shops (at drain locations as shown on newly located engineering drawings). • Analyze soil samples for metals, including hexavalent chromium, and cyanide.
16	Chromium and lead at Building 5 plating shop	Elevated chromium and lead in surface soil samples at plating shop. Confirmation sampling done as part of cadmium removal did not include chromium or lead analysis. Waste manifests show hazardous levels of chromium.	Cadmium removal conducted in three stages. Initial (and most extensive) area of excavation confirmed with samples analyzed for cadmium, chromium, hexavalent chromium, and lead. Lead and hexavalent chromium concentrations were below residential soil PRGs at all locations and chromium concentrations were below PRGs at the margins of the excavations. Step-out excavations confirmed only with samples analyzed for cadmium.	Lead and chromium analysis was not performed as part of the step-out cadmium removal confirmation sampling; however, chromium and lead concentrations at the margins of the initial excavation area were below PRGs. The waste profile sampling of the soil excavated and disposed of from the step-out cadmium removal showed the concentrations of chromium and lead to be below PRGs.	No supplemental RI sampling.
17	VOC sources in soil former plating shop	Evaluation of contaminant sources in soil (including DNAPL) in the vicinity of the former plating shop (IR Site 5), and delineation of the extent of VOCs in soil in this area.	Boring B05PS-08 sampled at 0, 1.3, 17.5, and 22 ft bgs. Water table at 7 ft bgs. VOCs ND above water table and at 17.5 ft bgs. At 22 ft bgs 1,1-DCA at a concentration of 4.3 mg/kg compared to PRG of 2.8 mg/kg and 1,1,1-TCA at 2 mg/kg compared to PRG of 1,200 mg/kg. These likely represent groundwater concentrations of 1,1-DCA and 1,1,1-TCA. DNAPL plume has been delineated as documented by DNAPL RAPP (IT 2002a,b; Shaw 2003). At least 11 other shallow borings (0 to 2 ft bgs) with VOCs ND.	Documentation is available to demonstrate an adequately characterized DNAPL plume (Plume 5-3); however, nature and extent of VOCs in the vadose zone not adequately characterized in the potential source area for DNAPL Plume 5-3.	Collect data (Evaluation Area 3): • Conduct vadose-zone soil sampling within southern portion of Building 5. • Analyze soil samples for VOCs.
18	Thallium and vanadium at metal work shop (southeastern corner of Building 5)	Thallium and vanadium reported above screening criteria in samples 054-002-012 (both) and 054-003-020 (vanadium only). Concentrations not delineated.	Thallium reported at 5.9 mg/kg (PRG is 5.2 mg/kg); vanadium reported at 95.3 and 85.1 mg/kg (PRG is 78 mg/kg).	Thallium and vanadium in soil at metal works shop not delineated vertically; no lateral delineation to the south or east. EBS sampling locations are present to the west (-016, -015) and to the north (-011, -021, -022, -023).	Collect data (Evaluation Area 3): • Conduct vadose-zone soil sampling within southeastern portion of Building 5. • Analyze soil samples for metals.

Table F-1 (continued)

Data Gap No.	Issue	Comment[c]	Data Available	Data Gap	Navy Recommendation[d]
	EVALUATION AREA 4 – Building 5 Aircraft Maintenance Line and Battery Acid Shop				
19	Arsenic in soil at 054-001-007; co-located with identified hot spot of thallium	• arsenic in soil at concentration of 329 mg/kg not identified as a hot spot (due to comparison of concentrations to PRGs, not background) • additional hot spots may be present if values are compared to the 95 percent UCL	Arsenic in location 054-001-007 at the surface. Several soil samples in the vicinity collected as part of the EBS.	Arsenic not fully delineated laterally (nearest western sampling location 054-001-005 is over 200 feet west; 054-001-006 to the north was only a subsurface sample) or vertically (no deeper samples at location 054-001-007).	Collect data (Evaluation Area 4): • Conduct vadose-zone soil sampling within northern portion of Building 5. • Analyze soil samples for metals.
20	Thallium and lead not delineated	• thallium in Aircraft Maintenance Line area not delineated laterally or vertically • lead in Aircraft Maintenance Line area not delineated laterally or vertically	• thallium in location 054-001-007 at surface. No deeper samples at this location; no nearby (<200 feet) surface soil samples • lead in locations 054-001-003 (SL), -005, and -006; samples -001, -002, and -004 located to west	• thallium not delineated laterally or vertically. • lead not delineated laterally to the north, south, or east or vertically.	Collect data (Evaluation Area 4). See Data Gap #19.
	EVALUATION AREA 5 – South of Building 5				
21	No PCB sampling in hazardous waste storage area (outside Building 5 in southeastern corner of site)	Hazardous waste storage area outside of Building 5 in the southeastern corner of the site formerly stored lubricating oils and hydraulic fluid. Soil in the area was not sampled for PCBs.	Two borings in this area in 1992 (M05HW01 and B05HW01). Samples not tested for PCBs. Subsequent sampling in this area included analysis for TPH but not PCBs.	PCB sampling was not conducted as part of the hazardous waste area sampling.	Collect data (Evaluation Area 5): • Conduct vadose-zone soil sampling at former location of Building 415 located with former hazardous waste storage area. • Analyze soil samples for PCBs and full suite of parameters for Data Gap buildings (see Appendix A1 of SAP).
22	Chromium in surface soil at Building 348	• history of chromium plating operations and discharge of wastewater containing hexavalent chromium • lack of hexavalent chromium data • extent of soil and groundwater contamination related to a hexavalent chromium wastewater spill is not delineated; floor of building reportedly sloped and a hole in the curb at the west end of the building reportedly allowed drainage to the street • additional hot spots may be present if values are compared to 95 percent UCL	• data appears to be total chromium only; hexavalent chromium analysis not specified • 3,000-gallon hexavalent chromium wastewater spill not presented in EBS or PEP; boring location 057-0029 shows vertical delineation. Lateral delineation: boring locations 057-001-002 to the east, 261-S8 and 261-S7 to the north, and 057-003-007, 057-006-016, and 057-003-008 to the north • data available for comparison to Alameda Point background 95th percentile	• no hexavalent chromium data for soil. • chromium in soil at the surface is delineated vertically, fairly well delineated laterally; groundwater not characterized. • concentrations were compared to the PRG, not the 95 percent UCL; potentially additional hot spots.	Collect data (Evaluation Area 5): • Conduct soil and discrete groundwater sampling and at former location of Building 348. • Analyze soil and groundwater samples for metals, including hexavalent chromium, and cyanide.
23	Vertical extent of VOCs in soil Building 348	• extent of TCE and PCE in the soil to the east and west of boring locations 057-001-001 and 057-001-002 • delineation of the vertical extent of VOCs in soil in the vicinity of former Building 348	At boring locations 057-001-001 and 057-001-002 at 4 ft bgs PCE was reported at 2 and 11 mg/kg, compared to PRG of 0.48 mg/kg. TCE was reported at 0.8 and 3 mg/kg, compared to PRG of 2.9 mg/kg.	Documentation is available to demonstrate that the DNAPL plume (Plume 5-3) is adequately characterized; however, nature and extent of VOCs in the vadose zone not adequately characterized in the potential source area for DNAPL Plume 5-3.	Collect data (Evaluation Area 5): • Conduct vadose-zone soil sampling south of Building 5 (including former locations of Buildings 261 and 348, and IWTP 5). • Analyze soil samples for VOCs.
24	Building 261 metals and cyanide	Building 261 was not investigated for metals and cyanide.	Building demolished; formerly used for storage of flammable hazardous materials and oily wastes.	Possible presence of metals and cyanide based on surrounding area activities.	Collect data (Evaluation Area 5): See Data Gaps #22 and 23.
	EVALUATION AREA 6				
25	VOCs east side of Building 5	• extent of TCE in soil in vicinity of soil borings B05-11, B05-14, and well M05-07 • evaluation of soil sources contributing to elevated levels of VOCs in soil boring B05-11, and delineation of VOCs in soil in this area	This location has undergone DNAPL removal.	Post-removal-action sampling needed to confirm reduction of VOC levels.	Collect data (Evaluation Area 6): • Conduct vadose-zone soil sampling east of Building 5 (including former Plume 5-1 area). • Analyze soil samples for VOCs, TPH, PCBs, and lead.
26	AOC 005 (USTs 5-2 and 5-3)	UST 5-3 was a waste-oil tank but its former location was never sampled for PCBs, lead, or chlorinated solvents during or following UST removal. UST 5-2 was not sampled for JP-5–range TPH.	See Table A1-18 in Appendix A1 of SAP.	Post-removal-action sampling needed to confirm absence of TPH, PCBs, and lead.	Collect data (Evaluation Area 6): See Data Gap #25.

Table F-1 (continued)

Data Gap No.	Issue	Comment[c]	Data Available	Data Gap	Navy Recommendation[d]
	DATA GAP SAMPLING				
27	PCB sampling	Is there still a need to do further sampling for PCBs in the vicinity of former PCB-containing equipment? Was soil sampled for PCBs beyond samples collected from soil borings? Evaluation of the potential for data gaps associated with possible PCB contamination related to transformers located at IR Site 12.	Final PCB Summary Removal Report (ITSI 2002) and PCB equipment inventory table reviewed. Wipe sampling and/or transformer-oil sampling conducted. No locations contained measurable PCBs.	No data gap exists.	No supplemental RI sampling.
28	Building 6	Sampling needed for VOCs, SVOCs, PCBs; benzene reported at southeastern corner of building.	Limited number of samples and parameters. PAHs characterized.	There has been no sampling for the full VOC suite.	Collect data (data gap buildings): • Conduct vadose-zone soil sampling within Building 6. • Analyze soil samples for VOCs, non-PAH SVOCs, PCBs, and metals.
29	Building 10	Evaluation of the potential data gaps associated with possible PCB contamination related to transformers located at IR Site 12. Building 10 was a former power plant facility with few samples analyzed for PCBs other than during monitoring well construction; sampling of groundwater and soil needed.	According to EBS, Building 10 was used for steam generation and air compression. Storage of 1,200 gallons of petroleum products, lab and plant treatment chemicals, morpholine, corrosives, and microbiocides were stored. Waste in Building 10 at NAS GAP 02. Spills were observed, but no cracks in floors were observed. PRC collected soil from borings for PCBs.	There does not appear to be a PCB data gap in the vicinity of Building 10; several soil borings were advanced in the vicinity of the building (some just outside the IR Site 12 boundary) including B12-05 through B12-09. Four soil samples were collected at each location between 0 and 15 ft; analysis included PCB analysis. Additionally, soil samples were collected during the installation of three monitoring wells (M12-01 through M12-04). See Data Gap #51 for NAS GAP 02.	No supplemental RI sampling.
30	Building 32	Analysis did not include cyanide; extent of contamination beneath building is a data gap.	Sampling was conducted beneath building using angled borings located around periphery of building. Sampling beneath building included soil samples analyzed for VOCs, metals, hexavalent chromium, and cyanide. No hexavalent chromium or cyanide detected.	Closed under RCRA Part B permit. No data gap exists.	No supplemental RI sampling.
31	Electrical Substations not sampled for PCBs – Building 34	Electrical substations including Buildings 34 and 560 were not sampled for PCBs. No additional electrical substations are present. Building 505 was potentially a former substation; however, this has not been confirmed.	See Data Gap #27. No data available at these locations.	Inadequate PCB sampling beneath Building 34. PCB sampling was not conducted at the location of the electrical substations known to store/house equipment with potentially PCB-containing transformer oils. No staining was noted during the EBS in these areas.	Collect data (data gap buildings): • Conduct vadose-zone soil sampling at former electrical substations (Buildings 34 and 505). • Analyze soil samples for VOCs, non-PAH SVOCs, PCBs, and metals.

Table F-1 (continued)

Data Gap No.	Issue	Comment[c]	Data Available	Data Gap	Navy Recommendation[d]
32	No sampling at several buildings that reportedly used or stored paint, petrol, solvents, and radioactive materials	No sampling was conducted at several buildings that used and/or stored paints, petroleum hydrocarbons, solvents, and radioactive materials. Buildings included the following: • Building 102 (EBS Parcel 46) • Building 505 (EBS Parcel 47) • Building 43 (EBS Parcel 47) • Building 44 (EBS Parcel 48) • Building 281 (EBS Parcel 48) • Building 346 (EBS Parcel 48)	EBS/PEP data related to historical use (IT 2001, ERM-West 1994): • Building 102 – used for packaged condition ordnance storage; also had 50 gallons of chemical storage • Building 505 – possibly a former electrical substation. In a 1994 survey, it was identified as Electrical Substation 5; however, a door in building 5 was labeled Electrical Substation 5. Additionally, Building 560 is identified as Electrical Substation 5. At time of inspection, two Connex boxes and a shed were present on the former concrete foundation • Building 43 – ammunition overhaul and rework shop; packaged condition ordnance storage; chemical storage (20 gallons) in hazardous materials lockers in equipment room and immediately north of building • Building 44 – one area used as a test bench for aircraft dials and benches; "caution" sign regarding radiation • Building 281 – paint and miscellaneous storage • Building 346 – administrative office, engineering laboratory, dry storage; 10 gallons of adhesive and spray paint stored in a hazardous materials locker	No sampling conducted at the buildings listed by agencies. At the site walk on April 18, 2006, agency representatives requested sampling at the following locations: • Building 102 – ordnance storage; however, ordnance was imported, stored, and exported in fully packaged containers. Other chemicals were stored (paint, nonhalogenated organic compounds, and petroleum products); however, no spills or leaks were documented. Additionally, no staining was observed. • Building 505 –.now open space for staged equipment. Former use not confirmed. No staining observed. • Building 43 – packaged condition ordnance storage. Other chemicals were stored (solvents, waxes, polish, cleaning agents, and petroleum products); however, no spills or spills were documented. Additionally, no staining was observed. • Building 44 – limited discussion of use other than test bench for gauges and dials; no evidence of spills or leaks. Note of radiological hazard. At the site walk on April 18, 2006, agency representatives concurred with no further sampling for the following locations: • Building 281– paint and miscellaneous storage (not specific); no stains or spills. No data gap exists. • Building 346 – No specifics provided on engineering laboratory activities. Very limited chemical storage included paints and adhesives in a hazardous materials locker. No evidence of staining or spills. Not a data gap.	Collect data (data gap buildings): • Conduct vadose-zone soil sampling within or at former locations of Buildings 102, 505, 43, and 44. • Analyze soil samples for VOCs, non-PAH SVOCs, PCBs, and metals. • Analyze soil samples for TPH at Building 505.
33	Building 282	No soil sampling conducted.	Demolished building, SWMU 282 (UST 282-1 and 282-2)	The former location of Building 282 represents a data gap. SWMU locations reviewed on a case-by-case basis.	Collect data (data gap buildings): • Conduct vadose-zone soil sampling at former location of Building 282. • Analyze soil samples for VOCs, TPH, non-PAH SVOCs, PCBs, and metals. • See Table A1-18 in Appendix A1 of SAP.
34	No sampling at Building 347	Building 347 was used as a general-purpose manufacturing and repair facility. No soil samples were collected near the building. Nearby samples contained PAHs (benzo[a]pyrene equivalent concentrations used in draft RI Report [Sultech 2005]) and vinyl chloride (15 ft bgs) at elevated levels. Draft RI Report also states that iron and arsenic concentrations were elevated.	PEP states that undocumented spills may have occurred outside Building 347 and that paint stains outside the building were present. No sampling was proposed because staining was considered minor. PEP states that the building (identified incorrectly as Building 349) was not inspected and spill documentation was not available.	No sampling at building and not inspected or fully investigated during the EBS. Used as a manufacturing and repair facility. Undocumented spills noted in PEP as having potentially occurred. Staining observed.	Collect data (data gap buildings): • Conduct vadose-zone soil sampling at former location of Building 347 • Analyze soil samples for VOCs, TPH, non-PAH SVOCs, PCBs, and metals.
35	IR Site 10 CSM – Building 400	CSM indicated hangar floor as a potential source of VOCs and TPH but samples were not analyzed for TPH or lead.	Limited sampling within northern portion of Building 400 for VOCs (three EBS boring locations). Extensive sampling within southern portion of building for VOCs (13 EBS boring locations).	No sampling for TPH or lead. Limited sampling for VOCs in northern portion of building.	Collect data (data gap buildings): • Conduct vadose-zone soil sampling within hangar area of Building 400. • Analyze soil samples for VOCs, TPH, non-PAH SVOCs, PCBs, and metals.

Table F-1 (continued)

Data Gap No.	Issue	Comment[c]	Data Available	Data Gap	Navy Recommendation[d]
36	No PCB or metals sampling in Building 405	Hazardous materials and waste storage (including hydraulic fluid) at Building 405. No PCB analysis was performed.	No sampling for PCBs.	PCB sampling was not conducted.	Collect data (data gap buildings): • Conduct vadose-zone soil sampling within Building 405. • Analyze soil samples for VOCs, TPH, non-PAH SVOCs, PCBs, and metals.
37	IR Site 12 CSM – Building 415 (mislocated)	Evaluate Building 415 as possible source of contamination and for possible data gaps.	Building 415 demolished and no information given in PEP or EBS; however, the EBS describes a Building 415 in EBS Parcel 57, which is in IR Site 5.	See Data Gap #39.	Collect data (data gap buildings): • Conduct vadose-zone soil sampling at former location of Building 415. • Analyze soil samples for VOCs, TPH, non-PAH SVOCs, PCBs, and metals, including hexavalent chromium, and cyanide.
38	No sampling at Building 500	No sampling was conducted at Building 500, which was used for chemical and equipment storage (and also for woodworking, per the EBS).	Woodworking materials included oils, stains, paint, solvents, and glue. These materials were stored in a locker on-site. Outdoor area to the south and open space was used for materials storage, equipment parking, and washdown. Hazardous materials storage located near building as well.	No sampling at or near the building with the exception of PAH sampling. Used for woodworking and chemical and equipment storage. Outdoor area used for washdown. No stains were observed in building or outside. Hazardous materials storage area located in the southeastern corner of Building 5 is located 50 feet from this building. This area was identified in a data gap above and perhaps should be combined with this data gap.	Collect data (data gap buildings): • Conduct vadose-zone soil sampling at former location of Building 500. • Analyze soil samples for VOCs, TPH, non-PAH SVOCs, PCBs, and metals.
	SOLID WASTE MANAGEMENT UNIT ISSUES				
39	SWMUs	See DTSC SWMU table (Attachment 1 to DTSC-GSU Comments).	See Table A1-18 in Appendix A1 of SAP. Recommendations for SWMUs at OU-2C (prepared with agency input following April 18 site walk). Table A1-18 addresses the 69 SWMUs at OU-2C, including the following: • 18 SWMUs requiring NFA (AST or NADEP GAP units) • 22 SWMUs requiring sampling (AOC, AST, distillation [M], NADEP GAP, NAS GAP, OWS, or UST[R] units) • 26 SWMUs requiring no further sampling (some located within evaluation areas) (AOC, AST, distillation [M], NADEP GAP, NAS GAP, OWS, SWMU or UST[R] units) • 3 SWMUs requiring no further sampling and addressed under TPH Program (AOC and UST[R] units)	SWMU locations reviewed on a case-by-case basis.	Collect data for selected SWMUs. See Table A1-18 in Appendix A1 of SAP.
40	IR Site 5 SWMUs	Several SWMUs were placed on the status list as NFA based on visual observation rather than on analytical data. SWMUs where sampling was not done and NFA was recommended (based on the findings of the RCRA Facility Act and not on observations of visible staining) are as follows: • AST 005H • M-01, M-02, M-03, M-04, M-05 (nearby floor drain) • NADEP GAPs 02, 03, 04, 05, 08, 10, 11, 12, 13, 14, 6, 17, 18 (samples not analyzed for lead), 20, 27 (include PCBs), 31 (include PCBs), 57 (include hexavalent chromium and cyanide), and 70 (include hexavalent chromium and cyanide) • NAS GAPs 01 and 05 • OWS 005 and OWS 615 • SWMU 005, SWMU 614, and SWMU 615	No nearby samples and/or inadequate analyte list. See Table A1-18 in Appendix A1 of SAP, Recommendations for SWMUs at OU-2C (prepared with agency input following April 18 site walk).	SWMU locations reviewed on a case-by-case basis.	Collect data for selected SWMUs. See Table A1-18 in Appendix A1 of SAP.

Table F-1 (continued)

Data Gap No.	Issue	Comment[c]	Data Available	Data Gap	Navy Recommendation[d]
41	IR Site 5 Data Gaps	• AOC 005 at Building 5 (former UST 5-3) – TCE, TPH-d, TPH-g • AOC 261 at Building 261 (former USTs 261-1 and 261-2 [kerosene] and former UST 261-3 [Stoddard solvent]) • AST 005G at Building 5 – waste oil • OWS 006A at Building 6 – steam cleaning condensate – BTEX • OWS 006B at Building 6 – grease trap, never sampled • UST(R)-02 at Building 6 – former UST with petroleum solvents – TPH and lead	See Table A1-18 in Appendix A1 of SAP.	SWMU locations reviewed on a case-by-case basis.	Collect data for selected SWMUs. See Table A1-18 in Appendix A1 of SAP.
42	OWS-005 and 615	Evaluation of the potential for data gaps associated with OWS-005, OWS-615.	See Table A1-18 in Appendix A1 of SAP.	SWMU locations reviewed on a case-by-case basis.	Collect data for selected SWMUs. See Table A1-18 in Appendix A1 of SAP.
43	IR Site 12 CSM – OWS 010	OWS-010 added to the CSM for IR Site 12 as possible source of contamination and evaluated for possible data gaps.	See Table A1-18 in Appendix A1 of SAP.	SWMU locations reviewed on a case-by-case basis.	Collect data. See Table A1-18 in Appendix A1 of SAP.
44	IR Site 12 Data Gaps	OWS 010 at Building 10 – oil interceptor in compressor area of Building 10, never sampled.	See Table A1-18 in Appendix A1 of SAP.	SWMU locations reviewed on a case-by-case basis.	Collect data. See Table A1-18 in Appendix A1 of SAP.
45	UST 2-1 (AOC 002)	Was soil at UST 2-1 sampled for TPH-d in addition to TPH-g? Maybe it was an earlier TPH method.	See Table A1-18 in Appendix A1 of SAP.	Closed under RCRA program.	No supplemental RI sampling.
46	UST 5-1 (UST[R]-1)	UST 5-1 was a waste oil tank but it was never sampled for PCBs and chlorinated solvents.	See Table A1-18 in Appendix A1 of SAP.	Closed under RCRA program.	No supplemental RI sampling.
47	UST 5-2 (AOC 005)	UST 5-2 was not sampled for JP-5 range TPH.	See Table A1-18 in Appendix A1 of SAP.	SWMU locations reviewed on a case-by-case basis.	Collect data. See Table A1-18 in Appendix A1 of SAP. (Evaluation Area 6)
48	UST 5-3 (AOC 005)	UST 5-3 was a waste oil tank but it was never sampled for PCBs and chlorinated solvents.	See Table A1-18 in Appendix A1 of SAP.	SWMU locations reviewed on a case-by-case basis.	Collect data. See Table A1-18 in Appendix A1 of SAP. (Evaluation Area 6)
49	IR Site 10 SWMUs	SWMU M-08 – relied on visual observation, no sampling. GAPs 36, 37, and 38 – relied on visual observation, no sampling.	See Table A1-18 in Appendix A1 of SAP.	SWMU locations reviewed on a case-by-case basis.	Collect data for selected SWMUs. See Table A1-18 in Appendix A1 of SAP.
50	IR Site 10 Data Gaps	UST(R)-12 at Building 400 – former UST 400-1 (diesel UST)	See Table A1-18 in Appendix A1 of SAP.	TPH Corrective Action Area 5C activities currently being addressed under another Navy program.	No supplemental RI sampling.
51	IR Site 12 SWMUs	SWMU NAS GAP 02 – sample groundwater and soil	See Table A1-18 in Appendix A1 of SAP.	SWMU locations reviewed on a case-by-case basis. See Table A1-18 in Appendix A1 of SAP.	No supplemental RI sampling.
52	IR Site 12 USTs/ASTs	Was soil sampled in the vicinity of most of the USTs and ASTs?	See Table A1-18 in Appendix A1 of SAP.	Closed under RCRA program.	No supplemental RI sampling.
53	IR Site 12 Data Gaps	• ASTs 010A through 010I at Building 10 – fuel oils, recommend close in place • AST 010J at Building 10 – diesel, recommend close in place	See Table A1-18 in Appendix A1 of SAP.	Closed under RCRA program.	No supplemental RI sampling.

Table F-1 (continued)

Data Gap No.	Issue	Comment[c]	Data Available	Data Gap	Navy Recommendation[d]
	OTHER ISSUES				
54	Radiological/ Reuse	Obtain a post-radiological removal action certification of unrestricted public use.	Closure activities continuing under another Navy program.	Addressed under another Navy program.	No supplemental RI sampling.
55	TPH in soil	Further action for TPH in soil warranted or not?	Conclusion of draft RI Report (SulTech 2005): IR Site 5 does not meet Water Board criteria for low-risk fuel site closure. The TPH risk evaluation results indicate that floating product and TPH fractions of xylene in soil and floating product and total TPH and benzene in groundwater near storm sewer drains exceed preliminary remediation criteria.	Review existing TPH data and any additional TPH data collected to address specific data gap areas or SWMUs by comparing to Water Board ESL criteria. See Data Gaps #25, 26, 32, 35, 39, and Table A1-18 in Appendix A1 of SAP.	No supplemental RI sampling.
56	IR Site 10 Data Gaps	North of Building 400 – TPH in soil	Conclusion of draft RI Report (SulTech 2005): Soil and groundwater have not been adequately characterized. Additional sampling at IR Site 10 is being conducted to support a TPH removal action.	No additional data required.	Review existing TPH data and any additional TPH data collected to address specific data gap areas or SWMUs by comparing to Water Board ESL criteria. See Data Gaps #25, 26, 32, 35, 39, and Table A1-18 in Appendix A1 of SAP. Any non-commingled plumes will be addressed under another Navy program.
57	IR Site 12 Storm sewer lines	IR Site 12 storm water lines (running from IR Site 12 to the Seaplane Lagoon thru Outfall F) need to be inspected and cleaned prior to the remediation of the Seaplane Lagoon sediments.	Storm drains from IR Site 12 discharge to Seaplane Lagoon thru Outfall G. Outfall G storm drains were characterized as "in poor condition" and "not cleaned in 1997."	Not a data gap. IR Site 12 is not a source of contaminants and it is unlikely that sediments in storm drains contain contaminants from IR Site 12 that would enter Seaplane Lagoon. No data gap exists.	No supplemental RI sampling.

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Notes:

[a] draft version of this table provided during meetings between regulatory agencies and Navy held on May 16 and June 15, 2006, to facilitate discussion of data gaps as identified by the regulatory agencies during their review of the Draft RI Report (SulTech 2005)

[b] agency concurrence with the Navy's proposed approach to address each data gap (by either sampling or by demonstrating that adequate data were already available) was received during the June 15, 2006, discussion

[c] summary of agency comments (See Attachment F) and data gaps identified in draft RI Report (SulTech 2005)

[d] See Appendix A1 of SAP for proposed field sampling activities

Table F-1 (continued)

Acronyms/Abbreviations:
AOC – area of concern
AST – aboveground storage tank
BGMP – basewide groundwater monitoring program
bgs – below ground surface
CSM – conceptual site model
DCA – dichloroethane
DCE – dichloroethene
DGS – (OU-1 and OU-2) data gap sampling
DNAPL – dense nonaqueous-phase liquid
DTSC – Department of Toxic Substances Control
EBMUD – East Bay Municipal Utility District
EBS – environmental baseline survey
ESL – environmental screening level
ft – feet
FWBZ – first water-bearing zone
GAP – generator accumulation point
IWTP – industrial wastewater treatment plant
JP-5 – jet propulsion fuel number 5
MCL – maximum contaminant level
µg/L – micrograms per liter
mg/kg – milligrams per kilogram
NADEP – Naval Aviation Depot
NAS – Naval Air Station
ND – not detected (not reported at concentrations above detection limits)
NFA – no further action
OU – operable unit
OWS – oil/water separator
PAH – polynuclear aromatic hydrocarbon
PCB – polychlorinated biphenyl
PCE – tetrachloroethene
PEP – parcel evaluation plan
PRG – (U.S. EPA Region 9) preliminary remediation goal
RAPP – removal action project plan
RCRA – Resource Conservation and Recovery Act
RI – remedial investigation
SAP – sampling and analysis plan
SVOC – semivolatile organic compound
SWBZ – second water-bearing zone
SWMU – solid waste management unit
TBD – to be determined
TCA – trichloroethene
TCE – trichloroethene
TPH – total petroleum hydrocarbons
TPH-d – total petroleum hydrocarbons as diesel
TPH-g – total petroleum hydrocarbons as gasoline
UCL – upper confidence limit
U.S. EPA – United States Environmental Protection Agency
UST – underground storage tank
VOC – volatile organic compound

ATTACHMENT G

RESPONSES TO COMMENTS

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RESPONSES TO COMMENTS FROM U.S. EPA DATED APRIL 3, 2007

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RESPONSE TO COMMENTS ON
DRAFT WORK PLAN FOR SUPPLEMENTAL REMEDIAL INVESTIGATION SAMPLING AT OPERABLE UNIT 2C
ALAMEDA POINT, ALAMEDA, CALIFORNIA
DATED SEPTEMBER 2006
CTO-0081

Comments from DTSC-GSU, 11/28/2006

GENERAL COMMENTS

General Comment A.

The Draft Work Plan (DWP) provides extensive information regarding the proposed field effort. However, the DWP excludes some of the required work plan elements in accordance with Guidance for Conducting Remedial Investigations and Feasibility Studies (RI/FS) under CERCLA (US EPA October 1988). The main body of the DWP lacks sufficient detail to meet the requirements set forth in the guidance, particularly in the scope of the proposed investigation and rationale. A general discussion of the rationale, approach, and scope of work should be included in the main body of the DWP to provide an understanding of the purpose of the investigation and the type of data to be collected to meet the objectives. RI/FS guidance states that, "The scope of the RI site characterization should be documented in the work plan, with detailed descriptions provided in the SAP." While this information is included in detail in the Sampling and Analysis Plan (SAP), the purpose of the SAP is to provide a detailed description of field methods, sampling procedures, analytical methods, and quality assurance/quality control requirements.

The DWP Section 1.2 - Scope of Effort provides a thumbnail sketch of the proposed investigation; however, the information in this section insufficiently addresses the required elements of the work plan. The scope of effort (RI tasks) should be presented in terms of the Conceptual Site Model (CSM), specifically:

- what is already known about the site
- the site history, and
- perceived data gaps.

Although a large number of samples and field activities are proposed, these are not tied to the specific evaluation areas, data gaps, or SWMUs, or to the objectives of the proposed sampling. As a result, the reviewer does not understand how the proposed activities will satisfy the data needs.

Recommendation

A new section that briefly describes the rationale, approach, and scope of work proposed for the OU-2C supplemental RI sampling should be added to the main body of the DWP, following after Section 3. This section should be organized by study areas (evaluation area, data gaps, and SWMUs) and may cross-reference the SAP for greater detail, if necessary.

Response to General Comment A.

Work Plan Section 1.2, Scope of Effort, Pages 1-2 and 1-3.

The requested information is provided in the SAP and Appendix A1 rather than the Work Plan in accordance with guidance provided by our Navy Quality Assurance Officer (QAO). The existing Section 1.2, Scope of Effort, was revised to include a brief summary of the information provided in Appendix A1 for the nature of the data gap(s) for each study area or group of study areas (e.g., SWMUs), and which of the proposed field activities apply to each study area.

General Comment B.

The SAP consists of the Field Sampling Plan and Quality Assurance Project Plan (QAPP). The SAP guides the investigation and field program and is used by the project team that executes the work. The SAP also facilitates regulatory oversight to ensure protection of human health and the environment. However, throughout the SAP, inconsistent or insufficient details are provided for field methods, procedures, and rationale. In addition, the data quality objectives (DQOs) for all six evaluation areas and other data gap areas are developed and presented on a single table, even though there are distinct differences among the various areas with respect to the media of concern, objectives, and limits of investigation. As a result, the decision rules are oversimplified. Because of the lack of rigorous detail provided in the SAP, particularly with respect to field procedures and decision rules, DTSC does not fully concur with the proposed activities.

Recommendation

A rigorous and systematic presentation of field sampling methods, procedures, and rationale should be provided in the SAP. In addition, due to the distinct differences and complexities of each evaluation area, DQOs within the table should be evaluated for each of the study areas, and modified as appropriate.

Response to General Comment B.

Attachment A, SAP, Tables 1-6 through 1-8.

The SAP was revised as described in response to specific comments by DTSC, EPA, and the Water Board. The DQO tables were revised as follows to provide additional clarity and detail:

1) Existing Table 1-6 was divided into two tables; one for groundwater and one for Evaluation Areas 2 through 6. Data Gap Buildings were included in the DQO table for SWMUs.
2) Step 7 of the DQO table for Evaluation Areas 2 through 6 includes specifics for each evaluation area.
3) Existing Table 1-8 for SWMUs also incorporates Data Gap Buildings, and Step 7 includes specifics for groups of study areas with the same sampling protocol.

General Comment C.

The DWP identifies 6 evaluation areas, 12 data gap areas, and 22 solid waste management units (SWMUs) as unique study areas at OU-2C. Appendix A1 – *Study Areas at OU-2C* describes each study area and provides area-specific problem statements and optimized sampling designs. The discussion in Appendix A1, however, describes only those SWMUs that are physically located within the boundaries of the evaluation areas. A separate section to discuss the SWMUs which are not physically located within the boundaries of an evaluation area is presented at the end of Appendix A1. The inclusion of SWMUs within evaluation area discussions produces a disjointed presentation and should be revised.

Recommendation

The discussion for each SWMU should be expanded within the individual evaluation area, to match the level of detail provided at the end of Appendix A1. Additionally, SWMUs described in each evaluation area should also be listed in Section A1.9 with a reference to the appropriate section earlier in the text.

Response to General Comment C.

Appendix A1, Sections A1.9.1 and A1.9.2. Most or all of the kind of information provided for the eight SWMUs covered by Section A1.9 is already included for the other 14 SWMUs in the sections (A1.3 through A1.6) that cover each of the individual evaluations areas. To provide for ease of comparison, new subsections were added to A1.9 for each of the 14 SWMUs included in Evaluation Areas 3 through 6. Section A1.9, page A1-76, will also be revised to delete the last sentence of the third paragraph beginning "This section addresses the remaining eight SWMUs..."

Appendix A1, Sections A1.3.1, A1.4.1, A1.5.1, and A1.6.1. Text was added that directs the reader to Section A1.9 for additional information on SWMUs.

General Comment D.

The terms *"screening criteria", "regulatory criteria", "comparison criteria", "Alameda Point screening criteria", and "Alameda Point background criteria"* are used in the document but are not defined. Although the DQO tables include a listing of the types of screening criteria, the specific values are not provided. The referenced SAP and SAP Appendix A1 tables list various screening criteria for soil and groundwater but the specific proposed values for the supplemental RI are not identified. The specific values should be identified, particularly when there are multiple criteria listed for the same analyte. Also, proposed screening criteria for soil gas are not referenced in the DQO tables and are not listed on tables in the SAP.

Recommendation

The terminology for screening criteria should be defined in the main body of the DWP and in the SAP. The screening criteria proposed for soil, soil gas, and groundwater should be identified and listed by analyte in tables in the main body of the DWP; alternatively the DWP could reference the appropriate tables in the SAP. DTSC suggests that a single table be provided for each medium of concern (soil, soil gas, and groundwater). The tables should list all potentially applicable screening criteria and should identify proposed values for the supplemental RI.

Response to General Comment D.

The Work Plan was revised to define terminology and to use "screening criteria" only when referring to Water Board ESLs, CHHSLs, or the Alameda Point PAH screening criterion. In all other instances, the term "comparison criteria" was used. [Note that italicized text, which was copied from the draft RI (SulTech 2005), will not be revised.]

Attachment A, SAP Appendix A1, Table A1-1 was revised to include all regulatory criteria used as comparison criteria for nature and extent evaluation of organic analytes (excluding TPH) in soil and groundwater. Table A1-2 was revised to include all regulatory criteria and Alameda Point background values used as comparison criteria for nature and extent evaluation of inorganic analytes in soil and groundwater. Footnotes have been added to Tables A1-1 and A1-2 to clearly indicate which criteria will be used for nature and extent comparison. SAP Table 2-2 has been revised to list only one regulatory criterion for each of the following: soil (residential PRGs), groundwater (federal or California MCLs, whichever is lower), surface water ecological receptors (CTR CCCs), and surface water human-health consumption of organisms (NRWQC). QAPP Worksheet 15 has been revised to include the lowest regulatory criterion for each analytes as the Project Action Limit for evaluation of Project Quantitation Limits and Method Reporting Limits. Soil gas data will be used for input to risk assessment calculations only; therefore comparison criteria for nature and extent evaluation are not applicable. Use of ESL and CHHSLs for soil gas is described in the RAWP.

General Comment E.

The DWP states that metals in soil are compared to Alameda Point background only if their concentrations are above preliminary remediation goals (PRGs). A metal concentration is only considered an exceedence if it is greater than both the residential PRG and the background threshold concentration (95th percentile of the Alameda Point background data set). This type of comparative analysis for the work plan and supplemental RI is inappropriate. Comparisons to PRGs will not provide sufficient information to determine whether a site-specific release has occurred. Comparison to the background threshold value is required.

Recommendation

All metals found in soil should be compared to the 95th percentile of the appropriate Alameda Point Background data set to determine whether or not a site-specific release has occurred and if so, whether the release has been adequately characterized

Response to General Comment E.

Attachment A, SAP, Appendix A1 Foreword, Page A1-iv.

In the RI report, all samples with metals concentrations exceeding the Alameda Point "pink" background data set 95th percentile concentrations will be evaluated to determine whether a release has occurred.

Please note that the section of the Foreword to Appendix A1 titled "Screening Criteria" (title revised to "Comparison Criteria") was revised and text was added to clarify that the evaluation is designed to provide a list of COPCs for developing the Work Plan. The RI report will include a more detailed evaluation, including the routine statistical comparison between the Alameda Point "pink" background data set and the site-specific data set.

General Comment F.

The DQOs specify that chemicals will be compared to screening criteria to determine whether characterization of the nature and extent of contamination is complete. However, comparisons to screening criteria for soil (such as PRGs) is not sufficient to determine whether potential impacts to groundwater have occurred and/or are ongoing. As a result, the need for additional groundwater sampling may be overlooked. If the analytical results for soil samples indicate that a release of VOCs, metals, or other constituents has occurred that may have impacted or continue to impact groundwater, additional groundwater sampling may be required.

Recommendation

Contaminant concentrations in soil should be evaluated to determine whether groundwater impacts may have occurred and to assess the need for further groundwater sampling. A decision rule should be added to the DQOs that identifies the steps to be taken if a release is discovered in soil that indicates groundwater may be impacted. This is particularly important for areas that do not have historical groundwater data and are not proposed for groundwater sampling as part of the supplemental RI.

Response to General Comment F.

Attachment A, SAP, Appendix A1, Figure A1-18, and Section A1.7.3

Most proposed soil sampling locations are within areas bounded by existing or planned monitoring wells and the nature of contaminants in groundwater has been characterized. However, to provide for areas in which little previous groundwater sampling and analysis was conducted, an additional Decision Logic was added (new Figure A1-18). In addition, Appendix A1, Section A1.7.3 was revised to include discrete groundwater sampling for the Data Gap Buildings area in the northwestern portion of IR Site 5 (Buildings 43, 44, 102, and 505) where limited groundwater sampling and analysis was conducted during previous studies. Additionally, a figure entitled Decision Logic for SWMU Step-Out Groundwater Sampling (Figure A1-20) has been added to SAP Appendix A-1 to provide for step-out discrete groundwater sampling for SWMUs outside the area of known groundwater contamination. SWMU step-out groundwater sampling will be conducted if results of discrete groundwater sampling are above comparison criteria and are not consistent with the known nature and extent of contamination. The new decision logic defaults to the decision logic for installation of monitoring wells if step-out samples are also above comparison criteria. The following definition is included on Figures A1-18 and A1-20:

"Any analyte present at a concentration exceeding comparison criteria and collected from a location where there are no other groundwater sampling results for this analyte within 50 feet is defined as not consistent."

General Comment G.

The DQOs (Table 1-6) state that the top of the Bay Sediment Unit (BSU) is approximately 35 feet below ground surface (bgs). However, lithologic logs from the draft RI report and cross-sections in the DWP indicate that the top of the BSU is roughly 15 feet bgs. The relationship between the artificial fill, BSU, and Merritt Sand has not been thoroughly evaluated in this work plan (see GSU Specific Comment 25). As such, the terms "upper" first water-bearing zone (FWBZ) and "lower" FWBZ should not be used in the DWP. While it is possible that the FWBZ

contains horizons within it that may be further defined, the hydrostratigraphy at OU-2C has not yet been evaluated to the level that is required to define such zones.

Recommendation

The terminology in the DWP should be revised for the FWBZ intervals proposed for investigation. One approach might be to refer to the "upper" and "lower" FWBZ as target sampling depth-intervals, such as "shallow" and "deeper." The hydrostratigraphy may be further refined during the data evaluation phase of the supplemental RI based on interpretation of the new data combined with existing data. If intervals within the FWBZ need to be further defined, recommendations for terminology can be made in the supplemental RI report.

Response to General Comment G.

A global revision was made to use the terms "shallower" and "deeper" to describe the target sampling intervals in the FWBZ.

General Comment H.

Several errors and inconsistencies were noted throughout the document. Be advised that the italicized text information that was extracted from the draft RI report may contain such errors and inconsistencies.

Response to General Comment H.

With the exception of the italicized text, errors and inconsistencies identified during review of the draft document were reviewed and revised, as appropriate. As noted for the italicized text, which was extracted from the draft RI report (SulTech 2005) to provide previously prepared summaries of site description and background information and brief descriptions of the purpose and scope of investigations previously performed at OU-2C pending new data to be collected during the Supplemental RI sampling, in general, no independent verification was or will be made of the accuracy of this information. Only errors or inconsistencies that were discovered when developing field activities were revised or corrected in the text. For example, see note on Work Plan page 2-14 where an error in text from the draft RI (SulTech 2005) that refers to "Outfall F" was corrected.

SPECIFIC COMMENTS

Specific Comment 1.

Section 1 – Introduction. A map should be added that identifies the study areas, such as evaluation areas, data gaps and SWMUs. Also, soil gas should be added as a media of concern for Evaluation Area 1 in this section and elsewhere in the DWP.

During the January 20, 2007, conference call, Mr. Peter Russell requested that reference to DTSC guidance concerning depth to groundwater and soil gas sampling be removed from the RTCs.

Response to Specific Comment 1.

Work Plan, Figure 1-3.

A new Figure 1-3 was added to show the study areas. Existing Figure 1-3 was renumbered as Figure 1-4.

Work Plan Section 1.2.

Soil gas will not be added as a medium of concern for Evaluation Area 1. Subslab soil gas data are being collected for use in modeling for indoor risk assessment calculations and evaluation. These data are used to evaluate the indoor air risk pathway to hypothetical future occupants of Building 5 from possible exposure to VOCs emanating from groundwater. See response to EPA General Comment 1 for revised text for SAP Appendix A1, Section A1.1.3.4 – Subslab Soil Gas Sampling. Note that no reference to DTSC guidance concerning depth to groundwater and soil gas sampling has been included in the revised text.

However, in five areas on the outskirts of the groundwater plume, additional proposed subslab soil gas samples (OU2CSG001 through OU2CSG005) paired with planned shallow discrete groundwater sample locations (SUSTSB01, SOWS10SB01, DG043SB01, SM08SB01, and DG034SB01) will be added to the sampling plan for selected buildings within the site (for example, Building 6/SWMU UST(R)-02, Building 10/SWMU OWS 010, Building 43, Building 400/SWMU M-08, and Buildings 34/500) to clarify the relationship between VOCs in groundwater and VOCs in soil gas.

Specific Comment 2.

Section 1.1 – Project Purpose. State that an additional project purpose is to evaluate the tidal influence between Seaplane Lagoon (located south of OU-2C) and OU-2C

Section 1.2 – Scope of Effort. Add a new section to the main body of the DWP that provides a general description of the rationale, approach, and scope of work for each study area (see General Comment A). For example, the text states that up to eight piezometers will be installed for aquifer testing but does not clarify why aquifer testing is needed. The purpose of the aquifer testing will determine what type of aquifer testing should be performed (i.e., slug test, step-drawdown test, constant-rate pump test). Without an understanding of the basis and rationale for the scope of work and general description of sampling locations (i.e., study areas), the usefulness of the information provided in this section is limited.

Response to Specific Comment 2.

Work Plan, Section 1.1, Page 1-2, first paragraph: The following phrase was added to the penultimate sentence:

"...to assess...tidal influence between Seaplane Lagoon and OU-2C."

Work Plan, Section 1.2.

As described in response to General Comment A, Section 1.2 was revised to include a brief summary of the information provided in Appendix A1 for the nature of the data gap(s) for each study area or group of study areas (e.g., SWMUs), and which of the proposed field activities apply to each study area.

For example, the purpose of the piezometers (three locations to characterize groundwater flow direction west of OU-2C and five locations to characterize tidal influence south of OU-2C) was added to the text.

Specific Comment 3.

Section 2.5 – Conceptual Site Model. The lithologies provided on the CSM for OU-2C should be verified and corrected, as appropriate. For example, the "Bay Sediments" are listed as "silty clay" on the CSM for IR Site 5. Although the BSU is consistently encountered beneath OU-2C as indicated by a color change in the soil, the lithology of this unit has been demonstrated to be variable. According to the lithologic logs provided in the draft RI Report (SulTech 2005) and on the cross sections in the DWP, bay sediments can include layers of sand, silty sand, sandy silt, silt, clayey sand, clayey silt, and silty clay. Also, the solvent groundwater plume (including free phase and dissolved phase solvents) at IR Site 5 has migrated to depths within the BSU, and possibly deeper, but this is not illustrated on the CSM. Thus, the CSM should be revised to correctly reflect lithology and the extent of the solvent groundwater plume.

Response to Specific Comment 3.

Work Plan, Figures 2-4 through 2-6.

The CSM Figures 2-4, 2-5, and 2-6 were revised as follows:

- All three figures were revised to indicate that the BSU consists of variable lithologies that may include layers of sand, silty sand, sandy silt, silt, clayey sand, clayey silt, and silty clay.
- Figure 2-4 (IR Site 5) was revised to indicate the horizontal extent of the dissolved-phase VOC plume.

- Figure 2-4 (IR Site 5) was revised to indicate the vertical extent of DNAPL into the BSU beneath the plating shop area and beneath the suspected solvent tank area.

Specific Comment 4.

Section 2.5.1 – Potential Soil Contamination. The following comments pertain to this section:

- Define the following terms used in this section and elsewhere in the DWP: *Alameda Point screening criteria, screening criteria, and Alameda Point background levels* (see General Comment D).
- The statement, "...little or no contamination of soil at OU-2C has been found during previous investigations..." is misleading. Previous investigations have confirmed soil contamination by VOCs, metals, and cyanide beneath Building 5, and a soil removal action for cadmium was required. The Navy should revise this statement to reflect the presence of soil contaminants detected beneath Building 5.
- For the bulleted discussion on page 2-26, the general study areas (such as evaluation areas, data gaps, and SWMUs) should be listed within each bulleted item. If a map is provided, as suggested in Specific Comment 1, it should contain the features that are called out in this discussion, such as industrial wastewater sewer lines, foundry, Aircraft Maintenance Line, battery acid shop, etc.
- The battery acid shop doesn't seem to belong in the category "Aircraft Maintenance Line."
- The phrase "and groundwater" should be removed from the third item listed under the third bullet on page 2-26.
- During the January 30, 2007, conference call, DTSC requested that pages 2-25 and 2-26 be reviewed and revised as necessary to ensure use of the correct term regarding "comparison criteria".

Response to Specific Comment 4.

Work Plan, Sections 2.5.1, Page 2-25 and 2-26.

First Comment Bullet – As discussed in the response to General Comment D, a global revision was made to limit the use of the term "screening criteria". In Section 2.5.1, new text was added and the sentence beginning "Very few..." was revised as follows:

> "To identify an initial list of the chemicals of interest in soil to be addressed by this Work Plan (i.e., chemicals present at levels that may represent a risk to human health and the environment), chemical concentrations were compared to regulatory criteria and Alameda Point specific comparison criteria. Regulatory comparison criteria used included residential soil preliminary remedial goals (PRGs) with the following exceptions.
>
> - Water Board environmental screening levels (ESLs) were used for total petroleum hydrocarbons (TPH).
> - The Alameda Point benzo(a)pyrene equivalent screening criterion (620 µg/kg) was used for polynuclear aromatic hydrocarbons (PAHs).
> - The Alameda Point "pink" background data set 95th percentile concentrations were used for selected metals for which the PRG value is greater than the 95th percentile concentration.
>
> For the more than 1,000 soil samples previously collected and analyzed from OU-2C only the following chemicals were reported at concentrations exceeding the comparison criteria:"

Second Comment Bullet – In Section 2.5.1, Page 2-25, the sentence beginning "Although little..." was revised as follows:

> "Other than in areas excavated to mitigate metals or TPH contamination, chemicals exceeding comparison criteria have been detected in very few soil samples (chlorinated VOCs - 12 of 333, benzene 3 of 403, PAHs - 5 of 612, PCBs - 1 of 86, metals 27 of 291). However, data gaps remain concerning some chemicals and potential source areas, including the following:"

Third Comment Bullet – Text has been added to list the study area. Features called out in text have been included in new Figure 1-3.

Fourth Comment Bullet – In Section 2.5.1, Page 2-26, the text was revised to read "Aircraft Maintenance Line and adjoining shop area".

Fifth Comment Bullet – In Section 2.5.1, Page 2-26, "and groundwater" was deleted from the text.

Sixth Comment Bullet – Pages 2-25 and 2-26 were reviewed to ensure use of the correct term regarding "comparison criteria."

Specific Comment 5.

Section 2.5.2 – Groundwater Contamination. The following comments pertain to this section:

- The locations of roadways discussed in this section should be depicted on a map, since the extent of groundwater contamination is discussed by using the roadways as landmarks.

The first paragraph states that "Few, if any, chemicals have been reported at concentrations above screening criteria in groundwater at IR Site 5 east of Lexington Avenue, at IR Site 10 south of West Tower Avenue, and at IR Site 12." The phrase, "few, if any" is ambiguous and imparts little, if any, information. The Navy should clearly state if chemicals have been reported above screening criteria in groundwater samples from these areas, and what screening criteria were used for this evaluation.

- The DWP states that "arsenic is naturally occurring and its presence is attributed to background conditions at OU-2C." The Navy should discuss the other nine metals detected in groundwater at concentrations exceeding screening criteria, indicate which are attributed to background, and state what screening criteria were used for this evaluation.
- A map should be provided that shows the boundaries of the four dense non-aqueous phase liquid (DNAPL) plumes (Plumes 5-1 through 5-4) discussed on page 2-28.
- We are unaware of the presence of a former solvent tank located in the vicinity of Plume 5-1 and well M05-07. Where did the Navy find this information and where is the tank located? The source of Plume 5-1 may be the storm sewer lines that pass through this area.

The last bullet of this section discusses soil gas, not groundwater. A separate section should be added to discuss the potential for soil gas contamination and migration to indoor air, as well as previous soil gas results from OU-2C.

Response to Specific Comment 5.

Work Plan, Section 2.5.2, Pages 2-27 through 2-29.

First Comment Bullet – New Figure 1-3 (added in response to Specific Comment 1) includes names of roads.

Second Comment Bullet – In Section 2.5.2, Page 2-27, a paragraph was added that summarizes the number of chemicals reported at concentrations above comparison criteria outside of Evaluation Area 1 in a similar manner to that provided for soil samples in Section 2.5.1, first paragraph.

Third Comment Bullet – In Section 2.5.2, Page 2-27, first paragraph, the following sentence was added at the end of the paragraph:

> "The RI report will address all metals reported in groundwater and will identify which metals may represent a release."

Fourth Comment Bullet – The locations of the Plumes 5-1 through 5-4 were added to new Figure 1-3 (original Figure 1-3 was renumbered as Figure 1-4).

Fifth Comment Bullet – The draft OU-2 RI report (TtEMI 1999a) identified this possible tank and showed the location on a figure. If additional information documenting a possible solvent tank can be located, it will be

included in the RI report. An evaluation to assess whether there is a relationship between storm drains and solvent plumes will be included in the RI report. The TtEMI (1999a) reference has been added to the Work Plan and cited in Section 2.5.2, where the possible solvent tank is first mentioned.

Sixth Comment Bullet – Please refer to response to Specific Comment 1 explaining that soil gas is not a medium of concern being addressed under this Work Plan. In Section 2.5.2, Page 2-29, the last bullet was revised as follows:

- "the impact of VOCs in groundwater on the indoor air risk pathway for Building 5 as represented by concentrations of VOCs in subslab soil gas (soil gas data to be used in the Johnson and Ettinger model)"

Attachment A, Sampling and Analysis Plan (SAP)

Specific Comment 6.

Attachment A, SAP Section 1.2 – Problem Definition/Background. Clarify why Evaluation Area 4 is specified as the *Aircraft Maintenance Line* rather than the *northern portion of Building 5* as identified elsewhere in the DWP.

Response to Specific Comment 6.

Attachment A, SAP, Section 1.2, Page A1-2; Work Plan, Section 1, Page 1-1; SAP Appendix A1-i.

The Work Plan was revised to consistently refer to Evaluation Area 4 as the "Aircraft Maintenance Line and adjoining shop area."

Specific Comment 7.

Attachment A, SAP Section 1.2.1 – Purpose and Objectives. As stated elsewhere in the DWP, another purpose is to evaluate the tidal influence between the Seaplane Lagoon and OU-2C.

Response to Specific Comment 7.

Attachment A, SAP Section 1.2.1, Page A1-3. A fourth bullet was added as follows:

"Evaluate tidal influence between Seaplane Lagoon (located south of OU-2C) and OU-2C"

Specific Comment 8.

Attachment A, SAP Section 1.2.3 – OU-2C Description. The discussion in this section identifies specific building numbers, street names, and other features that are not shown on the referenced figure (Figure 1-2). A figure should be added to illustrate the identified features.

Response to Specific Comment 8.

A new Figure 1-3 was added to the Work Plan , which shows locations of features cited in Section 1.2.3. Original work plan Figure 1-3 was renumbered as Figure 1-4. Text has been added to SAP Section 1.2.3 to refer the reader to the work plan figure.

Specific Comment 9.

Attachment A, SAP Section 1.3 – Project/Task Description. The following comments pertain to this section:

- All wells, not just the newly installed wells, should be sampled for the full suite of VOCs and metals during the supplemental RI so that the data interpretations presented on maps in the supplemental RI report represent a single sampling event.
- The specific geotechnical analyses that will be performed on soil samples should be clearly stated; the report should also indicate how the results will be used.
- The fourth bullet (Aquifer testing) states that aquifer testing will be performed at all new and existing monitoring wells. What type of aquifer testing is proposed? What will the Navy do with the results of the aquifer test? Please confirm that the Navy's intent is to conduct aquifer tests at all wells, both existing wells and

new wells. The answers to these questions should be included in the draft final Workplan text, not just in "response to comments."

The fifth bullet (Data evaluation) should include a statement that data from the investigation will also be used to evaluate hydraulic characteristics of the aquifer from the results of the aquifer testing.

Response to Specific Comment 9.

Attachment A, SAP, Section 1.3; SAP Table 1-2, SAP Appendix A1, Section A1.1.3.3, Page A1-30.

First Comment Bullet –SAP Table 1-2 was revised to provide for sampling existing wells for the full suite of VOCs and metals. Specifically, VOC analysis was added for wells M05-01, M05-02, M05-03, M05-05, M05-06, M05-09, D05-01, D05-03, D05-04, D05-05, P-5-1-MW4S, P-5-1-MW4I, and P-5-1-MW4D. Analyses for 1,4-dioxane, metals, hexavalent chromium, and cyanide were already included for these existing wells. Additionally, SAP Appendix Section A1.1.3.3, Page A1-30, was revised to provide for sampling both new and existing wells during the Supplemental RI field activities.

Second Comment Bullet - The rationale and list of analyses for geotechnical samples are provided in DQO Table 1-6, and the test methods are provided in QAPP Worksheet 19.

Third Comment Bullet – In SAP Section 1.3, Page A1-9, the bullet on aquifer testing was revised to clarify that piezometers and selected wells will be used for the 25-hour groundwater-elevation study and that slug tests will be performed on all newly installed monitoring wells. A list of the monitoring wells to be used in the 25-hour groundwater-elevation study was included in SAP Section 2.2.4.1, Page A2-12.

Fourth Comment Bullet – In SAP Section 1.3, Page A1-9, the last sentence of the bullet on data evaluation was revised as follows:

"A 25-hour groundwater elevation study will be conducted to assess the direction of groundwater flow at the western margin of OU-2C and to assess tidal influence between OU-2C and Seaplane Lagoon (located south of OU-2C). The 25-hour duration provides data for the calculation of mean daily water level using the Serfes method (Serfes 1991). Slug testing will be conducted to determine the hydrologic characteristics of the saturated zone at the locations of newly installed monitoring wells."

Specific Comment 10.

Attachment A, SAP Section 1.4 – Quality Objectives and Criteria. Table 1-6 does not include DQOs for subslab soil gas sampling. Subslab soilgas sampling DQOs should be added to the table.

Step 4 of the DQOs on Table 1-6 states that the lateral boundaries for the supplemental RI and data gap areas will include groundwater within OU-2C as defined by Evaluation Area 1. However, these limits do not encompass groundwater at Evaluation Area 2, which should also be included.

Previously, DTSC suggested in informal e-mail correspondence with the Navy that DQO tables be provided for each of the evaluation areas separately because the
problem statements, media of concern, study boundaries, and possibly decision rules
are different for most areas. While DTSC has withdrawn that request, due to the overly large tables that would be generated, we urge the Navy to take care to assess each Evaluation Area carefully and ensure that the information for each area is area-specific.

Response to Specific Comment 10.

Attachment A, SAP, Section 1.4; Table 1-6.

Table 1-6 was revised to include an additional paragraph under Step 3 to list subslab soil gas sampling results as an input to risk assessment calculation and modeling, and an additional paragraph under Step 7 to list subslab soil gas sampling for VOCs using U.S. EPA Method TO-15.

Table 1-6 Step 4 is correct as stated. As shown on Appendix A1 Figure A1-2, the Evaluation Area 1 boundary (green outline) includes Evaluation Area 2 as well as Evaluation Areas 3 through 6.

The DQO tables were revised to provide additional clarity and detail as described in response to General Comment B. The DQOs were expanded to include specifics for each evaluation area.

Specific Comment 11.

Attachment A, SAP Section 2.1.1 – Hollow-Stem-Auger Drilling. The following comments pertain to information presented in this section:

- It is unclear whether lithologic logging will be performed in accordance with Standard Operating Procedure (SOP) 3, *Borehole Logging*, as specified for direct-push drilling in the following section.
- This section does not state whether soil samples collected from hollow-stem auger borings will be submitted for geotechnical analysis. Also, soil sample collection and handling methods are not included, nor are the appropriate section(s) of the SAP referenced, which provides this information. Finally, this section should state whether soil samples will be collected for chemical analyses from hollow-stem-auger borings.
- The Navy should clarify on page A2-2 that only boreholes that are not completed as monitoring wells will be backfilled. Also, the SAP should clearly state that the borehole abandonment requirements of the Alameda County Public Agency will be followed, in addition to Department of Water Resources Bulletin 74-90 and SOP-13

Response to Specific Comment 11.

Attachment A, SAP Section 2.1.1.

First Comment Bullet – Section 2.1.1, Page A2-1, was revised to refer to direct-push soil sampling procedures for collection of soil samples for lithologic logging and geotechnical analysis; and to include reference to SOP 3 for borehole logging.

Second Comment Bullet – Section 2.1.1, Page A2-1, was revised to refer to lithologic logging and geotechnical analysis only. The last sentence of the first paragraph was revised to refer to geotechnical methods presented in QAPP Worksheet 19. The last sentence of the second paragraph was revised to refer to geotechnical analysis. The first sentence of Section 2.1.1 was revised as follows:

> "A hollow-stem auger rig will be used to drill borings for well installation. The hollow-stem auger method uses a truck-mounted drilling rig equipped with hollow-stem, continuous-flight augers. Soil samples for lithologic logging and geotechnical analysis will be collected using continuous direct-push soil sampling through the hollow-stem auger flights and in advance of the auger cutter head to avoid sample disruption. Soil samples for geotechnical analysis will be collected from well borings using a split-barrel sampler lined with stainless steel or acetate sleeves."

Third Comment Bullet – The last two paragraphs of Section 2.1.1, Page A2-2, were deleted. In Section 2.1.2 Direct-Push Drilling, Page, A2-3, reference to the borehole abandonment requirements of the Alameda County Public Agency was included, in addition to Department of Water Resources Bulletin 74-90 and SOP-13.

Specific Comment 12.

Attachment A, SAP Section 2.1.2 - Direct-Push Drilling. Does SOP 13, *Destruction of Boreholes and Wells*, also apply to the destruction of direct-push boreholes? This should be clearly stated in this section.

Also, according to the information in Table 1-3, many of the direct push boreholes will be drilled to a depth of 30 feet bgs. The Navy should clarify in the last bullet of this section that the expected sampling depth is generally up to 30 feet bgs, not 20 feet bgs as stated.

Response to Specific Comment 12.

Attachment A, SAP Section 2.1.2, Page A2-3, text was revised to include reference to SOP 13 and to the requirements of the Alameda County Public Agency.

In SAP Section 2.1.2, Page A2-3, the last bullet was revised to state depths of 30 feet bgs.

Specific Comment 13.

Attachment A, SAP Section 2.1.3 - Piezometer Installation. The Navy should provide additional details regarding piezometer installation including construction methods, construction details, and construction materials. Include the rationale for proposed construction details (i.e., depths, screen intervals, screen lengths).

Response to Specific Comment 13.

Attachment A, SAP Section 2.1.3, Page A2-3.

This section was expanded to provide details regarding piezometer installation including construction methods, construction details, and construction materials, and the rationale for the construction design.

Specific Comment 14.

Attachment A, SAP Section 2.1.4 - Aquifer Testing. The text indicates that slug tests are proposed for all newly constructed wells and previously existing monitoring wells. Please verify that this is the Navy's intent. Also, the purpose of the aquifer testing should be clearly stated to ensure that the selected method will meet the objectives. The Navy should also provide a reference to subsequent SAP Section 2.2.4 for detailed information on aquifer testing procedures and methods of analysis.

Response to Specific Comment 14.

Attachment A, SAP Section 2.1.4, Page A2-3.

This section was revised to clarify that slug tests will only be conducted on newly installed wells and that the 25-hour groundwater-elevation study will include temporary piezometers and selected monitoring as described in SAP Section 2.2.4, Page A2-12.

Attachment A, SAP Section 2.2.4, Page A2-12.

Text was added to provide the details of the 25-hour groundwater-elevation study and the rationale related to determining groundwater flow direction at the western margin of OU-2C and tidal influence in the area between Seaplane Lagoon and OU-2C.

Specific Comment 15.

Attachment A, SAP Section 2.1.5 – Subslab Soil Gas Sampling. The following comments pertain to this section:

- The SAP should clearly state that Building 5 is currently vacant and that the potential risk evaluation is for hypothetical future building occupants.
- The Navy should provide a reference to subsequent SAP Section 2.2.3 for detailed information on subslab soil gas sampling procedures and to Appendix E for the risk assessment work plan.

The SAP states that risk assessment results, interpretations, and conclusions will be presented in a technical memorandum. Is this technical memorandum in addition to the Supplemental RI Report outlined in Figure 1.3 of the main body of the DWP?

Response to Specific Comment 15.

Attachment A, SAP Section 2.1.5, Pages A2-3 and A2-4.

First Comment Bullet – In SAP Section 2.1.5, Page A2-3, text was revised to clearly state that Building 5 is currently vacant and that the potential risk evaluation is for hypothetical future building occupants.

Second Comment Bullet – SAP Section 2.1.5, Page A2-4, was revised to include a reference to subsequent SAP Section 2.2.3 for detailed information on subslab soil gas sampling procedures and to Appendix E for the risk assessment work plan.

Third Comment Bullet – In SAP Section 2.1.5, Page A2-4, the sentence referring to a "technical memorandum" was deleted. The risk assessment will be included in the OU-2C RI report as indicated in Work Plan Figure 1-3

(now Figure 1-4). Note also that the Supplemental RI Sampling activities were designed to prepare the final OU-2C RI report, not a supplemental RI report.

Specific Comment 16.

Attachment A, SAP Section 2.1.6 – Monitoring Well Construction. The following comments pertain to this section:

- List the specific geotechnical analyses for soil samples and the purpose of the analyses, or cross-reference a section which provides this information.
- Provide the rationale for screen placement in wells that are not planned to intersect the water table.
- Figure 2-1 does not show the 0.5-foot blank casing to be used as a sump. Please add this feature to the diagram.
- Adjust the proposed well design to account for shallow water table conditions at OU-2C to include appropriate annular sealing materials used for well construction. If a well is screened 2 feet above the water table, and the filter pack extends two feet above the top of the screen, the well materials are within a foot of the ground surface. Design specifications for water-table wells and deeper wells should be discussed separately.
- Specify that well vaults will be raised slightly above grade to allow surface water to drain away from the well.

Expand the well development procedures description to provide greater detail on the proposed methods, equipment to be used, and water quality parameter monitoring. Development should proceed until water quality parameters have stabilized and at least 5 well volumes (including water within the casing and filter pack) have been removed. The applicable SOP that will be followed for well development should be referenced.

Response to Specific Comment 16.

Attachment A, SAP Section 2.1.6, Pages A2-4 to A2-5; SAP Figure 2-1.

First Comment Bullet – The rationale and list of analyses for geotechnical samples are provided in DQO Table 1-6, and the test methods are provided in QAPP Worksheet 19. Reference to Table 1-6 and QAPP Worksheet 19 was added to SAP Section 2.1.6.

Second Comment Bullet – SAP Section 2.1.6, Page A2-4, was revised to include rationale for screen placement in wells within the deeper portion of the FWBZ and within the SWBZ.

Third Comment Bullet – SAP Figure 2-1 was revised to state "4-inch-diameter, Schedule 40 PVC blank casing with threaded, flush-jointed end cap."

Fourth Comment Bullet – SAP Section 2.1.6, Page A2-4, was revised to account for shallow water table conditions at OU-2C to include appropriate annular sealing materials used for well construction. Text was added to discuss the design specification for deeper wells separately.

Fifth Comment Bullet –In SAP Section 2.1.6, Page A2-5, text was added to refer the reader to Figure 2-1, which demonstrates that the design of a flush mounted, traffic-rated vault set in concrete includes a 1- to 2-inch elevation above existing ground surface in order to provide for directing surface water runoff away from the well.

Sixth Comment Bullet – In SAP Section 2.1.6, Page A2-5, Item 5, text was expanded and reference to SOP 5 was repeated.

Specific Comment 17.

Attachment A, SAP Section 2.1.9 – Groundwater Monitoring Well Sampling. The last sentence of the first full paragraph of this section is unclear and should be revised.

Response to Specific Comment 17.

Attachment A, SAP Section 2.1.9, Page A2-6, last sentence. The text was revised to read "...presented in Table 2-1."

Specific Comment 18.

Attachment A, SAP Section 2.2.1 – Soil Sampling Procedures. Item number 2 states that soil samples will be collected with a disposable scoop. This is an inappropriate method for "undisturbed" samples that are required to be collected in stainless steel, brass, or acetate sleeves (per QAPP Worksheet 19-soil). The Navy should provide the sampling procedures for soil samples collected in stainless steel, brass, or acetate sleeves to be submitted for geotechnical and chemical analyses.

Response to Specific Comment 18.

Attachment A, SAP Section 2.2.1.

In SAP Section 2.2.1, Page A2-8, Item 2, text was revised to provide the procedure for shallow soil sampling. All soil samples for chemical and geotechnical analysis will be collected using direct-push sampling methods and a split-barrel sampler lined with stainless steel or acetate liners (sleeves). As described in Item 3 of Section 2.2.1, the sample volume for VOC analysis will be collected from the soil in the coring body (sample sleeve) using an En Core sampling device.

Specific Comment 19.

Attachment A, SAP Section 2.2.2 – Groundwater Sampling Procedures. The following comments pertain to this section:

- Specify the estimated depth of sampling for each well by specifying the pump placement within the screened interval. The basis for the proposed sampling depth should be provided. Also, specify the procedures for lowering the sampling equipment into the wells and how agitation of the water column will be minimized.
- State that pump discharge rate will be lowered, as necessary, to minimize drawdown during purging and allow water levels to stabilize prior to sampling in accordance with the requirements for low-flow sampling.
- Specify that field water-quality parameter measurements will begin after one tubing volume (Including the pump and flow-through cell volumes) has been purged.
- Clarify that water levels will be measured and recorded at frequent intervals during purging, and that sampling will proceed after both water level drawdown and field parameters have stabilized. Stabilization of water levels prior to sampling is a key component of low-flow sampling.
- Item 10 states that sampling is planned for unfiltered metals analysis. However, in Section 2.1.8 on page A2-6, it is stated that groundwater samples for metals analysis will be filtered in the field. This contradiction should be reconciled.
- State that samples collected for VOC analyses will be checked to ensure that they do not contain air bubbles.
- Specify that total well depth measurements will be taken after sample collection to minimize disturbance of the water column prior to sampling.
- Clarify the sampling method that is proposed for wells or sample locations that are purged to dryness and/or for which drawdown cannot be stabilized, even using low-flow methods.

The Ground Water Forum Issue Paper: *Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers* (Yeskis, D. and B. Zavala, 2002) is a useful reference for groundwater sampling procedures in the DWP.

Response to Specific Comment 19.

Attachment A, SAP Section 2.2.2.

First Comment Bullet – SAP Section 2.2.2, Page A2-9, was revised to reference SOP 8 Groundwater Sampling and to provide information on pump placement.

Second Comment Bullet – SAP Section 2.2.2, Page A2-9, Item 8 was revised to be consistent with low flow sampling techniques described in SOP 8 and to include the instruction to maintain a flow rate "between 100 and 500 milliliters per minute" with the goal of minimal drawdown (less than 0.1 meter).

Third Comment Bullet – In SAP Section 2.2.2, Page A2-9, Item 8 (renumbered Item 10), additional text and reference to SOP 8 was included to provide instruction for measurement of field water quality parameters, including stabilization parameters for pH (± 0.1) and conductivity (±3%), which are consistent with stabilization parameters listed in Section 2.1.9.

Fourth Comment Bullet – In SAP Section 2.2.2, Page A2-9, Item 8, reference to SOP 8 was included to provide instruction for monitoring water levels and maintaining minimal drawdown.

Fifth Comment Bullet – SAP Section 2.2.2 describes monitoring well groundwater sampling and SAP Section 2.1.8 describes discrete groundwater sampling. To avoid confusion, the last sentence of SAP Section 2.1.8, Page A2-6, was revised to specify that discrete groundwater samples for metals analysis will be filtered in the field and the first paragraph of SAP Section 2.2.2, Page A2-9 was revised to specify that the described procedures refer to monitoring well sampling only and to refer the reader to Section 2.1.8 for discrete groundwater sampling.

Sixth Comment Bullet – In SAP Section 2.2.2, Page A2-9, Item 10, additional text and reference to SOP 8 was included to provide for proper collection of samples for VOC analyses including examination for air bubbles.

Seventh Comment Bullet – SOP 8 provides for well depth sounding prior to purging to confirm that there are no obstructions, breaks in the casing, or sedimentation that may interfere with placement of the pump. However, the following text has been added to SAP Section 2.2.2 to address low-flow sampling:

"To avoid disturbing sediment at the bottom of the well prior to using low-flow sampling procedures, do not sound the well (measure total well depth) immediately before sampling."

Eighth Comment Bullet – In SAP Section 2.2.2, Page A2-10, an additional numbered item and reference to SOP 8 was included to provide for sampling in wells with that are slow to recover and/or are purged to dryness.

Ninth Comment Bullet – Comment noted.

Specific Comment 20.

Attachment A, SAP Section 2.2.5 – Equipment Decontamination. Decontamination procedures should be described for large down-hole equipment such as hollow-stem augers, direct-push drilling rods, surge blocks, and well development bailers.

Response to Specific Comment 20.

Attachment A, SAP Section 2.2.5, Page A2-13. Text was added to refer to decontamination of large, reusable equipment as described in SOP 11.

Specific Comment 21.

Attachment A, SAP Section 2.4 – Analytical Methods. Why does Table 2-2 list only soil PRGs and California Toxics Rule (CTR) values as regulatory criteria and not maximum contaminant levels (MCLs), Alameda Point background values, and other potentially applicable criteria (see General Comment D)? Also, a table listing method reporting limits and screening criteria for soil gas samples should be included in this section, similar to Table 2-2.

Response to Specific Comment 21.

Attachment A, SAP Section 2.4 and SAP Table 2-2.

Table 2-2 is intended to provide the most stringent (lowest) regulatory concentrations to demonstrate that the selected analytical methods have sufficiently low target method reporting limits. Although Table 2-2 is not intended to provide the nature and extent comparison criteria, it has been revised to list only one value for each of the following: soil (residential PRGs), groundwater (federal or California MCLs, whichever is lower), surface water ecological receptors (CTR CCCs), and surface water human-health consumptions of organisms

(NRWQC). Additionally, footnotes have been added to Tables A1-1 and A1-2 to clearly indicate which criteria will be used for nature and extent comparison. QAPP Worksheet 15 has been revised to include the lowest regulatory criterion for each analyte as the Project Action Limit for evaluation of Project Quantitation Limits and Method Reporting Limits. See response to General Comment D for revisions to Tables A1-1 and A1-3, which provide a complete listing of comparison criteria to be used for the nature and extent evaluation in the RI report.

No table for subslab soil gas analysis is provided because the analytical method (U.S. EPA TO-15) and results are used to provide the specific analytical results required for input to risk assessment evaluation and modeling of possible vapor intrusion to indoor air.

Appendix A1 to the SAP – Study Areas at OU-2C

Specific Comment 22.

Appendix A1 to the SAP – Foreword. In the subsection entitled *Source Documents*, it is stated that data from the referenced investigations in this section are presented on the compact disk in Appendix A2 to the SAP. However, it appears that Appendix A2 only includes the data tables from Appendix C of the draft RI report (SulTech 2005). The Navy should clarify whether these tables include all of the data available for OU-2C from the referenced sources, such as data from the Basewide Groundwater Monitoring Program (BGMP) and DNAPL removal actions, or if separate data tables should be provided

Response to Specific Comment 22.

Attachment A, SAP Appendix A1, Foreword.

The Supplemental RI Sampling Work Plan presents all the groundwater data collected through 2004 that was extracted from the draft RI report (SulTech 2005). This data set is presented in Appendix A2 and includes data collected under the BGMP through 2004 (ITSI 2005).

In SAP Appendix A1, Foreword, Page A1-ii, text was added to "Data Sources" clarifying that the Work Plan and Appendix A2 include data collected through 2004. The OU-2C RI report to be prepared at the conclusion of the Supplemental RI sampling event will also include any additional data generated after 2004 that is available at the time that the report is written. This will include data collected under the BGMP after 2004, data from groundwater monitoring conducted during and after the six-phase heating activity for the DNAPL source removal action, any ongoing TPH investigations, and any other sampling activities relevant to OU-2C.

Specific Comment 23.

Appendix A1 to the SAP – Foreword. The following comments pertain to the subsection entitled *Screening Criteria* and to the subsequent tables:

- The screening criteria tables do not specifically identify which value is used when there are multiple screening values provided for a given analyte. The specific screening value that was used should be identified in these tables.
- Tables A1-4 through A1-17, which present the compounds of potential concern exceeding screening criteria, should specify which screening value was used when there are multiple values, that is, Federal MCL or California MCL, residential PRG or industrial PRG.
- The federal MCL for cyanide on Tables A1-1 and A1-11 is incorrectly listed as 150 micrograms per liter (μg/l). The federal MCL for cyanide is 200 μg/l. The California MCL of 150 μg/l should be used on Table A1-11 because it is the lower of the two values.
- Why are CTR criteria not included in Tables A1-4 through A1-17?
- It is stated that metals in soil are compared to Alameda Point background if their concentrations are above PRGs. DTSC disagrees with this type of comparative analysis for this work plan and for the supplemental RI. Comparisons to PRGs will not provide sufficient information to determine whether a site-specific release has occurred. Comparison to the background threshold value is required. A metal

concentration is only considered in exceedence if it is greater than both the residential PRG and the background threshold concentration (95th percentile of the Alameda Point background data set). This approach will not determine whether or not a site-specific release has occurred and if so, whether the release has been adequately characterized

Response to Specific Comment 23.

Attachment A, SAP Appendix A1, Foreword.

First Comment Bullet – See response to General Comment D for revisions to SAP Appendix A Tables A1-1 and A1-3 to provide a complete listing of comparison criteria. In SAP Appendix A1, Foreword, Page A1-iv, text was added to clarify which comparison criteria were used to identify the chemicals of potential concern for the Work Plan.

Second Comment Bullet – Where not already specified, a footnote was added to SAP Appendix A1 groundwater tables indicating the lower or either federal or California MCL was used and the column heading on SAP Appendix A1 soil tables was revised to specify that residential PRGs were used.

Third Comment Bullet – For SAP Appendix A1, Tables A1-1 and A1-11, MCLs for cyanide were revised.

Fourth Comment Bullet – Tables A1-4 through A1-11 (groundwater) and A1-12 through A1-17 (soil) are summary tables to provide an initial list of COPCs to develop the Work Plan and to provide a summary of historical data. A comprehensive evaluation of the nature and extent of contamination using the comparison criteria described in the SAP DQO tables, including CTR criteria if appropriate, will be conducted to prepare the OU-2C RI report. .

Fifth Comment Bullet – See response to General Comment E for clarification on use of comparison criteria in the Work Plan versus evaluation of metals exceeding the Alameda Point "pink" background data set 95th percentile concentrations for the RI report.

Specific Comment 24.

Appendix A1 to the SAP – Foreword. The SAP states that, depending on the field conditions, soil samples may be collected using hand-auger equipment, but does not specify a method for collecting soil samples for chemical or geotechnical analyses in hand-auger borings.

The method for soil sample collection from hand-auger borings should be specified in an appropriate section in the SAP. It should be clarified how samples collected using hand-auger equipment will meet the requirements of QAPP Worksheet 19-soil. The SAP should also specify the field conditions that would require soil samples to be collected using hand-auger equipment.

Response to Specific Comment 24.

Attachment A, SAP Appendix A1, Foreword.

In SAP Appendix A, Foreword, Page A1-v, the sentence referring to hand auger sampling beginning "Depending on field conditions, soil samples…" was deleted. No borings for soil sample collection will be advanced using hand auger methods, All soil samples will be collected using direct-push sampling. Hand auguring will only be used to confirm that the subsurface at a sampling location is clear of underground utilities or other obstructions.

Specific Comment 25.

Appendix A1 to the SAP, Section A1.1 – Evaluation Area 1. The following comments pertain to this section:

- The SAP states that Evaluation Area 1 consists of groundwater beneath OU-2C that has been impacted by chlorinated VOCs. However, other contaminants such as 1,4-dioxane, cyanide, and metals that may potentially impact groundwater are also included in Evaluation Area 1, which should be acknowledged by the SAP. In addition, it should be clarified that soil gas beneath Building 5 is being evaluated as part of Evaluation Area 1.

- Page A1-3 of the SAP states that the upper FWBZ extends from 5 to 15 or 17 feet bgs, and that the lower FWBZ extends from 17 to 35 or 40 feet bgs. However, Figure A1-3 illustrates the upper FWBZ from 5 to 18 feet bgs and Figure A1-4 illustrates the lower FWBZ from 20 to 40 feet bgs. Depth intervals between figures and text should be consistent.
- The description of the hydrostratigraphy beneath OU-2C is not supported with sufficient analysis and interpretation. The basis for the determination of an "upper" and "lower" FWBZ is not thoroughly presented and evaluated (such as through the use of cross-sections and/or fence diagrams). Also, the terminology is not consistent with that described in Section 2.3.3.1 of the main body of the DWP (see first full paragraph on page 2-18). It is unclear whether the BSU at OU-2C is considered to be acting as an aquitard between the FWBZ and SWBZ, or if it is considered to be part of the FWBZ, or both. The Navy should provide site-specific cross-sections and analyses that support the description of the hydrostratigraphy at OU-2C, or remove the terminology which specifies an "upper" and "lower" FWBZ until additional data can be obtained and evaluated (see General Comment G). We suggest that the "upper" and "lower" FWBZ are referred to as target sampling depth-intervals, such as "shallow" and "deeper" intervals for the purposes of the DWP.
- A map showing SWBZ sample locations and chlorinated hydrocarbon detections should be included, similar to Figures A1-3 and A1-4.
- The analytical results for groundwater samples collected at Evaluation Area 2 should be shown on Figure A1-3 for a more complete representation of the historical groundwater data for OU-2C. This figure can be referenced in the discussion of Evaluation Area 2 (Section A1.2.2.1).
- The Navy should indicate whether FWBZ monitoring well 2MW8S is currently sampled as part of the BGMP or whether this well has been decommissioned as a result of the DNAPL removal action at Plume 5-3.

Response to Specific Comment 25.

Attachment A, SAP Appendix A1, Section 1.1.

First Comment Bullet – SAP Appendix A1, Section A1.1, Page A1-2. The first sentence was revised to state that groundwater within Evaluation Area 1 has been impacted by metals and cyanide and the potential for impact by 1,4-dioxane. This information will also be incorporated in appropriate sections of the main Work Plan text (pages 1-1 and 2-29 and new text in Section 1.2) and the SAP (pages A1-1 and A1-7).

As discussed in response to Specific Comment 1, soil gas is not being evaluated as a medium of concern. Subslab soil gas data are being collected for use in modeling for indoor risk assessment calculations and evaluation. These data are used to evaluate the indoor air risk pathway to hypothetical future occupants of Building 5 from possible exposure to VOCs emanating from groundwater. This information is provided in SAP Appendix A1, Section A1.1.3.4 and additional text was added to the Work Plan clarifying the purpose and intended use of subslab soil gas data.

Second Comment Bullet – In SAP Appendix A1, Section A1.1, Page A1-3, text was revised to cite consistent depths for the FWBZ and to indicate that SAP Appendix A Figures A1-3 and A1-4 present data collected from within specific depth ranges representing the shallower and deeper portions of the FWBZ.

Third Comment Bullet – As described in response to General Comment G, a global revision was made to use "shallower" and "deeper" to describe the target sampling intervals in the FWBZ.

Fourth Comment Bullet – A new Figure A1-5 showing chlorinated VOCs reported in the SWBZ was included in SAP Appendix A1 (subsequent figures were renumbered).

Fifth Comment Bullet – SAP Appendix Figure A1-3 was revised to include historical groundwater sampling locations for Evaluation Area 2.

Sixth Comment Bullet – Monitoring well 2MW8S was sampled for analysis under the BGMP in April 2006 prior to commencement of the DNAPL source removal activities for Plume 5-3. The continued existence or destruction of this well will be verified and documented in the RI report.

Specific Comment 26.

Section A1.1.3 – Proposed Sampling Rationale and Design. The following comments pertain to this section:

- The boundaries of all four DNAPL plumes (including Plumes 5-2 and 5-4) should be shown on a map.
- DTSC is unaware of the presence of a former solvent tank located in the vicinity of Plume 5-1 and well M05-07. The Navy should cite the source of this information and the size and location of the tank. Also, the Navy should acknowledge that the source of Plume 5-1 may be the storm sewer lines that pass through this area.
- The SAP states that the source of solvent Plumes 5-2 and 5-4 may be the former foundry and heat treatment area. If these areas are the source of plumes 5-2 and 5-4, significant VOC contamination may be present beneath these areas. The supplemental RI investigation should be designed to evaluate whether the source of Plumes 5-2 and 5-4 may be the former foundry and heat treatment area. Soil and groundwater samples should be collected from these areas.
- The SAP states that additional groundwater sampling for VOCs in the two areas that have been targeted for removal actions (Plumes 5-1 and 5-3) is not proposed as part of the supplemental RI field activities. Rebound effects in excess of remediation goals (yet to be established) may occur as a result of back-diffusion from the underlying low-permeability soils. Hence, continued groundwater monitoring should be performed inside and outside of the DNAPL plume boundaries. The Navy should clarify whether sampling for rebound effects is being conducted and the duration and locations of rebound sampling, or provide a reference to the appropriate source for this information.
- The SAP states that "arsenic is naturally occurring and its presence is attributed to background conditions at OU-2C." The Navy should clarify which, if any, of the other nine metals detected in groundwater at concentrations exceeding screening criteria are attributed to background, and clarify what screening criteria were used for this comparison (i.e., Alameda Point background or MCLs).

This section discusses groundwater flow patterns at OU-2C. However, there are no groundwater elevation maps provided in the DWP to support the interpretations. Groundwater elevation maps that have been used to develop the scope of this investigation should be provided in the DWP.

Response to Specific Comment 26.

Attachment A, SAP Appendix A1, Section A1.1.3.

First Comment Bullet - SAP Appendix A1 Figure A1-2 was revised to include the locations of Plumes 5-2 and 5-4.

Second Comment Bullet - The draft OU-2 RI report (TtEMI 1999a) identified the possible solvent tank and showed the location on a figure. If additional information documenting this possible solvent tank is located, the information will be included in the RI report. An evaluation to assess whether there is a relationship between storm drains and solvent plumes will be included in the RI report.

Third Comment Bullet – As described in SAP Appendix A1 Section A1.3, Page A1-33, the former foundry and heat treatment area are included in Evaluation Area 3. Two soil sampling locations (EA3SB36 and EA3SB37) and one SWMU soil and groundwater sampling location (SM02SB01) are located within the former foundry and heat treatment area. Planned analyses for samples from these locations include VOCs as well as metals and other analytes. In addition, other planned soil and groundwater sampling locations in Building 5 are adjacent to the area of Plumes 5-2 and 5-4 (EA3SB24 through EA2SB27, SND70SB01, and SM01SB01). SAP Appendix A1 Figures A1-3 and A1-4 show the historical groundwater sampling locations in this area.

Fourth Comment Bullet – The DNAPL source removal actions include groundwater monitoring conducted during and after the six-phase heating activity. In SAP Appendix A1, Foreword, Page A1-ii, text was added to clarify that the monitoring data from wells installed as part of the six-phase heating activity, including monitoring for rebound effects, will be included in the OU-2C RI report.

Fifth Comment Bullet – In SAP Appendix A1 Section A1.1.3, text was revised to indicate that MCLs were used for comparison criteria in the Work Plan and the following sentence was added:

"The RI report will address all metals reported in groundwater and will identify which metals may indicate a release."

Sixth Comment Bullet – A groundwater elevation map (Figure 2-7) was added to the Work Plan.

Specific Comment 27.

Appendix A1 to the SAP, Section A1.1.3.1 – Aquifer Testing. This discussion should be expanded so that the procedures for aquifer testing and purpose of each task is spelled out more clearly, as follows:

- The details of the proposed tidal influence study should be clearly stated, and specific OU-2C specific wells which will be used should be identified.
- Will water levels be measured at low tide during the supplemental RI, or will data from the BGMP from Spring 2006 be used?
- Clarify what decisions will be used as the basis for determining whether piezometers pairs and/or lower FWBZ piezometers will be needed.
- Describe the purpose of the slug tests and how the data from the slug tests will be used.

State the reason why slug tests were chosen over other aquifer test methods and provide information on which wells will be selected for testing.

Response to Specific Comment 27.

Attachment A, SAP Appendix A1, Section A1.1.3.1.

First Comment Bullet – Details of the tidal influence study for OU-2C, which was completed under the BGMP during spring 2006, were added to Attachment A SAP, Section 2.1.4, page A2-3, Section 2.2.4.1, page A2-12, and SAP Appendix A1, Section A1.1.3.1. A list of ells that will be used in conjunction with the 25-hour groundwater-elevation study for the area between Seaplane Lagoon and OU-2C and for the western margin of OU-2C was added to SAP Appendix A1, Section A1.1.3.1.

Second Comment Bullet – For both the BGMP tidal influence study conducted in 2006 and the 25-hour groundwater-elevation study to be conducted during the Supplemental RI field activities, water level measurement are monitored hourly over a 25-hour period using pressure transducers with data loggers.

Third Comment Bullet – Text was added to Attachment A SAP, Section 2.2.4, page A2-12 to describe the basis for determining where piezometers pairs or shallower FWBZ piezometers only will be installed for the Supplemental RI sampling activities.

Fourth Comment Bullet – Text was expanded in Attachment A SAP, Section 2.2.4.2, page A2-12 to clarify the purpose and use of the slug test results.

Fifth Comment Bullet – The rationale for slug tests is provided in the SAP Section 2.2.4.2. As described in response to Specific Comment 9, slug tests will be performed for newly installed wells only. Text in Section A1.1.3.1 was revised to include this information.

Specific Comment 28.

Appendix A1 to the SAP, Section A1.1.3.2 – Monitoring Well Installation. Identify the proposed location of well M05-19 on Figure A1-2. Also, DTSC recommends that the discussion of proposed monitoring wells for Evaluation Area 2 be moved to Section A1.2 - *Evaluation Area 2*. While Table 1-2 of the SAP identifies the proposed depths and locations of geotechnical soil samples, the rationale are not provided on this table. The Navy should also include the purpose of the proposed geotechnical samples

Response to Specific Comment 28.

Attachment A, SAP Appendix A1.

Figure A1-2 was revised to show the proposed locations of "to be determined" well M05-19 and L05-07. The existing discussion of the "to be determined" monitoring wells for Evaluation Area 2 that is included in Section A1.2.3 was revised to include the proposed well numbers (M05-17 and M05-18). Because Evaluation Area 2 is within Evaluation Area 1, it is appropriate to retain the initial reference to these wells in Section A1.1.3.2.

The rationale and list of analyses for geotechnical samples are provided in DQO Table 1-6, and the test methods are provided in QAPP Worksheet 19.

Specific Comment 29.

Appendix A1 to the SAP, Section A1.1.3.3 – Monitoring Well Sampling. A full round of samples should be collected from new and previously existing monitoring wells during the supplemental RI and analyzed for the full-suite of VOCs, metals, and 1,4-dioxane so that data interpretations presented in the RI report represent a single sampling event.

Response to Specific Comment 29.

Attachment A, SAP Appendix A1, Section A1.1.3.3.

SAP Appendix A1, Section A1.1.3.3 was revised to include these analyses as described in the response to Specific Comment 9.

Specific Comment 30.

Appendix A1 to the SAP, Section A1.1.3.4 – Subslab Soil Gas Sampling. The SAP should clearly state that the building is currently vacant and the risk is being evaluated for hypothetical future building occupants

Response to Specific Comment 30.

Attachment A, SAP Appendix A1, Section A1.1.3.4.

Text was revised to clearly state that Building 5 is currently vacant and that the indoor air pathway risk evaluation is for hypothetical future building occupants.

Specific Comment 31.

Appendix A1 to the SAP, Section A1.2.3 – Proposed Sampling Rationale and Design. The objectives for Evaluation Area 2 should include a provision to assess the vertical extent of groundwater contamination if shallow groundwater is found to contain elevated levels of VOCs.

Response to Specific Comment 31.

Attachment A, SAP Appendix A1, Section A1.2.3.

The proposed sampling design was revised to include collection of discrete groundwater samples in both the shallower and deeper portions of the FWBZ in order to provide data to assess the vertical extent if groundwater is found to contain elevated levels of VOCs.

Specific Comment 32.

Appendix A1 to the SAP, Section A1.3 – Evaluation Area 3. The following comments pertain to this section:

- Section A1.1.3 states that the former foundry and heat treatment areas may be the source of solvent plumes 5-2 and 5-4. Therefore, it is unclear why data gap sampling only specifies "a possible release of metals" in this area.

Response to Specific Comment 32.

Attachment A, SAP Appendix A1, Section A1.3.

The primary data gap for all of Evaluation Area 3 is the potential presence of VOCs in soil that may represent an ongoing release to groundwater. The possible release of metals in the former foundry and heat treatment areas is an additional data gap. The first bullet in Section A1.3 was revised to include the statement "including, but not limited to, the areas adjacent to Plumes 5-2, 5-3, and 5-4".

Specific Comment 33.

Appendix A1 to the SAP, Section A1.3.1 – Historical Use. This section should include a discussion of the areas within Evaluation Area 3 that are proposed for further investigation such as the foundry, heat treatment area, rubber room, and the industrial wastewater lines.

Response to Specific Comment 33.

Attachment A, SAP Appendix A1, Section A1.3.1. The first sentence of this section was revised as follows:

> "The southern portion of Building 5 housed various shops for activities including cleaning, reworking, and manufacturing of metal parts, such as the foundry and the heat treatment shop; plating, painting, and tool maintenance operations; and specialty operations such as the application of radioluminescent paint to aircraft dial faces and rubber manufacturing (Canonie Environmental 1990)."

The portion of the first paragraph describing the industrial wastewater lines was revised as follows:

> "After 1972, an industrial wastewater collection and treatment system was installed and operated until 1991 when plating operations were discontinued in Building 5. A system of industrial wastewater lines were installed that collected plating wastewaters and routed them to a cyanide destruction and plating wastewater pretreatment area prior to treatment at IWTP 5 (shown in Figures A1-6 and A1-7). The wastewater from the plating shops was split into two waste streams: one for alkaline tanks and one for cyanide tanks. The wastewater streams were kept separate until the cyanide stream was treated in a cyanide destruction unit. The two waste streams were then rerouted together to pretreatment plant IWTP 5) located near the southwestern corner of Building 5 (Figure A1-6) prior to discharge to the Basewide NAS Alameda industrial wastewater system."

Specific Comment 34.

Appendix A1 to the SAP, Section A1.3.3 – Proposed Sampling Rationale and Design. The following comments pertain to this section:

- If the analytical results for soil samples indicate that a release of VOCs, metals, or other constituents has occurred that may have impacted groundwater, groundwater sampling may be warranted. The Navy should devise a decision rule in the DQOs that will be followed if soil contaminant impacts indicate strong potential for a release to groundwater. This comment pertains to the following sections as well.
    - A1.4.3
    - A1.5.3
    - A1.6.3
    - A1.7.3.3
    - A1.7.4.3
    - A1.7.5.3
    - A1.8.3

- The Navy will need to identify the locations and depths of samples from previous investigations with elevated metals (lead, iron, thallium and vanadium) as well as the range of concentrations before DTSC can concur with the proposed sampling approach in the foundry and heat treatment shop.
- The SAP states that the source of solvent Plumes 5-2 and 5-4 may be the former foundry and heat treatment area. If these areas are the source of Plumes 5-2 and 5-4, significant VOC contamination may be present beneath these areas. The supplemental RI investigation should be designed to evaluate whether the source of Plumes 5-2 and 5-4 may be the former foundry and heat treatment area. Groundwater samples, in addition to soil samples, should be collected from these areas and analyzed for the same suite of constituents identified for soil samples.
- Due to the possibility that solvents were transported within the industrial sewer lines, soil samples EA3SB28 through EA3SB35 should also be analyzed for VOCs. Additional samples should be collected at a similar spacing along the segment of the industrial wastewater line that originates near the cyanide and chrome surge tanks and analyzed for the same suite of constituents (metals, hexavalent chromium, cyanide, and VOCs).
- During preliminary discussions on the scope of the supplemental RI between the Navy and the regulatory agencies (June 15, 2006 teleconference), the Navy indicated that groundwater samples would be collected along the industrial wastewater drain lines. The groundwater samples should be analyzed for metals, hexavalent chromium, cyanide, and VOCs.
- The SAP should indicate the purpose of the geotechnical analyses that will be conducted on the soil sample collected at location EA3SB12. Specifically, what geotechnical analyses will be performed?
- As stated on page A1-41, borings EA3SB36 through EA3SB39 will be located adjacent to and on the assumed downgradient side of each feature. These borings should also be located as close to the feature of interest as possible, or at an obvious low point or crack/joint.
- The Navy should indicate how the data gap regarding "confirmation of removal of soil with elevated concentrations of chromium and lead at the limits of the cadmium excavation area" will be addressed.

Response to Specific Comment 34.

Attachment A, SAP Appendix A1, Section A1.3.3.

First Comment Bullet – Because the rationale for conducting soil sampling is the presence of known VOC, hexavalent chromium, and cyanide contamination in groundwater, in most cases, no additional groundwater sampling will be needed. A third Decision Logic was added for discrete groundwater sampling if soil sample results indicate the presence of other constituents for areas where no previous groundwater sampling for these constituents was conducted (New Figure A1-18 added and existing figure renumbered as Figure A1-19). Figure A1-18 includes footnotes defining the criteria for determining whether soil sample results indicate a "potential source of groundwater contamination" and defining the criteria for what constitutes a "consistent with known nature and extent". A fourth figure entitled Decision Logic for SWMU Step-Out Groundwater Sampling (Figure A1-20) has been added, as described in the response to General Comment F above.

The following addresses the potential need for additional groundwater sampling for each section specified in this comment:

Section A1.3.3 Evaluation Area 3.

- No groundwater sampling and analysis is needed at soil sampling locations intended to characterize VOC concentrations in soil above the known VOC groundwater plume (applies to all sampling points within Evaluation Area 3).
- For the former location of AST 005H and the five SWMU sampling locations, the existing decision logic (Figure A1-16) applies as described in the last paragraph of Section A1.3.3.

- For the eastern portion of Building 5 (including the foundry, heat treatment shop, and rubber shop), where the presence of metals in soil is a data gap, the new Decision Logic for discrete groundwater sampling will apply.
- For the sampling along the industrial wastewater lines, historical groundwater sampling has confirmed metals, hexavalent chromium, and cyanide in groundwater, plus as described in response to Specific Comment 34, discrete groundwater sampling will be conducted at three of the soil sampling locations along the industrial wastewater lines.

Section A1.4.3 Evaluation Area 4.

- For the Aircraft Maintenance Line, where the presence of metals in soil is a data gap, the new Decision Logic for discrete groundwater sampling will apply.
- For the Battery Acid shop, paint mixing area and the four SWMU sampling locations, the existing decision logic (Figure A1-16) applies as described in Section A1.4.3.

Section A1.5.3 Evaluation Area 5.

- No groundwater sampling and analysis is needed at soil sampling locations intended to characterize VOC concentrations in soil above the known VOC groundwater plume (applies to all sampling points within Evaluation Area 5).
- For the former location of Building 348 (EA5SB17) and the two SWMU sampling locations, the existing decision logic (Figure A1-16) applies as described in Section A1.5.3.
- For the sampling along the industrial wastewater lines, historical groundwater sampling has confirmed metals, hexavalent chromium, and cyanide in groundwater, plus as described in response to Specific Comment 38, discrete groundwater sampling will be conducted at the two soil sampling locations along the industrial wastewater lines.

Section A1.5.3 Evaluation Area 6

- No groundwater sampling and analysis is needed at soil sampling locations intended to characterize VOC and TPH concentrations in soil above the known VOC groundwater plume (applies to all sampling points within Evaluation Area 6 north of Data Gap Building 500).
- Because the presence of PCBs in soil is a data gap, the new decision logic for discrete groundwater sampling will apply for Evaluation Area 6.
- For the three SWMU sampling locations, the existing decision logic (Figure A1-16) applies as described in Section A1.6.3.
- For Data Gap Buildings 34 and 500, text in Section A1.7.2.3 was revised to state that the existing decision logic for SWMUs (Figure A1-16) applies.

Section A1.7.3.3 Data Gap Buildings 43, 44, 102, 347, and 505

- As described in response to General Comment F, the Work Plan was revised to include discrete groundwater sampling for the four buildings where little groundwater sampling and analysis was conducted (Building 347 is adjacent to an existing monitoring well). In addition, Section A1.7.3.3 was revised to state that the existing decision logic for SWMUs (Figure A1-16) applies.

Section A1.7.4.3 Data Gap Building 405, Section A1.7.5.3 Data Gap Building 415, and Section A1.8.3 Data Gap Building 400

- The new decision logic for discrete groundwater sampling will apply for Data Gap Buildings 405, 415, and 400.

Second Comment Bullet – The sample depths and analytical results for the two samples (locations 054-002-011 and 054-002-012) collected in the foundry and heat treatment shop area are presented in Section A1.3.2.3, the

depths and concentrations of metals exceeding PRGs are presented in Table A1-17, and locations are shown on Figure A1-6. Text was revised to cite concentration ranges for iron, lead, thallium, and vanadium.

Third Comment Bullet – Historical groundwater sampling has already confirmed the presence of VOCs in groundwater in the former foundry area (see Figures A1-3 and A1-4). As described in response to Specific Comment 26, there are already nine planned soil and groundwater sampling locations in Building 5 adjacent to the area of Plumes 5-2 and 5-4 (EA3SB24 through EA3SB27, EA3SB36, EA3SB37, SND70SB01, SM01SB01, and SM02SB01).

Fourth Comment Bullet – For soil sampling locations EA3SB28 through EA3SB35, samples will also be analyzed for VOCs and 1,4-dioxane. Two additional soil sampling locations (EA3SB40 and EA3SB41) were added along the segment of the industrial wastewater line that originates near the cyanide and chrome surge tanks and samples will be analyzed for the same suite of constituents (metals, hexavalent chromium, cyanide, and VOCs and 1,4-dioxane).

Fifth Comment Bullet – Groundwater sampling was added at three soil sampling locations along the industrial wastewater line (EA3SB29, and new locations EA3SB40 and EA3SB41).

Sixth Comment Bullet – The rationale and list of analyses for geotechnical samples are provided in DQO Table 1-6, and the test methods are provided in QAPP Worksheet 19.

Seventh Comment Bullet – Text on page A1-41 was revised to state "The borings will be located as close to the feature of interest as possible, or at an obvious low point or crack/joint, and on the assumed downgradient side..."

Eighth Comment Bullet – Additional text was added in Section A1.3.3 to clarify that this data gap is being addressed by the sampling locations along the industrial wastewater lines at the southern limits of the cadmium excavation area (EA3SB28, EA3SB34, EA3SB40, and EA3SB41).

Specific Comment 35.

Appendix A1 to the SAP, Section A1.4.1 – Historical Use. This section should include a discussion of the areas within Evaluation Area 4 that are proposed for further investigation, such as the battery acid shop and paint mixing areas.

Response to Specific Comment 35.

Attachment A, SAP Appendix A1, Section A1.4.1.

No additional text is needed. The existing second bullet describes the battery acid shop and the paint mixing areas.

Specific Comment 36.

Appendix A1 to the SAP, Section A1.4.3 – Proposed Sampling Rationale and Design. The following comments pertain to this section:

- DTSC cannot concur with the sampling approach in the Aircraft Maintenance Line area without further information on the previous data from this area. The Navy should identify the locations and depths of the previous samples with elevated metals and provide the range of concentrations.
- A closer spacing of samples should be used to evaluate locations where elevated metals were previously found in soil in Evaluation Area 4. For those locations, at least three samples should be collected at a spacing of approximately 25 feet from the original sample and analyzed for metals.

The SAP should indicate the purpose of the geotechnical analyses that will be conducted on the soil sample collected at location SM05B02. Specifically, what geotechnical analyses will be performed?

Response to Specific Comment 36.

Attachment A, SAP Appendix A1, Section A1.3.3

First Comment Bullet – The analytical results for the samples (locations 054-001-003 through 054-001-007) collected in Aircraft Maintenance Line area are presented in Section A1.4.2.3, the depths and concentrations of metals exceeding PRGs are presented in Table A1-17, and locations are shown on Figure A1-8. Where not already provided, text was revised to cite concentration ranges for metals.

Second Comment Bullet – For previous sampling locations 054-001-003, 054-001-005, 054-001-006, and 054-001-007, at which metals results exceeded PRGs, currently planned soil sampling locations were adjusted and six new soil sampling locations (EA4SB23 through EA4SB28) were added to provide three sampling locations at a distance of approximately 25 feet from the each of the original sampling locations and spaced around each original sampling location at positions corresponding to the points of an equilateral triangle.

Third Comment Bullet – The rationale and list of analyses for geotechnical samples are provided in DQO Table 1-5, and the test methods are provided in QAPP Worksheet 19.

Specific Comment 37.

Appendix A1 to the SAP, Section A1.5 – Evaluation Area 5. This section should indicate that Building 415 is addressed in Section 1.7, which discusses buildings at IR Site 5 that have been identified as data gaps.

Response to Specific Comment 37.

Attachment A, SAP Appendix A1, Section A1.5.

No revision is needed. The last paragraph of Section A1.5.3 directs the reader to Section 1.7.

Specific Comment 38.

Appendix A1 to the SAP, Section A1.5.3 – Proposed Sampling Rationale and Design. The following comments pertain to this section:

- The Navy should include the locations and depths of the previous data that contained elevated chromium and lead and the range of concentrations.
- The Navy should include a decision rule that will be applied if the groundwater sample collected from EA5SB17 exceeds screening criteria.
- Due to the possibility that solvents were transported within these industrial sewer lines, soil samples EA5SB18 through EA5SB19 should also be analyzed for VOCs. Groundwater samples should also be collected from these locations and analyzed for metals, hexavalent chromium, cyanide, and VOCs.
- A soil sample should be proposed within the 100-foot grid that is roughly centered on Building 615 in Evaluation Area 5. The Navy should add a sample location within this grid.
- Due to the storage of chromium and cyanide in Building 261, this building was identified as a data gap. Samples should be collected from the vicinity of Building 261 and analyzed for hexavalent chromium and cyanide in addition to VOCs. (This data gap should be discussed in Section 1.7 for consistency.)
- Analyses for polychlorinated biphenyls (PCBs) were not performed on previous samples collected from the hazardous waste storage area and this was identified as a data gap. Thus, soil samples should be collected from the hazardous waste storage area and analyzed for PCBs. The single sampling location proposed for Building 415 may not be sufficient.

The SAP should indicate the purpose of the geotechnical analyses that will be conducted on the soil sample collected at location EA5SB14. Specifically, what geotechnical analyses will be performed?

Response to Specific Comment 38.

Attachment A, SAP Appendix A1, Section A1.5.3.

First Comment Bullet – The analytical results for three samples (locations 057-001-001, 057-001-003, and 261-S8) with elevated chromium and lead concentration are presented in Sections A1.5.2.3 and A1.5.2.5, the depths and concentrations of metals exceeding PRGs are presented in Table A1-17, and locations are shown on Figure A1-9 (renumbered as A1-10). Text was revised to cite concentrations ranges for chromium and lead.

Second Comment Bullet – No additional text is needed. This topic is already addressed in Section A1.5.3, page A1-56, in the paragraph beginning "In the event that analytical results…".

Third Comment Bullet – For soil sampling locations EA5SB18 and EA5SB19, samples will also be analyzed for VOCs and 1,4-dioxane. Groundwater sampling was added at these two locations and samples will be analyzed for the same suite of constituents (metals, hexavalent chromium, cyanide, and VOCs and 1,4-dioxane).

Fourth Comment Bullet – An additional sampling point (EA5SB20) was added within the grid in which Building 615 is located.

Fifth Comment Bullet – Sampling locations EA5SB13 were moved into the footprint of former Building 261 and soil samples will be analyzed for metals, hexavalent chromium, and cyanide in addition to VOCs.

Sixth Comment Bullet – Section A1.7.5.3 was revised to include a second sampling location (DG415SB02) within the former hazardous waste storage area encompassing former Building 415. Soil samples for this location will be analyzed for the same suite of analytes as for sampling location DG415SB01.

Seventh Comment Bullet - The rationale and list of analyses for geotechnical samples are provided in DQO Table 1-6, and the test methods are provided in QAPP Worksheet 19.

Specific Comment 39.

Appendix A1 to the SAP, Section A1.6 – Evaluation Area 6. This section should indicate that Buildings 34 and 500 are addressed in Section 1.7, which discusses buildings at IR Site 5 that have been identified as data gaps.

Response to Specific Comment 39.

Attachment A, SAP Appendix A1, Section A1.6.

No revision is needed. The last paragraph of Section A1.6.3 directs the reader to Section 1.7.

Specific Comment 40.

Appendix A1 to the SAP, Section A1.6.1 – Historical Use. DTSC questions the possible location of a former solvent tank shown on Figure A-10 in the northern portion of Area 6. The Navy should state the source of this information, and the location and size of the tank. Also, the locations of underground storage tanks (USTs) 5-2 and 5-3 are not shown on Figure A1-10. These features should be identified.

Response to Specific Comment 40.

Attachment A, SAP Appendix A1, Section A1.6.1.

The draft OU-2 RI Report (TtEMI 1999a) identified this possible solvent tank and showed the location on a figure. If additional information documenting this possible solvent tank is located, it will be included in the RI report.

Figure A1-10 was revised to include labels to identify the UST symbols that represent the former locations of USTs 5-2 and 5-3, which together form AOC 005.

Specific Comment 41.

Appendix A1 to the SAP, Section A1.6.3 – Proposed Sampling Rationale and Design. The following comments pertain to this section:

- A data gap pertaining to UST 5-3 was identified because the former waste oil tank location was not previously sampled for PCBs, lead, or VOCs. Soil samples should be collected within the footprint of former UST 5-3 and analyzed for VOCs, TPH, metals, and PCBs.

The sampling location shown on Figure A1-10 to address AST 005G (location SAST5SB01) should be moved so that it is located as close as possible to, and on the downgradient side of, the former AST.

Response to Specific Comment 41.

Attachment A, SAP Appendix A1, Section A1.6.3.

First Comment Bullet – No soil sampling is planned within the UST excavation footprint that most likely would have been backfilled with clean fill soil. Planned soil sampling locations for AOC 005, which comprises former locations of UST 5-2 and UST 5-3, are designed to be just outside of the excavation footprint. Confirmation soil samples (030-MOD1-283 and 284) collected after removal of UST 5-3 were analyzed for VOCs, TPH, SVOCs, and metals. Text in Section A1.6.2.5 was revised to include this information.

Second Comment Bullet – Sampling location SAST5SB01 was moved so that it is located as close as possible to, and on the downgradient side of, the former AST. Note that this sampling location also serves to characterize PCBs in soil in the vicinity of former UST 5-3, which was located approximately 15 feet north (upgradient) of AST 005G.

Specific Comment 42.

Appendix A1 to the SAP, Section A1.7.1.3 – Proposed Sampling Rationale and Design. The basis for the proposed locations of soil samples to be collected beneath Building 6 (DG006SB01 through DG006SB03) should be provided. Are these samples located adjacent to features that may have had a chemical release?

Response to Specific Comment 42.

Attachment A, SAP Appendix A1, Section A1.7.1.3

Text was revised to clarify the basis for the proposed sampling locations. Specifically, two sampling points are located in the vicinity of the former garage bays and one sampling point is in the northwest corner of the building nearest OWS 006B. As presented in Section A1.7.1.1, the EBS (IT 2001a) describes the location of OWS 006B as "in the northwest corner" of the building, which is in conflict with the mapped location for this OWS.

Specific Comment 43.

Appendix A1 to the SAP, Section A1.7.3.3 – Proposed Sampling Rationale and Design. The following comments pertain to this section:

- This section discusses collecting soil and discrete groundwater samples, but Figure A1-12 shows only soil sampling locations at these data gap areas. Are groundwater samples proposed for this area? If so, these should be included on Figure A1-12.
- The SAP should indicate the purpose of the geotechnical analyses that will be conducted on the soil sample collected at location DG102SB01 Specifically, what geotechnical analyses will be performed?

Response to Specific Comment 43.

Attachment A, SAP Appendix A1, Section A1.7.3.3.

First Comment Bullet –Figure A1-12 and SAP Table 1-3 were revised to include groundwater sampling at Data Gap Buildings 43, 44,102, and 505. Note that existing monitoring well M05-02 and the planned location of monitoring wells L05-02 and D05-09 are next to and downgradient of Building 347.

Second Comment Bullet - The rationale and list of analyses for geotechnical samples are provided in DQO Table 1-5, and the test methods are provided in QAPP Worksheet 19.

Specific Comment 1.

DTSC agrees that in those cases where there are fewer than 10 samples (Section 2.2.2, page E2-2) the maximum concentration may be used as the Exposure Point Concentration (EPC). In cases where there are more than 10 samples, calculation of the EPC should use the most current available version of the U.S. EPA ProUCL software rather than version 2.3 (Section 2.2.2, page E2-2). The most current release version, as of October 25, 2006, is 3.00.02 (http://www.epa.gov/esd/tsc/software.htm).

Response to Specific Comment 1.

RAWP, Section 2.2.2, page E2-2.

As requested, the most current version of ProUCL was added for EPC calculations.

Specific Comment 2.

There is no mention of any process in the HHRA methodology (Section 2, paged E2-1 though E2-5) to reduce the number of Contaminants of Potential Concern (COPCs). Health protective media concentrations (e.g., EPA Region 9 Preliminary Remediation Goals [PRGs]), meant to screen sites, should not be used as a 'bright line' criterion to reduce the number of COPCs.

Response to Specific Comment 2.

RAWP, Section 2, page E2-1 through E2-5.

There is no reduction in the number of COPCs prior to calculating risks; all organic and inorganic analytes reported at least once are included in the risk assessment calculations.

Specific Comment 3.

Arsenic in groundwater is attributed to 'background' at OU-2C (Section 2.5.2, page 2-27). Detected and estimated (J-qualified) arsenic 'ambient' groundwater concentrations range from 1.4 µg/L to 40.7 µg/L (n=107; File Name *BCK_GW_METALS_111202.xls).* Three of 31 (9.67%) groundwater arsenic detects are in excess of 40.7 µg/L (85.8 µg/L, 79 µg/L, and 64.6 µg/L) (Table A1-10). Once the additional OU-2C groundwater samples are collected and analyzed, a statistical test should be performed to determine whether OU-2C groundwater arsenic concentrations are, in fact, 'ambient' concentrations. The statistical test chosen should focus on whether the extremes of the two groups differ (e.g., a quantile test) as opposed to focusing on whether the central tendencies differ. Arsenic in groundwater must be included in the estimate of cancer risk and/or hazard for total concentration in the Human Health Risk Assessment (HHRA).

Response to Specific Comment 3.

See response to Specific Comment 2 above. The Human-Health Risk Assessment (HHRA) includes the total arsenic concentration in the estimate of cancer risk and/or hazard.

Specific Comment 4.

Analysis for 1,4-dioxane, "a common additive to chlorinated degreasing solvents", has not been conducted (Section 2.5.2, page 2-29) and should be incorporated into the suite of analytes of this OU-2C sampling and analysis event.

Response to Specific Comment 4.

The supplemental RI sampling includes analysis for 1,4-dioxane. Please refer to SAP Tables 1-2, 1-3, 1-6 through 1-8, and 2-2.

Specific Comment 5.

Groundwater, soil vapor and soil samples should all be analyzed for naphthalene, currently classified as a carcinogen by the Office of Environmental Health Hazard Assessment (OEHHA). Although EPA Method TO-15 recoveries of naphthalene may be variable (Hayes, et al., 2005), naphthalene can apparently be accurately measured by EPA method TO-15 being used in this investigation as long as correct naphthalene standards with appropriate moisture content are used.

Response to Specific Comment 5.

Please refer to SAP Table 2-2 which demonstrates that planned analytical methods for VOCs (U.S. EPA Method 8260B) for soil and groundwater samples include naphthalene. As noted, EPA Method TO-15 will be used for soil gas analysis and will include naphthalene as a target analyte.

SPECIFIC COMMENTS ATTACHMENT A – RISK ASSESSMENT WORK PLAN

Specific Comment 6.

The proposed homegrown produce exposure period of 20 percent of the residential use year (i.e., 70 days per year) (Section 2.2.3, page E2-3) is a reasonable approximation for the probable central tendency exposure period. HERD discussed this exposure route with Dr. Sophia Serda, U.S. EPA Region 9, on October 30, 2006 and EPA also agrees this value is representative.

Response to Specific Comment 6.

Comment noted. No response necessary.

Specific Comment 7.

The Federal Guidance Report No. 13 (2001) is proposed as the source for radioisotope cancer slope factors (Section 2.3, page E2-4). Regardless of source, the cancer slope factors should agree with the most recent values available from the U.S. EPA (http://www.epa.gov/superfund/resources/radiation/radrisk.htm#prg) for health assessment of Superfund sites. DTSC defers to the California Department of Health Services should discrete sources be identified or in the event of differing advice on radioisotope cancer slope factors.

Response to Specific Comment 7.

RAWP, Section 2.3, page E2-4. Text was revised to confirm that the most recent values available for cancer slope factors will be used.

Specific Comment 8.

Total risk estimates for OU-2C sites determined to be contaminated with radioisotopes (Section 2.3, pageE2-4) must be presented as the sum of the incremental risk associated with both chemical exposure and radiological exposure (OSWER, 1997).

Response to Specific Comment 8.

RAWP, Section 2.3, page E2-4. Text was revised to confirm that total risks will be presented as the sum of the incremental risk associated with both chemical and radiological exposure.

Specific Comment 9.

DTSC agrees that evaluation of the inhalation pathway may not be required for the representative vertebrate receptors included in the OU 2-C ERA. Please clearly explain, in the text, why this exposure pathway is considered 'not applicable' (Section 3.2.6, page E3-7).

Response to Specific Comment 9.

RAWP, Section 3.2.6. The text was revised to clarify the rationale regarding the inhalation exposure pathway.

Specific Comment 10.

The San Francisco Regional Water Quality Control Board (SFRWQCB) Environmental Screening Level (ESL) for mercury in marine waters (2.5 E-02 μg/L) should be used in the screening level ERA for aquatic receptors, rather than the proposed 0.94 μg/L concentration (Section 3.3.1, page E3-8).

Mr. Erich Simon of the Water Board provided the following additional comment on this issue: "After review of Jim Polisini's comment #10 on the OU-2C Work Plan regarding the appropriate mercury screening level for use in the ERA, we are in agreement with his conclusion that the 0.94 ug/L level specified in the Work Plan (from the 2002 National Recommended Water Quality Criteria) is not appropriate. In fact, this criterion is not applicable at all within the state of California. The value stated in the most current Basin Plan (Table 3-3, 0.025 ug/L), which is the same value specified in our 2/05 ESLs, overrides the California Toxics Rule criteria, which override the National Toxics Rule criteria. Any changes to the criteria specified within our Basin Plan would require an official Basin Plan Amendment, which is an elaborate and time-consuming process."

Response to Specific Comment 10.

RAWP, Section 3.3.1.

Although the 0.025 µg/L was established by EPA's 1984 mercury review, this value is based on a 1 ppm FDA Action Level and a Bioconcentration Factor (BCF) of 40,000 L/kg that is protective of "the marketability" of saltwater fish and shellfish for human consumption. This value is not based on potential risk to ecological receptors. Because Alameda Point is within the area addressed by the San Francisco Bay Basin Plan, the OU-2C ERA will use the 0.025 µg/L for screening purposes. However, ERA decisions based on this value for mercury for fish and invertebrates may not be valid.

National Recommended Ambient Water Quality Criteria (AWQC) provided by EPA since 1995 include a CCC of 0.94 µg/L, which is based on a review of more than 50 toxicity values for saltwater fish and invertebrates, and therefore has ecological and ERA relevance. The 0.94 ug/L value was derived from the Final Chronic Value (1.106 µg/L) listed in Table 3 of EPA's 1984 mercury review, and the 0.85 conversion factor (total to dissolved concentrations) provided by EPA.

U.S. FWS and U.S. EPA have been engaged in a debate regarding the CCC value. U.S. FWS is concerned about the protection of the endangered species in San Francisco Bay and holds the opinion is that 0.94 µg/L is not protective of the California least tern. However, for ERA calculations at Alameda Point, the California least tern, along with a few other birds, is evaluated separately. The separate exposure scenario dedicated to the California least tern provides an ERA for that species. The 0.94 µg/L value is used only for the ERA for fish and invertebrates.

The 0.025 µg/L value will be used in the screening-level ERA. The 0.94 µg/L value will be used for aquatic life (fish and invertebrates) in the refined ERA.

Specific Comment 11.

The hierarchy of aquatic toxicity values should be modified so that the 'available data from the scientific literature' (current fourth bulleted group) is the third preferred source over the 'Gold Book' values (current third bulleted group) (Section 3.3.1, page E3-8). Twenty years of aquatic testing and research have been published subsequent to the publication of the 'Gold Book'.

Response to Specific Comment 11.

RAWP, Section 3.3.1. The hierarchy of toxicity values was revised as requested.

Specific Comment 12.

Recent re-evaluation (Birak, et al., 2001 and EPA 2005) of the Travis and Arms (1988) soil-to-plant Bioaccumulation Factors (BAFs) should be incorporated into applicable estimation equations for the ERA. The link to the EPA (2005) changes for plant uptake can be found in the Update Sheet at http://www.epa.gov/ecotox/ecossl/.

Response to Specific Comment 12.

RAWP. The requested soil-to-plant BAF information was incorporated.

Specific Comment 13.

HERD agrees that selection of a median value BAF is appropriate when multiple BAF estimates are available (Section 3.4, page E3-10) as long as the BAF measurements or estimations are of equal rigor. However, please provide a more detailed explanation and justification for the selection of the single chemical or group-specific BAF where multiple BAFs are available. This could most easily be accomplished with a multiple-column table listing the available BAFs for each source in columns and the COPECs in rows with the value selected highlighted or shaded in some manner.

Response to Specific Comment 13.

RAWP, Section 3.4. Explanation and justification were provided for the selection of median BAF values when more than one BAF is available.

Specific Comment 14.

The Exposure Path diagram (Figure 1-1) indicates, in note b, that groundwater exposure will only be considered a complete pathway if there is evidence that groundwater is discharging to San Francisco Bay, Seaplane Lagoon or Oakland Inner Harbor. As this work plan outlines supplemental characterization, please indicate in footnote b whether this determination has been already made based on existing data or will be made subsequent to the supplemental sampling. The significant detail provided for aquatic toxicity evaluation in the Draft work plan would indicate that the determination has been made that groundwater discharges to San Francisco Bay surface waters.

Response to Specific Comment 14.

RAWP, Figure 1-1.

The footnote for Figure 1-1 was revised to state that this information will be determined subsequent to the supplemental RI sampling.

Specific Comment 15.

The screening-level risk assessment process is described as medium-by-medium (Figure 3-1). In a medium-by-medium evaluation the figure should be amended so that the action after the first decision point of 'Complete exposure pathway present' for a 'no' response is 'Delete preliminary COC from further consideration for medium under evaluation'.

Response to Specific Comment 15.

RAWP Figure 3-1 was amended as requested.

Specific Comment 17.

This work plan proposes to evaluate herbivorous and insectivorous diets in both the SLERA and Step 3 refined SLERA (Table 3-3). However, different dietary regimes are proposed for the same representative species in the SLERA versus the Step 3A refined SLERA. Please provide some rationale for estimating ecological hazard for the same representative species as an herbivore in the SLERA but as an invertivore (e.g., song sparrow) in the Step 3A refined SLERA (Table 3-3). At the same time a different representative species is evaluated as an invertivore in the SLERA but as an herbivore (e.g., American robin) in the Step 3A refined SLERA.

Response to Specific Comment 17.

Rationale was provided for the herbivorous and insectivorous dietary regimes of the representative species.

Specific Comment 18.

A subset of the aquatic toxicity values (Table 3-4) was checked and all aquatic toxicity values checked are acceptable. However, the recent (i.e., since 1986) scientific literature should be checked for more protective concentrations for the mono-substituted benzene compounds and Polycyclic Aromatic Hydrocarbons (PAHs) where the 'Gold Book' is cited as the source.

Response to Specific Comment 18.

The scientific literature will be checked for toxicity more current than the 'Gold Book' values. If this information is published, it will be cited.

CONCLUSIONS

Comment.

Several clarifications and modifications are required in the HHRA, the SLERA and the refined, Step 3A, ERA methodologies outlined. HERD does not consider these extensive changes.

The modification with the most potential impact to the SLERA is the use of the SFRWQCB Environmental Screening Level of 0.94 μg/L water concentration for mercury. A minor clarification is the inclusion of a table presenting the range of Bioaccumulation Factors (BAFs) available indicating the value selected as representative. The second minor clarification is validation that more recent scientific studies have not superceded the 'Gold Book' substituted benzene and PAH toxicity values published in 1986.

Response to Comment.

Comment noted. Text was revised to include the requested modifications as described in the Comment/Responses above.

RESPONSE TO COMMENTS ON
DRAFT WORK PLAN FOR SUPPLEMENTAL REMEDIAL INVESTIGATION SAMPLING AT OPERABLE UNIT 2C
ALAMEDA POINT, ALAMEDA, CALIFORNIA
DATED SEPTEMBER 2006
CTO-0081

Comments from RWQCB, 11/20/2006

GENERAL COMMENTS

General Comment 1.

Petroleum Screen Criteria – Please use the appropriate screening criteria for all TPH program constituents as established in the *Interim Final Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater* prepared by the San Francisco Bay Water Board dated February 2005 (ESLs).

Response to General Comment 1.

Text and tables (Table 2-2, QAPP Worksheet 15-Soil and Water, and Table A1-2) were revised to refer to the 2005 ESLs.

SPECIFIC COMMENTS

Specific Comment 1.

Section 1, pg 1-1: Bullet labeled "12 data gap areas" - The buildings listed for IR Site 5 includes Building #34, which seems to be located in IR Site 12, based on Figure 2-1. Also, buildings 282 and 415 are listed here, but not on Figure 2-1. Please correct this discrepancy.

Response to Specific Comment 1.

Figure 2-1 was revised to include labels for the former locations of Building 34 (northeast corner of Building 500) and Building 415 (southeast corner of Building 5). The former location of Building 282 is already shown and labeled (southeast corner of Building 6). Note that the former location of Building 34-1, which is not a data gap, is located at IR Site 12.

Specific Comment 2.

Section 2.2.3, pg 2-13: Underground Storage Tank table – USTs 10-1 through 10-6 are listed as removed in this table, whereas in the Underground Storage Tank Summary Report (4/10/03, Tetra Tech) these tanks are listed as closed in place and filled with sand. Please address this discrepancy.

Response to Specific Comment 2.

The UST table on page 2-13 was revised to show that USTs 10-1 through 10-5 were closed in place and only UST 10-6 was removed.

Specific Comment 3.

Figure 1-2: IR Sites 8 and 26 are shown in this Site Location Map for OU-2C, even though they are not part in OU-2C? Please remove reference to sites 8 and 26. Figure 1-2 in Attachment A needs to be corrected as well.

Response to Specific Comment 3.

The boundaries for OU-2C are clearly defined by the blue border on Figure 1-2. Site location maps typically include adjacent IR sites to provide an indication of other nearby potential source areas and to show locations of site features relevant to the area under investigation (e.g., IR Site 8 and 26 monitoring well locations). Therefore, Figure 1-2 will not be revised to remove IR Sites 8 and 26.

Specific Comment 4.

Figure 2-1: The zoomed out map on the upper right corner of this figure makes it look like Alameda Point is floating in the San Francisco Bay without the rest of Alameda attached. Please fix this map so it looks correct.

Response to Specific Comment 4.

Since a previous figure (Figure 1-2) shows the relationship between Alameda Point and other land areas, Figure 2-1 was not revised.

Specific Comment 5.

Attachment A: Table 1-2 – Evaluation Area 3 – At the 10/17/06 Alameda Point BCT meetings, there was discussion about DNAPL Plume 5-3 being within evaluation area 3. Why are only 2 groundwater samples proposed to be taken within evaluation area 3?

Response to Specific Comment 5.

The DNAPL source removal actions, consisting of the six-phase heating activity, include groundwater monitoring during and after the removal action in order to monitor the effectiveness and possible rebound. In SAP Appendix A1, Foreword, Page A1-ii, text was added to clarify that the monitoring data from wells installed as part of the six-phase heating activity, including monitoring for rebound effects, will be included in the OU-2C RI report.

Specific Comment 6.

Attachment A: Table 2-2 - Some analytes shown in this table have Target Method Reporting Limits above ESLs (These analytes were called out with footnote 'f'). Please include a section in the report that discusses why these constituents are being analyzed using methods with detection limits above screening levels. See comment #S8 also.

Response to Specific Comment 6.

Text was added to SAP Section 2.4 to discuss analytes with detection limits above regulatory comparison criteria.

Specific Comment 7.

QAPP Worksheets: QAPP Worksheet 3 - Please update the distribution list so that the Water Board project manager is Erich Simon, (510) 622-2355, ersimon@waterboards.ca.gov.

Response to Specific Comment 7.

Attachment A, QAPP Worksheet 3 was updated as requested.

Specific Comment 8.

QAPP Worksheets: QAPP Worksheet 15 – Soil - Some analytes shown in this table have Project Quantitation Limits and Method Detection Limits above ESLs (These analytes were called out with footnote 'e'). Please include a section in the report that discusses why these constituents are being analyzed using methods with detection limits above screening levels.

Response to Specific Comment 8.

Text was added to SAP Section 2.4 to discuss analytes with detection limits above regulatory comparison criteria.

Specific Comment 9.

Section A1.2.2.1, pg. A1-31: EBS, 2001 Soil and Groundwater Sampling – Please include at what depths the Phase 2B HydroPunch groundwater sampling occurred at. Also, please define what 'elevated concentrations' means in the third to last sentence (above PRGs or ESLs?)

Response to Specific Comment 9.

Appendix A1, Section A1.2.2.1, Page A1-31.

Text was revised to indicate the depth of hydropunch samples (10 to 12 feet bgs) and the third to last sentence was revised as follows:

"Concentrations exceeding MCLs were reported for 1,2-DCE (240 to 320 µg/L) and vinyl chloride (4 to 79 µg/L) in two of the groundwater samples."

Specific Comment 10.

Table A1-1: Appendix A1 – MCLs for Chromium – The MCLs for chromium listed are 100 µg/L for Federal MCL and 50 µg/L for California Modified MCL. Please specify these MCLs are for Total Chromium.

Response to Specific Comment 10.

Appendix A1, Table A1-1 was revised to specify that 100 and 50 µg/L are the federal and California MCLs, respectively, for total chromium.

Specific Comment 11.

Table A1-6: 2001 result for FWBZ Wells M05-03, M05HW-01, M10-01 – The gasoline result listed here shows that 486,000,000 µg/kg were measured. Please confirm that this is correct, and if so, include a footnote to discuss this measurement.

Response to Specific Comment 11.

This gasoline result is discussed in Section A1.5.2.5, page A1-54. A footnote was added to Table A1-6 to refer the reader to this section.

Specific Comment 12.

Table A1-9: Table – Please specify if chromium results that are presented are total chromium, chromium III, or chromium VI.

Response to Specific Comment 12.

Entries for total chromium in Tables A1-9 and A1-10 were revised to "chromium, total".

RESPONSE TO COMMENTS ON
DRAFT WORK PLAN FOR SUPPLEMENTAL REMEDIAL INVESTIGATION SAMPLING AT OPERABLE UNIT 2C
ALAMEDA POINT, ALAMEDA, CALIFORNIA
DATED SEPTEMBER 2006
CTO-0081

Comments from U.S. EPA, 11/20/2006

GENERAL COMMENTS

General Comment 1.

Please address the impact, if any, on the proposed soil gas sampling, from the ongoing six-phase heating removal actions at Building 5. Include a figure depicting the vertical and lateral area affected by the heating during the current and future removal actions together with the locations of the proposed soil gas samples.

During the teleconference on January 30, 2007, EPA requested that the plan include a clear explanation of the stated purpose of the soil gas sampling and how it was going to be coordinated with the six-phase heating project. EPA requested incorporation of an explanation of how the collection of good quality samples would be accomplished and at what temperature the subsurface needs to be. Additionally, DTSC suggested that subslab soil gas samples be collected 2 to 4 weeks after temperatures returned to ambient following cessation of heating and agreed to provide a reference on subsurface conditions.

Response to General Comment 1.

A detailed discussion has replaced existing text in SAP Appendix A1, Section A1.1.3.4 – Subslab Soil Gas Sampling, in order to provide a clear explanation of the stated purpose of the soil gas sampling, how it will be coordinated with the six-phase heating DNAPL source removal action, and how the quality (representativeness) of data collected in the vicinity of the six-phase heating activity will be evaluated. This discussion clarifies that the number of sampling points expected to be directly impacted by the six-phase heating activity (i.e., located within the boundaries of the activity) is limited (10 of 100 sampling locations), that the area likely to be impacted by elevated groundwater temperature is limited (up to 40 feet from the six-phase heating electrodes), and that collection and removal of steam and vapors generated by the six-phase activity likely mitigates the impact to ambient soil gas concentrations. The following is the text of the new Section A1.1.3.4:

"Soil gas samples will be collected from under the concrete slab at Building 5 at a density of approximately one sample per 6,000 square feet (SAP Figure 2-3) distributed over a grid with spacing of approximately 90 feet between sampling points. Samples will be collected in Summa canisters in accordance with subslab soil sampling procedures and will be analyzed for VOCs plus naphthalene using United States Environmental Protection Agency (U.S. EPA) Method TO-15. The data from this investigation will be used to evaluate the potential risk to the hypothetical future occupants of the building from vapor intrusion of VOCs that may migrate from groundwater to indoor air. Note that Building 5 is currently vacant.

"The primary use of subslab soil gas data will be for risk assessment calculations. Subslab soil gas data will not be used to characterize the nature and extent of soil or groundwater contamination because soil and groundwater are being sampled and analyzed directly. Additionally, subslab soil gas data for VOCs that are also reported in soil and groundwater may be used to evaluate the relative distribution of VOCs among the environmental media.

"The structure currently identified as Building 5 was erected in two stages, with the southern portion built in 1942, followed some years later by the northern portion (5A). The foundations and footers of the two portions of the building may differ, which may influence the distribution of subslab soil gas. To provide for evaluation of subslab soil gas data as impacted by possible subsurface infrastructure differences between the northern and southern portions of Building 5, sampling is planned as follows:

- For the southern portion of the building (approximately 315,000 square feet), 55 subslab soil gas sampling locations are planned, to be numbered EA1SG001 through EA1SG055.

- For the northern portion of the building (approximately 300,000 square feet), 45 subslab soil gas sampling locations are planned, to be numbered EA1SG056 through EA1SG100.

"The ongoing six-phase heating source removal action may impact the quality of subslab soil gas data in the vicinity of Plume 5-3 (Figure A1-2). Ten of the 100 planned subslab soil gas sampling locations are within the boundaries of area currently undergoing six-phase heating activities, including sampling locations EA1SG017, EA1SG018, EA1SG027, and EA1SG028 within the Phase I area (activities completed in January 2007), and sampling locations EA1SG038 through EA1SG040, and EA1SG049 through EA1SG051, within the Phases II and III area. SAP Figure 2-3 shows the portions of the Plume 5-3 addressed by each phase and the larger fenced areas that encompass the removal activities. Note that heating electrodes are all located inside the area delineated by the 10,000 µg/L contour. Elevated groundwater temperatures, collection and removal of soil vapors, and reduction of VOC concentrations in groundwater may impact subslab soil gas data quality; specifically, subslab soil gas concentrations will not be at steady state within the area of the six-phase heating removal action.

"Six-phase heating source removal activities began in August 2006 for Plume 5-3, which is located beneath the former plating shop area in the central area of the southern portion of Building 5 and encompasses an area of approximately 40,000 square feet (Shaw 2007). The removal action is being conducted in three phases (each phase addresses groundwater beneath a surface area of approximately 13,000 square feet) and raises groundwater temperatures in the center of the plume at 12 feet bgs to approximately 90°C. Vapor extraction wells installed to 5 feet bgs collect and remove steam with entrained contaminant vapors from the plume area. Phase I was to be completed in January 2007, with Phases II and III to follow. Monitoring of groundwater temperatures during Phase I of the Plume 5-3 removal action (Shaw 2007) and during the Plume 5-1 removal action completed in 2004 (Shaw 2006) demonstrated that groundwater temperatures are not elevated above ambient (approximately 22 °C) beyond 30 to 40 feet from each heating electrode. Additionally, data from the six-phase heating source removal action for Plume 5-1 (located to the east of the northern portion of the building, as shown on Figure A1-2 and SAP Figure 2-3) indicated that groundwater temperatures at the center of the heated area returned to ambient levels after approximately 1.5 years (Shaw 2006).

"Within the area of Plume 5-3, six-phase heating activities will have impacted soil gas concentrations that were likely at near-steady conditions for the past 10 to 15 years (plating shop activities that were the probable source of VOCs in groundwater were discontinued by 1991), as suggested by calculations presented in the article "Assessing the Significance of Subsurface Contaminant Vapor Migration to Enclosed Spaces" (Johnson et al. 1999). However, subslab soil gas concentrations (i.e., concentrations in the proposed sampling zone at 5 inches below the base of the slab) are likely not significantly affected where groundwater temperatures remain at ambient levels outside the six-phase heating area. The collection and removal of steam with entrained contaminant vapors from above the heated plume area may reduce the impact of the heating activities on soil gas concentrations outside the plume area; specifically, captured vapors cannot migrate beyond the removal area. Reduction of VOCs in groundwater from concentrations greater than 10,000 µg/L to concentrations less than 1,000 µg/L will have a long-term impact on subslab soil vapor concentrations. Regardless of when planned subslab soil gas sampling within the six-phase heating removal action area is conducted (before, during, or after heating), concentrations measured will only be representative of the time of sampling.

"Both the ongoing six-phase heating activities and the subsequent reduction of VOC concentrations in groundwater result in a level of uncertainty as to whether measured soil gas concentrations represent steady-state conditions. As a result, there is a level of uncertainty regarding the representativeness (i.e., quality) of subslab soil gas in the vicinity of Plume 5-3. Therefore, subslab soil gas data from this area will be evaluated prior to use in characterizing risks for the indoor air pathway. However, it is likely that soil gas concentrations will not be greatly impacted outside the area of heated groundwater (i.e., at distance greater than 40 feet from the heating electrodes). To assess the representativeness of subslab soil gas data collected outside the expected radius of influence of the six-phase heating activities, the distribution of VOC concentrations in subslab soil gas in relation to distance from the six-phase heating source removal activities will be examined. In addition, the impact of collection and removal of steam with entrained

contaminant vapors from above the heated plume and the reduction of VOC concentrations in groundwater as a result of the removal action will be taken into consideration.

"To provide for collection of subslab soil gas in conjunction with six-phase heating activities and for evaluation of quality of soil gas data, as impacted by this source removal action in the southern portion of Building 5, sampling is planned as follows.

- Prior to installation of the subslab soil gas sampling probe at all sampling locations within the six-phase heating source removal action area and at selected locations outside the six-phase heating area, temperature measurements will be collected from beneath the slab.
- For the ten subslab soil gas sampling locations that are within the Plume 5-3 area, samples will be collected prior to implementation of heating activities (six-phase heating Phases II and III), if possible, or 2 to 4 weeks after groundwater temperatures have returned to ambient levels. This includes sampling locations EA1SG017, EA1SG018, EA1SG027, and EA1SG028 within the Phase I area, and sampling locations EA1SG038 through EA1SG040, and EA1SG049 through EA1SG051, within the Phases II and III area.
- For the remaining subslab soil sampling locations, which are all more than 40 feet from the six-phase heating electrodes and unlikely to be significantly impacted by the removal action, samples will be collected without restrictions related to the six-phase heating area."

References:

Johnson, P.C., M.W. Kemblowski, and R.L. Johnson. 1999. Assessing the significance of subsurface contaminant vapor migration to enclosed spaces: site-specific alternatives to generic estimates. *Journal of Soil Contamination*, *8*(3):389–421.

Shaw Environmental, Inc. 2006. Final Field Activities Report DNAPL Source Removal Action, Installation Restoration Site 5, Plume 5-1, Alameda Point, Alameda, California. January 25.

_____. 2007. Project Update: Electrical Resistance Heating for DNAPL Source Removal at IR Sites 4 and 5, Alameda Point, Alameda, California. PowerPoint presentation. January.

General Comment 2.

Please describe more fully the scope of the proposed radiological removal action as it relates to Site 5, i.e. the storm/sewer segment running west of Building 5 to the Seaplane Lagoon and the lateral storm drain running from Building 5 to Site 26. Even though the workplan states that it will not address rad issues, the Remedial Investigation Report does need to include all information related to radiological cleanup, including the two areas mentioned above, in order to make a determination of whether further action is needed for the Feasibility Study.

Response to General Comment 2.

For Work Plan Section 3.17 a new paragraph was added to include the following new information on the planned radiological removal action:

"A storm drain radiological removal action is being planned. Preparation of the work plan and the removal activities will be conducted by another Navy contractor. The primary objectives are 1) to research and investigate all previous storm and sewer line removal work in OU-2C, including IR Site 5 and Building 400 and storm drain lines from Building 5 to Seaplane Lagoon, which was done by New World Technology in the fall of 1998 and spring of 1999 (New World Technology 2002), and 2) to complete a time-critical removal action (TCRA) action memorandum and work plan, along with all removal of the storm and sewer lines with radiological contamination in the OU and reconstruction of the storm drain system. The end result of this TCRA at impacted sites will be a final status survey (FSS) document. The FSS will provide the documentation needed to confirm that radiological contamination has been remediated to levels that satisfy criteria established by the Navy Radiological Affairs Support Office (RASO), U.S. EPA, and the California DHS. For radiological contamination associated with storm drains and sewers, the FSS will provide the documentation for the Navy to obtain RASO, U.S. EPA, and DHS concurrence on the release of OU-2C for unrestricted public use as specified by applicable federal and state guidance and policies (NRC 1974, 1992; DHS 1988). "

General Comment 3.

Please be aware when drafting the Remedial Investigation Report and presenting the Human Health Risk Assessment, that the total risk for all contaminants must be included in addition to presenting the incremental risk. Thus the risk due to background inorganics must be included in the risk number representing total risk.

Response to General Comment 3.

In accordance with standard procedures for RIs, both total (background inorganics included) and incremental risk are calculated and all analytes detected at least once are included in the HHRA. Both total and incremental risks are discussed and tabulated in the risk assessment section of the RI report. Additionally, there is no elimination of COPCs prior to risk calculation; all organic and inorganic analytes reported at least once are included in the risk assessment calculations.

SPECIFIC COMMENTS

Specific Comment 1.

Although the SAP states that there will be 100 subslab soil gas sampling locations, Appendix A1 and the SAP do not include a figure depicting the locations where soil gas samples will be collected. Please provide a figure with the soil gas sampling locations.

Response to Specific Comment 1.

A new figure showing subslab soil gas sampling locations has been included in the SAP (Figure 2-3) in the draft final Work Plan.

Specific Comment 2.

Section 2.3.4, Water Quality, fourth paragraph: Please remove the last sentence from this paragraph as it is incorrect. Groundwater with TDS less than 10,000 mg/l is considered a potential drinking water source and thus would be considered potentially suitable for domestic use.

Response to Specific Comment 2.

Work Plan, Section 2.3.4, Page 2-20, fourth paragraph, last sentence. The phrase "...and would not be considered for domestic use" was deleted.

Specific Comment 3.

Section 2.5.2, Groundwater Contamination: The text in this section and in Attachment A1 describes groundwater plumes 5-1, 5-2, 5-3, and 5-4, but these figures are not labeled on any of the figures. Figure A1-2 includes two of the plumes, but neither is labeled. Please provide one figure that includes all four groundwater plumes with labels.

Response to Specific Comment 3.

SAP Appendix A1, Figure A1-2 was revised to include the locations of Plumes 5-2 and 5-4 and labels for each plume. In addition, in response to DTSC comments, a Figure 1-3 was added to the Work Plan (and existing Figure 1-3 was renumbered 1-4) showing the locations of the study areas and the four plumes.

Specific Comment 4.

Section 3.11: EPA would disagree with the assertion that the Surfactant Enhanced DNAPL extraction showed "excellent mass removal". In our review of the workplan and subsequent study report we expressed concern that the initial subsurface mass of DNAPL had been vastly underestimated. This underestimation was due 1) to lack of lateral and vertical subsurface characterization of the area prior to the pilot study, and 2) using concentrations from scant monitoring well data, rather than taking more representative discrete hydropunch data, to derive mass of DNAPL present. This concern was shown to be valid when BERC performed an in-depth lateral and vertical

characterization of the subsurface in preparation for their Steam Enhanced Extraction (SEE) Pilot Study. They found concentrations of contamination two to three orders of magnitude higher than that used in the Surbec Pilot Study calculations. Thus, the extraordinarily high percentage removed during the Surbec Pilot Study is directly a result of underestimating the initial mass of contamination in the subsurface rather than a demonstration of the effectiveness of their treatment. Please revise this section and also include a description of the more successful BERC SEE Pilot Project for completeness. The BERC SEE pilot study helped to support the later use of six-phase heating for further DNAPL removal because it employs similar remediation techniques.

Response to Specific Comment 4.

The section will be revised to provide the requested additional information on the BERC Study. The information regarding the Surbec study was extracted directly from the Draft RI report (SulTech 2005) **and will not be modified.**

Specific Comment 5.

Figure A1-16: Decision Logic for Installation of Permanent Groundwater Monitoring Wells: It is unclear why all of the arrows from the boxes with text that begins, "With Active Involvement of the Regulatory Agencies..." exit those boxes and go directly to a box containing the text "No Further Remedial Investigation." Since these boxes call for installation of new monitoring wells and/or adding contaminants of concern (COCs) to the Basewide Groundwater Monitoring Plan (BGMP), it appears that an intermediate box/action is needed. For example, the new well or the upgradient or downgradient well should be sampled at the same time the groundwater well in which the inconsistent results were detected. Then, the decision about adding COCs to the BGMP would require a separate box, with an arrow from this box to the no further investigation box.

Response to Specific Comment 5.

Decision Logic for Installation of Permanent Groundwater Wells (Figure A1-16, renumbered A1-17) was revised to confirm that one round of groundwater sampling during the Supplemental RI field activities will be conducted for all new monitoring wells and when there is an existing downgradient or upgradient monitoring well, screened at the depth of interest, that meets the requirement of the decision logic, one round of groundwater sampling during the Supplemental RI field activities will be conducted for this well also. Additional text has been added to Figure A1-17 to provide for additional rounds of sampling under the basewide groundwater monitoring program.

Specific Comment 6.

Figure A1-17: Decision Logic for SWMU Step-Out Soil Sampling: The decision logic needs to be revised. First, the decision, "Are there other soil data collected within 50 feet with results below criteria?" does not address the vertical extent of contamination. Second, the decision "Are results consistent with known nature and extent of contamination?" will not identify locations where the extent of contamination has not been defined. It is possible that constituents consistent with previous results could be detected above the comparison criteria; this would result in a "Yes" decision for question about consistency and would result in no further investigation even though the extent of contamination may not have been defined. It appears that the second question (after determining that results are above comparison criteria) should be replaced by a question that asks if the extent of contamination has been delineated. If the answer is Yes, then the question about consistency can be asked. If the answer is "No," then the result should be to collect and analyze samples. Please revise the decision logic.

Response to Specific Comment 6.

Decision Logic for SWMU Step-Out Soil Sampling (Figure A1-17, renumbered A1-19) was revised as follows:

1) A new second decision has been added that asks whether the vertical extent has been characterized. This will require further sampling if existing soil data do not address vertical extent. If the vertical extent has not been characterized, an intermediate step has been added to collect and analyze additional soil samples from the saturated zone in the FWBZ (to maximum depth of 30 feet bgs) for analytes above comparison criteria.

2) The third decision was revised to read "Are there other soil data collected at comparable depths within 50 feet for the analyte(s) exceeding comparison criteria?" If there are no planned or existing data within 50 feet for the analytes exceeding criteria, additional sampling will be conducted.

3) The Supplemental RI sampling is designed to address those areas of known contamination where the extent of contamination has not been delineated (i.e., Evaluation Areas 1 through 6), and most SWMUs are within the Evaluation Areas. Therefore, SWMU step out sampling is not needed to complete the delineation of the extent of known contamination. SWMU step-out sampling is designed to complete the characterization of previously unknown contamination associated with the SWMU. To clarify that the purpose of the Decision Logic for SWMUs is to characterize the extent of contamination associated with SWMUs, the final step of this logic has been revised to read "No Further SWMU/Data Gap Investigation."

Additionally, a figure entitled Decision Logic for SWMU/Data Gap Step-Out Groundwater Sampling (Figure A1-20, attached) has been added to SAP Appendix A-1 to provide for step-out discrete groundwater sampling for SWMUs outside the area of known groundwater contamination and for Data Gap buildings. SWMU/Data Gap step-out groundwater sampling will be conducted if results of discrete groundwater sampling are above comparison criteria and there are no planned or existing data within 50 feet for the analyte(s) exceeding comparison criteria.

The DQOs (SAP Tables 1-7, 1-8, and 1-9) for soil sampling at locations at which TPH is a potential contaminant of concern have been revised to state that the vertical boundary includes vadose zone soil and soil collected at the water table. SAP Table 1-3 has been revised to include collection of a soil sample at the soil/water interface (4 to 6 feet bgs) for each of 51 planned soil sampling locations for which TPH analysis was included. Note that the sample collected at the third soil sampling interval will be analyzed for the same parameters as those for the planned shallower samples. SAP Table 1-3 was also revised to include sampling at the soil/water interface for step-out soil sampling locations.

Specific Comment 7.

Table A1-9, Monitoring Well Groundwater Data: Summary of Metals Exceeding Screening Criteria: Results appear to be reported in micrograms per liter however, the table header indicates that results are "reported in milligrams per liter. Please address this discrepancy.

Response to Specific Comment 7.

Table A1-9 was revised to read "reported in micrograms per liter."

Comments on Evaluation Area 1

Specific Comment 8.

Although VOCs were reported above screening criteria at several discrete groundwater sampling locations (including, 057-006-014 and S052-2 through S052-4) in the southern portion of Evaluation Area 1, no monitoring wells or additional delineation is proposed in this area. Since these locations were only grab groundwater samples, it appears that a monitoring well is needed in this area. Please include a shallow (water table well) in this area.

Response to Specific Comment 8.

No monitoring well is needed. Existing (and currently monitored) wells M10-01 and M05HW-01 are located in the area south of Building 5. Groundwater sampling was conducted south (upgradient) of this area within EBS Parcel 53 (Building 12 adjacent to IR Site 10) and south of IR Site 5. VOC results for these sampling points (collected as part of the same investigation as S05-02-2 and S05-2-4, and collected during the EBS) indicated that VOCs were below detection limits or below MCLs. These data points were added to Figure 3-1 in the main Work Plan, and Figures A1-3 and A1-4 in Appendix A1. A discussion and evaluation of the analytical results derived from these sampling points was added to the text in Appendix A1 Section A1.1.2.7.

Specific Comment 9.

Section A1.1.2.1, Phase 2B and 3 Investigation, 1991 Groundwater Sampling, Page A1-7: During the Phase 2B and 3 Investigation, the concentrations of arsenic (27.3 ug/L) and nickel (222 ug/L) in groundwater at M05-03 exceeded their respective screening criteria (i.e., the 95 groundwater percentile for arsenic [20.7 ug/L] and Cal-MCL for nickel [100 ug/]) at M05-03; however, the last sentence of the first paragraph states that only VOCs were reported at concentrations exceeding the screening criteria. Please resolve this discrepancy.

Response to Specific Comment 9.

SAP Appendix A1, Section A1.1.2.1, Page A1-7. This section was revised to include a discussion of metals exceeding MCLs.

Specific Comment 10.

Section A1.1.2.1, Phase 2B and 3 Investigation, 1991 Groundwater Sampling, Page A1-7: According to Table C-8 of Appendix C, SVOCs reported in groundwater at M05-3 during the Phase 2B and 3 Investigation include 1,2-dichlorobenzene (DCB); 1,3-DCB; 1,4-DCB; 2,4-dimethylphenol; 2-methylnaphthalene; bis(2-chloroethyl)ether and naphthalene. However, the discussion in the third paragraph of SVOC results for M05-3 indicates that phenol, 2,4-dimethylphenol, and bis(2-ethylhexyl)phthalate were reported in groundwater, and that bis(2-ethylhexyl)phthalate exceeded screening criteria. Please revise the discussion of groundwater results from M05-3 to be consistent with Table C-8.

Response to Specific Comment 10.

SAP Appendix A1, Section A1.1.2.1, Page A1-8. This section was revised to cite the list of SVOCs reported (1,2-dichlorobenzene (DCB); 1,3-DCB; 1,4-DCB; 2,4-dimethylphenol; 2-methylnaphthalene; bis(2-chloroethyl)ether and naphthalene), which is consistent with Appendix A2, Table C-8.

Specific Comment 11.

Section A1.1.2.5, Environmental Baseline Survey, 1995 Groundwater Sampling, Page A1-13 through A1-14: The discussion of VOCs reported in groundwater at EBS Parcel 57 is incomplete. According to Table C-8, in addition to the VOCs mentioned in the discussion on Page A1-13, Phase 2B groundwater samples (i.e., 057-006-014 through -016) also contained 1,2-dichloropropane (1,2-DCP) at 1 to 2 ug/L), 2-butonone (39 J ug/L), benzene (0.6 XJ to 1 J ug/L), carbon tetrachloride (130 ug/L), chlorobenzene (19 ug/L), chloroethane (2 to 13 ug/L), chloroform (28 to 85 ug/L), chloromethane (4 J ug/L), ethylbenzene (31 ug/L), methylene chloride (2 to 5 ug/L), PCE (2 ug/L), toluene (12 to 69 ug/L), TCE (3 to 10 ug/L) and total xylenes (270D to 790D ug/L). Please revise the discussion of VOCs reported in groundwater in EBS Parcel 57 to discuss all VOCs reported during the Phase 2B groundwater sampling.

Response to Specific Comment 11.

SAP Appendix A1, Section A1.1.2.5, Pages A1-13 through A1-14. This section was revised to clarify that the VOCs currently cited were reported at concentrations exceeding MCLs and to list other VOCs also reported.

Specific Comment 12.

Figure A1-2, Evaluation Area 1: This figure does not include locations M05-19 or L05-07, which are discussed in the text of Section A.1.1.3.2. For completeness, please include these proposed locations; if necessary, an asterisk or another symbol could be used with the well identifier to indicate that these wells may not be installed.

Response to Specific Comment 12.

SAP Appendix A1, Figure A1-2 was revised to show the proposed locations of "to be determined" well M05-19 and L05-07. A typographical error on the revised figure that was noted during the January 30, 2007, conference call has been revised.

Comments on Evaluation Area 3

Specific Comment 13.

Section A1.3.2.1, Additional Work at IR Sites 4 and 5, 1992-1993 Soil Sampling: The description sample locations B05PS-01 through B05PS-10 is not consistent with Figure A1-7 or Figure 3-1. For example, Figure 3-1 depicts the location of borings B05PS-01 through B05PS-05 to the north of the plating shop in or adjacent to the area labeled "Landing Gear," and borings B05PS-06 through B05PS-10 appear to be located along the industrial waste water drain in the northern portion of the plating shop. The discussion in Section A1.3.2.1 indicates that these samples were collected through the floor of the chromium and cyanide processing areas of the plating shop; however, Figure A1-7 depicts the location of the chromium and cyanide processing areas in the southern portion of the plating area. Please revise the text to be consistent with the figures.

In addition, all of the soil samples collected in the vicinity of the chromium and cyanide eductor sumps and surge tanks, including confirmation samples from the cadmium removal action (Figure A1-7) were analyzed for cadmium only. Therefore, soil left in place in the vicinity of the surge tanks and eductor sumps may contain elevated levels of chromium and cyanide. This appears to be a data gap. Please discuss this data gap for chromium and cyanide in soil in the vicinity of the chromium and cyanide eductor sumps and surge tanks and propose sampling to address this data gap.

Response to Specific Comment 13.

Work Plan Figure 3-1 and Appendix A1 Figure A1-7 (renumbered A1-8). Review of the original investigation report (PRC and MW 1995) indicates that the database files have incorrect location coordinates for samples from this investigation. Sampling points were plotted approximately 60 feet north of correct locations on the figures. Figures 3-1 and A1-7 were revised accordingly.

Additional text was added in SAP Appendix A1, Section A1.3.3 to clarify that this data gap is being addressed by the sampling locations along the industrial wastewater lines at the southern limits of the cadmium excavation area (EA3SB28, EA3SB34, EA3SB40, and EA3SB41). Two sampling locations will also address the locations of the former cyanide eductor sump (EA3SB42) and the former chromium eductor sump (EA3SB43). The locations of these sampling points are shown on revised Figures A1-7 and A1-8. For location EA3SB42 (south of the excavated area), two soil samples (0 to 0.5 and 2 to 4 feet bgs) and one discrete groundwater sample will be collected. For location EA3SB43 (within the excavated area), one discrete groundwater sample will be collected. The discrete groundwater samples will be collected at the soil/water interface.

The Navy requests a meeting with the agencies to further discuss this topic.

Specific Comment 14.

Section A1.3.2.5, Supplemental Remedial Investigation Data Gap Sampling, 2001 Soil Sampling, Page A1-38: The discussion of metals analysis performed on soil samples collected during Data Gap Sampling (2001) and the Cadmium Removal Action (2001-2002) is not consistent with Appendix A2. According to the analytical results, soil sampling locations S05-DGS-DP14, S05-DGS-DP17 through S05-DGS-DP20, S05-DGS-DP31 through S05-DGS-DP33, and S05-DGS-DP50 through S05-DGS-DP60 were analyzed for cadmium only; however, Section A1.3.2.5 indicates that soil samples from these locations were analyzed for cadmium, chromium, hexavalent chromium, and lead. In addition, many of the confirmation samples were only analyzed for cadmium, but the text states that confirmation samples were analyzed for cadmium, chromium, hexavalent chromium, and lead. Please revise the discussion of soil analysis to be consistent with Appendix A2.

Response to Specific Comment 14.

SAP Appendix A1, Section A1.3.2.5. Text was revised to state that the analyses were conducted on confirmation samples.

Specific Comment 15.

Section A1.3.2.6, Cadmium Removal Action, 2001-2002 Soil Sampling, Page A1-38 and A1-39; and Table A1-17, Metals in Soil Exceeding Screening Criteria: The depth to which soil was removed at S05-EXC-X2Y2 and S05-EXC-X3Y2 is not reported consistently in Table A1-17 and Table C-4 of

Appendix A2. According to Table A1-17, soil at 7 feet bgs was left in place; however, Table C-4 indicates that soil at 7 feet bgs was removed. Please clarify whether soil was excavated below 7 feet bgs at these locations, and if so, whether confirmation samples were collected below 7 feet bgs.

Response to Specific Comment 15.

The information provided in Table A1-17 is correct. As discussed in Section A1.3.2.6, samples S05-EXC-X2Y2 and S05-EXC-X3Y2 were confirmation samples that were collected from beneath the fill material following the initial excavation. No additional excavation was conducted at the locations of these two confirmation samples. The information presented in Appendix A2, Table C-4 was reproduced from the draft RI Report (SulTech 2005) and is provided for historical purposes and will not be revised. A foreword was added to note that there are some inaccuracies in these tables and that correct information on historical data will be provided in the RI report and a footnote was added to the page with the inaccurate information.

Specific Comment 16.

Section A1.3.3, Proposed Sampling Rational and Design, Pages A1-39 through A1-42; and Figure 2-4, Conceptual Site Model (CSM) for IR Site 5: Figure 2-4 depicts the rinse tanks and floor drains of the plating shop area as possible release areas for solvents; however, Section A1.3.3 does not recommend VOC analysis at soil borings EA3SB28 through EA3SB35, which have been proposed for investigation of potential releases from the industrial drain lines of the plating shop. Please analyze samples from these locations for VOCs as well.

Response to Specific Comment 16.

SAP Appendix A1, Section A1.3.3. Soil samples collected at locations EA3SB28 through EA3SB35 will also be analyzed for VOCs. Two additional soil sampling locations were added along the segment of the industrial wastewater line that originates near the former location of the cyanide and chrome surge tanks and two sampling points were added at the locations of the former cyanide and chromium eductor sumps. Samples will be analyzed for the same suite of constituents (metals, hexavalent chromium, cyanide, and VOCs).

Comments on Evaluation Area 4

Specific Comment 17.

Section A1.4, Evaluation Area 4: The text does not include the data gaps associated with the Paint Mixing Room and the Battery Acid Shop that were identified during the site tour. Please add these data gap areas to the bulleted list in this section.

Response to Specific Comment 17.

The existing second bullet in SAP Appendix A1, Section A1.4 does describe the battery acid shop and the paint mixing areas. No additional text is needed.

Specific Comment 18.

Section A.1.4.3, Proposed Sampling Rationale and Design, Pages A1-45 and A1-46: The text omits the Paint Mixing Shop; this area was identified as a data gap during the site walk. Please add the Paint Mixing Shop to the text in this section.

Response to Specific Comment 18.

SAP Appendix A1, Section A1.4.3, Page A1-46, second bullet. The first sentence was revised as follows:

"Soil samples and one discrete groundwater sample will be collected from two borings at each of the following locations: M-05, within the paint mixing area that includes NADEP GAP 04, and within the battery acid shop."

Specific Comment 19.

Section A.1.4.3, Proposed Sampling Rationale and Design, Pages A1-45 and A1-46: In addition, during the site tour, the Regulatory Agencies expressed concern about the extent of arsenic in the vicinity of boring 054-001-007, where arsenic was detected at 329 mg/kg. Two borings within 50 feet of this location should be

included to evaluate the extent of arsenic in soil. Please revise the Work Plan to incorporate defining the extent of arsenic in the vicinity of boring 054-001-007.

Response to Specific Comment 19.

Although the draft Work Plan included three sampling points located at a distance of 50 feet from boring 054-001-007 (EA4SB14, EA4SB15, and EA4SB19), the sampling plan was revised as follows in response to DTSC Specific Comment 26: For previous sampling locations 054-001-003, 054-001-005, 054-001-006, and 054-001-007, for which metals results exceeded PRGs, existing planned soil sampling locations were moved to be within 25 feet and six new soil sampling locations (EA4SB23 through EA4SB28) were added to provide three sampling locations at a distance of approximately 25 feet from the each of the original sampling locations.

Comments on Evaluation Area 5 (soil and groundwater)

Specific Comment 20.

Section 1.5.2.3 Environmental Baseline Survey, 2001 Soil Sampling, Page A1-49 through A1-53: According to Table C-1 of Appendix C, soil samples from borings 055-001-001 and 055-001-002 were not analyzed for metals; however, the discussion of soil sampling at Target Area 1 in EBS Parcel 55 indicates that metals were detected below screening criteria in these borings. Please resolve this discrepancy.

Response to Specific Comment 20.

SAP Appendix A1, Section A1.5.2.3. The sentence beginning "Analytical results revealed detectable concentrations of metals..." was deleted.

Comments on IR Site 5 Data Gap Areas

Buildings 6 and 282

Specific Comment 21.

Section A1.7.1.1, Historical Use, Page A1-63: The historical use of NAS GAP 01 is not discussed; however, the work plan recommends soil and groundwater sampling in this area. Please revise Section A1.7.1.1 to discuss materials stored at NAS GAP 01.

Response to Specific Comment 21.

The historical use of NAS GAP 01, which is one the 22 SWMUs being addressed by this Work Plan, is discussed in SAP Appendix A1, Section A1.9.1.7 NAS GAP 01. No revision is needed.

Buildings 43, 44, 102, 347, 407 and 606, and SWMU NADEP GAP 27

Specific Comment 22.

Section A1.7.3.2, Previous Investigations, Page A1-69 and A1-70; and Table A1-14 Benzo(a)pyrene Equivalents in Soil Exceeding Residential Soil Screening Criteria: The extent of soil containing PAHs above the screening criteria (0.62 mg/kg, B[a]P equivalent) has not been delineated in the vicinity of soil sample 030-S05-009. According to Table C-5 of Appendix A2, the B(a)P equivalent was reported at 12.8 mg/kg in an excavation soil sample collected from 0-7 ft bgs at 030-S05-009. Step out samples were not collected within fifty feet this location. Please identify this exceedance on Table A1-14 and in Section A1.7.3.2, and discuss how this data gap will be addressed.

Similarly, the extent of soil containing PAHs above the screening criteria has not been delineated to the east, west and north of soil sample C3S005B048. According Table A1-14, the soil sample collected from 4-8 ft bgs contained a B(a)P equivalent of 1,170 mg/kg. Step out samples were not collected. Please discuss how this data gap will be addressed.

Response to Specific Comment 22.

SAP Appendix A1, Table A1-14 and Section A1.7.3. BAP equivalent results for sample 030-S05-009 were added to Table A1-14 and text was added to Section A1.7.3.2 – Fuel Line Removal Action Sampling to discuss this analytical result. An additional sampling location (DGPAHSB01) has been added at a location 25 feet west of sampling point 030-S05-009, which is outside of the area subject to the Marsh Crust ROD. Two additional sampling locations (DGPAHSB02 and DGPAHSB03) have been added at a distance of 15 feet northeast and northwest of sampling location C3S005B048. Locations for PAH data gap sampling have been added to Figure A1-13. Samples will be collected in accordance with the PAH Assessment sampling protocol: soil samples collected at four depth intervals (0 to 0.5, 0.5 to 2, 2 to 4, and 4 to 8 feet bgs) and analyzed for PAHs only by U.S. EPA Method 8260 SIM. Note that historical analytical data for sampling locations north, south, and east of 030-S05-009, and locations south and west of C3S005B048 had PAH concentrations below the BAP equivalent screening level. .

Solid Waste Management Units:

Specific Comment 23.

Section A1.9.3, Proposed Sampling Rationale and Design, Page A1-81; and Figure A1-11, Data Gap Buildings 6 and 282, and SWMUs OWS 006A, OWS 006B, NAS GAP 01, and UST(R)-02: The work plan proposes collecting soil and groundwater samples on the upgradient (i.e., southeast) side of OWS 006B; however, this location may not adequately characterize a potential impact to groundwater. Please consider soil and groundwater sampling on the downgradient (i.e., northwest) side of OWS 006B, since this may better characterize possible impacts to soil and groundwater at OWS 006B.

Response to Specific Comment 23.

SAP Appendix A1, Figure A1-11 (renumbered A1-12) was revised to show the proposed sampling point on the downgradient (northwest) side of OWS 006B.

Specific Comment 24.

Section A1.9.3, Proposed Sampling Rationale and Design, Page A1-81 and Figure A1-14, SWMU OWS 010: Similarly, the soil/hydropunch sampling location for OWS 010 is located crossgradient, not downgradient. Please move this sample location to the northwest corner of this OWS.

Response to Specific Comment 24.

SAP Appendix A1, Figure A1-14 (renumbered A1-15) was revised to show the proposed sampling point on the downgradient (northwest) side of OWS 010.

Attachment A – Sampling and Analysis Plans

Specific Comment 25.

Appendix A, Section 2.1.1, Hollow-Stem-Auger Drilling, Page A2-1 and Section 2.1.10, Utility Survey, Page A2-7: It appears that there is a contradiction in the description of field procedures in these two sections. The first sentence in the third paragraph of Section 2.1.1, Hollow-Stem-Auger Drilling, Page A2-1 states, "The first 5 feet bgs at the borehole location will be advanced with a hand auger to confirm the absence of underground utilities." Bullet 7 in Section 2.1.10, Utility Survey, Page A2-7, describes utility clearance protocol and states, "Physically clear the first 4 to 5 feet bgs adjacent to each boring using a hand auger prior to advancing the boring with the hollow-stem-auger or direct-push rig." In addition, since samples will be collected from the first 4 to 5 feet, it is unclear these samples will be collected. Please revise the text to clarify utility clearance protocols for hollow-stem-auger and direct-push drilling. Please also provide necessary modifications to the soil sampling methods if samples will be collected by hand auger in Section 2.1.2.

Response to Specific Comment 25.

Attachment A, SAP Section 2.1.1, Page A2-1. Text was revised to be consistent with Section 2.1.10 Utility Clearance.

References to hand auger sampling were removed. No borings for sample collection will be advanced using hand auger methods. All soil samples will be collected using direct-push sampling. Hand augering will only be used to confirm that a sampling location is clear of underground utilities or other obstructions.

Specific Comment 26.

Appendix A, Section 2.1.1, Hollow-Stem-Auger Drilling, Page A2-2: It is unclear how water used to flush the borehole will be captured and contained since a conductor casing is not specified. In addition, since grout is usually added as the augers are removed, it appears that there will not be an open borehole to flush. Please explain how borehole flushing and containment of the water will be accomplished or delete this step.

Response to Specific Comment 26.

Attachment A, SAP Section 2.1.1, Page A2-2. The paragraph and numbered items that include the reference to flushing the borehole were deleted. Hollow-stem auger boreholes will be used for monitoring well installation and the newly installed wells will not be abandoned during the Supplemental RI sampling field activities.

Specific Comment 27.

Appendix A, Section 2.1.6, Monitoring Well Construction, Page A2-4: It is not clear how shallow monitoring wells will be constructed. The third and fourth paragraphs in this section specify monitoring well construction details for the proposed wells, including the following: "The wells will be screened from approximately 2 feet above the water table to 8 feet below the water table."; "The filter pack will extend at least 2 feet above the screened interval"; "a 2-foot thick transition seal of #30 sand will be placed above the sand filter pack..."; and "a minimum 3-foot-thick annular seal consisting of bentonite pellets...will be placed above the transitional sand. The remaining borehole annulus will be filled with a cement/bentonite grout to a depth of approximately 3 feet bgs." Table 1-2 indicates that the target groundwater sampling depth interval for selected new wells is 10-15 feet bgs. If groundwater is encountered at shallow depths closer to 10 feet bgs, completion of the well based on these specified well construction details is not possible. Please revise these well construction details to accommodate the construction of shallow wells, if field conditions warrant.

Response to Specific Comment 27.

Attachment A, SAP Section 2.1.6. Text was revised to include appropriate well construction details for the shallow water table conditions that are found at OU-2C.

Response to Specific Comment 28.

Text in SAP Section 2.2.1 describing shallow soil sampling was revised. All soil samples for chemical and geotechnical analysis will be collected using direct-push sampling methods and a split-barrel sampler lined with stainless steel or acetate liners (sleeves). As described in Item 3 of Section 2.2.1, the sample volume for VOC analysis will be collected from the soil in the coring body (sample sleeve) using an En Core sampling device.

Specific Comment 29.

Appendix A, Section 2.2.2, Groundwater Sampling Procedures, Page A2-9: The procedures do not specify that the flow-through cell will be disconnected before samples are collected. Groundwater samples should not be collected from a flow-through cell since turbulence in the cell can result in oxidation of metals and turbulence and/or solar heating can result in volatilization and photodegradation of VOCs. The resulting sample would not be representative of aquifer conditions. Please revise the procedures to specify that the flow-through cell will be disconnected before gloves are changed prior to sample collection.

Response to Specific Comment 29.

Text in SAP Section 2.2.2 was added to reference SOP 8 Groundwater Sampling and to include direction to disconnect the flowthrough cell prior to collection of groundwater samples.

Specific Comment 30.

Section 2.2.3, Subslab Soil Gas Sampling Procedures, Page A2-11: Step 4 calls for folding over sampling line prior to disconnection of the pump, but this will still allow air to enter the tubing. One way that this could be minimized is to use connect the purge pump to one branch and the Summa canister to the other branch of Y-shaped tubing with a central valve; when the position of the valve is changed, different branches of the tubing can be purged. This would allow purging and sampling without removing any equipment and filling the tubing with air. Please change the sampling procedure to specify use of Y-tubing with a central valve and to specify purging each branch of the tubing.

Response to Specific Comment 30.

Text in SAP Section 2.2.3 was revised to provide the methodology to prevent ambient air from entering the system.

Specific Comment 31.

Appendix A, Section 2.2.4.1, 25-Hour Groundwater-Elevation Study, Page A2-12: The last sentence in the third paragraph of this section states, "In addition, the results of the general water chemistry parameters collected prior to each round of potentiometric-surface measurements will be used to evaluate tidal influence." It is unclear whether these general water chemistry parameters will be the same as those specified during purging the monitoring wells or whether they will be collected from the temporary piezometers and monitoring wells as a part of this aquifer study. Further, only pressure transducers are specified in the text, although downhole probes/data loggers are available with the capability to monitor water quality parameters as well as pressure. Please clarify which water chemistry parameters will be measured as well as how and when they will be collected.

Response to Specific Comment 31.

Attachment A, SAP Section 2.2.4.1, Page A2-12, last paragraph.

The last sentence beginning "In addition, the results of the general water chemistry..." was deleted.

Specific Comment 32.

Appendix A, Section 2.3, Sample Handing and Custody, Page A2-14 and Section 2.3.4, Sample Documentation, Page A2-15: This section describes sample handling and custody requirements but does not include examples of sample labels, custody forms, and sample custody logs as required by EPA Requirements for Quality Assurance Project Plans, QA/R-5. Please include these examples in the next version of the Sampling and Analysis Plan.

Response to Specific Comment 32.

Examples of sample labels, custody forms, and sample custody logs are included in SOP 10. Text was added in SAP Section 2.3.4 to refer to the SOPs.

Specific Comment 33.

Appendix A, Section 2.4, Analytical Methods, Page A2-17: The analytical laboratory is not specified as required by EPA Requirements for Quality Assurance Project Plans, QA/R-5. Please provide the name(s) of the analytical laboratory(ies) selected for this project in the next version of the Sampling and Analysis Plan.

Response to Specific Comment 33.

The Navy CLEAN contractor has open contracts with several analytical laboratories that are on the list approved by the Navy. The laboratory that will perform the work is selected in accordance with the Navy Installation Restoration Chemical Data Quality Manual. The laboratory evaluation includes certification by the California

Department of Health Services Environmental Laboratory Accreditation, performance evaluation samples, and audits. The name of the laboratory(ies) selected will be provided in the final version of the SAP.

Specific Comment 34.

Appendix A, QAPP Worksheet 22, Field Equipment Calibration, Maintenance, Testing, and Inspection and Section 2.1.2, Direct-Push Drilling, Page A2-2: The second bullet in section 2.1.2 states that "Organic vapor readings of the drill cuttings will be collected using a photoionization detector (PID) or organic vapor analyzer," but this conflicts with QAPP Worksheet 22. This worksheet includes information on a flame ionization detector but does not contain any information about PID calibration, maintenance, testing, and inspection. Please either modify QAPP Worksheet 22 to include PID information or modify the text in Section 2.1.2 to correct this discrepancy.

Response to Specific Comment 34.

Attachment A, SAP Section 2.1.2. This text was revised to refer to flame iodization detector (FID) rather than PID.

Specific Comment 35.

Appendix A, Table 1-3, Supplemental Remedial Investigation Activities and Rationales for OU-2C: Soil and Discrete Groundwater Samples, Pages 2 and 3, and Table 1-7, Data Quality Objectives for Oil/Water Separators and Underground Storage Tanks at OU-2C, Page 1: The Soil Sampling Depth Intervals column in Table 1-3 indicates soil samples will be collected from depths of 0-0.5, 2-4, and 4-6 feet bgs for the oil/water separator and underground storage tank areas. Step 7 of Table 1-7 indicates "soil samples will be collected from each boring (0 to 2, 2 to 4, and 4 to 8 feet bgs)." Please resolve this discrepancy.

Response to Specific Comment 35.

Attachment A, SAP Tables 1-3 and 1-7 were revised to indicate that soil samples will be collected at "0 to 0.5, 2 to 4, and 4 to 8 feet bgs". The text was also revised to be consistent with these sampling intervals.

Specific Comment 36.

Appendix A, Table 1-3, Supplemental Remedial Investigation Activities and Rationales for OU-2C: Soil and Discrete Groundwater Samples, Pages 3 and 4, and Table 1-8, Data Quality Objectives for SWMUs at OU-2C, Page 1: Similarly, the Soil Sampling Depth Intervals column in Table 1-3 indicates soil samples will be collected from depths of 0-0.5 and 2-4 feet bgs for the solid waste management unit (SWMU) areas. Step 7 of Table 1-8 indicates "soil samples will be collected from each boring (0 to 2 and 2 to 4 feet bgs)." Please resolve this discrepancy.

Response to Specific Comment 36.

Attachment A, SAP Tables 1-3 and 1-8 were revised to indicate that soil samples will be collected at "0 to 0.5 and 2 to 4 feet bgs". The text was also revised to be consistent with these sampling intervals.

Comments on Attachment A2 (CD with data tables)

Specific Comment 37.

Table C-1, Site 5 Soil and Other Matrices Sampling Summary: According to Table C-1, SVOC analysis was performed on soil samples collected at a depth of 4-4.5 ft bgs from borings 057-001-001, -002 and -003; however, there are no analytical results in Table C-5 for SVOCs at these sample locations. Please provide the results.

Response to Specific Comment 37.

Attachment A, SAP Appendix A2, Table C-1 is in error; no SVOCs analyses were conducted for samples from borings 057-001-001, -002, and -003. The information presented in Appendix A2, Table C-1 was reproduced from the draft RI Report (SulTech 2005) and is provided for historical purposes and will not be revised. A Foreword was added to note that there are some inaccuracies in these tables and that correct information on

historical data will be provided in the RI report and a footnote was added to the page that has inaccurate information.

Specific Comment 38.

Table C-8, Complete Analytical Results for OU-2C Groundwater Samples: The table notes do not define the qualifiers BWJ, EJ, X and XJ which were used for groundwater samples collected during the Environmental Baseline Survey. For example, results for thallium (2.3 ug/L), iron (370,000 ug/L), and nickel (1,090 ug/L) were qualified BWJ, EJ, and EJ, respectively in hydropunch sample 057-006-014. In addition, 1,2-DCE was reported at 0.7 ug/L with an X qualifier in sample 057-006-014 and benzene was reported at 0.6 ug/L with an XJ qualifier in sample 057-006-015. Please define all qualifiers in the table notes.

Response to Specific Comment 38.

The database for the historical OU-2C data includes both laboratory and validation review qualifiers. The qualifiers BWJ, EJ, X, and XJ are laboratory qualifiers that were not replaced with validation qualifiers in Table C-8. In the database, laboratory qualifiers BWJ, EJ, and XJ are replaced with validation qualifier J and laboratory qualifier X is replaced with an unqualified result.

The information presented in Appendix A2, Table C-8 was reproduced from the draft RI Report (SulTech 2005) and is provided for historical purposes and will not be revised.

Appendix C

Specific Comment 39.

Appendix C, Page C-1: The last sentence of the first paragraph reads, "The wastes generated will include soil cuttings from soil borings, disposable personal protective equipment (PPE), and equipment-decontamination water." Groundwater monitoring well sampling will also generate purge water as investigation-derived waste. Please revise this sentence to include purge water from monitoring wells.

Response to Specific Comment 39.

Attachment C, Page C-1. The text was revised to include the phrase "purge water from monitoring wells".

MINOR COMMENTS

Minor Comment 1.

Table A1-10, Metals in Discrete Groundwater Samples Exceeding Screening Criteria and Section A1.1.2.1, Additional Work at IR Sites 4 and 5, 1992 Groundwater Sampling, Page A1-9: According to Table A1-10, hexavalent chromium was reported at 9,350 micrograms per liter (ug/L) in ground water at B05WT-01; however, the discussion in the last paragraph on page A1-9 indicates that hexavalent chromium was measured at 9,530 ug/L. Please resolve this discrepancy.

Response to Minor Comment 1.

SAP Appendix A1, Section A1.2.2.2, Page A1-9, last paragraph. The typographical error in the text was corrected to read "9,350 µg/L".

Minor Comment 2.

Attachment A, Section 2.1.9, Groundwater Monitoring Well Sampling, Page A2-6: The last sentence in the first paragraph of this section incorrectly states "Monitoring well construction details of existing wells are presented in QAPP Worksheet 15-groundwater." It appears that these details are presented in Table 2-1. Please revise the quoted statement with the correct reference.

Response to Minor Comment 2.

Attachment A, SAP Section 2.1.9, Page A2-6, last sentence. The text was corrected to read "...presented in Table 2-1".

Minor Comment 3.

Table C-5, Complete Analytical Results for Site 5 Soil Samples: The result for lead (<0 mg/kg) at boring 261-01 appears to be a typographic error. Please correct this entry.

Response to Minor Comment 3.

The database for the historical OU-2C data includes an analytical result of 0 with a validation qualifier of "U". This is not a typographical error in Table C-8.

RESPONSE TO COMMENTS ON
DRAFT FINAL WORK PLAN FOR SUPPLEMENTAL REMEDIAL INVESTIGATION SAMPLING AT OPERABLE UNIT 2C
ALAMEDA POINT, ALAMEDA, CALIFORNIA
DATED FEBRUARY 2007
CTO-0093

Comments from U.S. EPA, 3/14/2007

SPECIFIC COMMENTS

Specific Comment 1.

Response to Specific Comment 4: *The text in Section 3.11 still states that the Surfactant Enhanced DNAPL extraction showed "excellent mass removal" and the response indicates that the " information regarding the Surbec study was extracted directly from the Draft RI report (SulTech 2005) and will not be modified," which does not address the concern raised in EPA's original comment. Since the RI was in error, it is recommended that the text in the Work Plan be revised to state that this conclusion was based on an inadequate horizontal and vertical subsurface characterization and use of monitoring well data, rather than groundwater samples collected from discrete intervals using a hydropunch. Since contaminant concentrations were actually two to three orders of magnitude higher than those used to evaluate the Surbec study, the original conclusions that the mass removal was excellent and exceeded 95 percent were in error. Please revise the text of Section 3.11 to state that the Surbec evaluation was based on inadequate horizontal and vertical subsurface characterization and that the failure to use discrete groundwater samples resulted in an apparent effectiveness that was much greater than the actual effectiveness of surfactant enhanced mass removal.*

Response to Specific Comment 1.

The following text will be added to Section 3.11 of the Draft Final Work Plan:

> "The evaluation of the results of the Surbec study was based on inadequate horizontal and vertical subsurface characterization and used monitoring well sampling results rather than HydroPunch groundwater samples collected from discrete intervals to characterize post-test concentrations of VOCs in groundwater. This resulted in an apparent effectiveness that was much greater than the actual effectiveness of surfactant-enhanced mass removal. The conclusions based on post-test soil sampling and the Post-Partitioning Interwell Tracer Test (which indicated that the mass removal was excellent and exceeded 97 percent) were in error. VOC concentrations in groundwater were actually two to three orders of magnitude greater than those used to evaluate the Surbec study (Cook, pers. com. 2007)."

Specific Comment 2.

Response to Specific Comment 6 and Figure A1-19: *Decision Logic for SWMU Step-Out Sampling: The response and figure still do not address the issue of whether the vertical extent of contamination has been defined. An additional decision diamond, "Has the vertical extent of contamination been defined?" should be added prior to question, "Are there other soil data collected at comparable depths within 50 feet?" The yes decision arrow should lead to the question "Are there other soil data collected at comparable depths within 50 feet?" The no decision arrow should lead to a box that calls for collection of soil samples at depths greater than the maximum sampling depth at locations where the vertical extent of contamination has not been defined. Please make these changes to Figure A1-19.*

Response to Specific Comment 2.

Refer to Response to Specific Comment 2 dated April 3, 2007.

Specific Comment 3.

Revised Figure A1-18: *Decision Logic for Discrete Groundwater Step-Out Sampling: The decision diamond on the right side of the diagram, "Do all decision-makers agree that no further groundwater sampling is necessary?" does not have a provision for the "no" decision. In addition, the "yes" decision, which leads to the box "No further sampling" is not labeled. Please revise this decision logic diagram to provide for the case where decision-makers decide that further groundwater sampling is necessary. In addition, please label the decision arrows from this diamond.*

Response to Specific Comment 3.

Refer to Response to Specific Comment 2 dated April 3, 2007.

Specific Comment 4.

Response to Sepcific Comment 8: *The response states that no monitoring well is needed and that volatile organic compounds (VOCs) were not detected or were detected at concentrations below maximum contaminant levels (MCLs) in the area between Building 5 and IR Site 10, but the OU-2C RI Report indicates that VOCs were detected above MCLs. The following list some of the detections above MCLs (Note, multiple results are for different depth intervals):*

057-006-014:	*1,1 DCA 80 ug/L (MCL=5); TCE 6.0 (MCL = 5); vinyl chloride 580 ug/L (MCL=0.5)*
057-006-15:	*1,1 DCA 680 ug/L(MCL=5); vinyl chloride 11 ug/L (MCL=0.5)*
057-006-16:	*1,1 DCA 1300 ug/L(MCL=5); chloroform 85 ug/L (MCL = 80); vinyl chloride 1 ug/L (MCL=0.5)*
S05-2-2:	*1,1 DCA 7.5 ug/L, 13 ug/L(MCL=5); TCE 23 ug/L (MCL=5)*
S-5-2-3	*1,1 DCA 290, 220, 170, 310 ug/L(MCL=5); vinyl chloride 93, 76, 81 ug/L (MCL=0.5)*
S-5-2-4	*1,1 DCA 16, 19, 78 ug/L(MCL=5); vinyl chloride 8.9 ug/L (MCL=0.5)*

Two wells are needed to monitor these areas. One well is needed between locations 057-006-14 and S05-2-3, which are about 50 feet apart; and an additional well is needed between location 057-006-015 and 057-006-16, which were located in former Building 348 (this is the Building that CSO indicated had been used for paint stripping using methylene chloride during our OU-2C site walk). Please revise the Work Plan and SAP to include these two wells.

Response to Specific Comment 4.

Refer to Response to Specific Comment 1 dated April 3, 2007.

Specific Comment 5.

Response to Specific Comment 34: *Although the response states that the text has been revised to reference a flame ionization detector (FID), the text in Sampling and Analysis Plan (SAP) section A2.1.2 has been changed to once again reference a photoionization detector (PID), while the Quality Assurance Project Plan (QAPP) Worksheet 22 (Field Calibration, Maintenance, Testing, and Inspection) still only includes the FID. It would seem that worksheet 22 should be revised to include a PID. Please revise Worksheet 22 to include PID calibration and maintenance requirements.*

Response to Specific Comment 5.

The SAP will be revised to refer to use of the FID throughout the document.

RESPONSE TO COMMENTS ON
DRAFT FINAL WORK PLAN FOR SUPPLEMENTAL REMEDIAL INVESTIGATION
SAMPLING AT OPERABLE UNIT 2C
ALAMEDA POINT, ALAMEDA, CALIFORNIA
DATED FEBRUARY 2007
CTO-0093

Comments from U.S. EPA, 4/3/2007

COMMENTS

After reviewing the latest RTCs, we are concerned that the most recent version of the decision logic will not result in any delineation beyond the initial data gap sampling unless you find a contaminant not previously detected above PRGs/MCLs/background or you find a new maximum concentration. In addition, the proposed well location in Evaluation Area 5 will not answer the question of whether groundwater contamination remains in some areas where it was previously detected. Here are our comments:

Specific Comment 1.

Response to Specific Comment 4: Since groundwater flows to the north-northwest, the proposed additional well (M05-19) will not monitor groundwater quality in the vicinity of previous locations 057-006-014, 057-006-15, 057-006-16, S05-2-2, S05-2-3 or S05-2-4 as requested in EPA's previous comment. An upgradient well would not answer questions about whether groundwater contamination remains in these areas.
Therefore the additional monitoring well (M05-19) should be placed in one of the areas where contamination was previously detected (i.e., either in the 057-006-14/S05-2-3 or in the 057-006-015/057-006-16 areas). Please revise the location of the proposed well to place it in the 057-006-14/S05-2-3 area or in the 057-006-015/057-006-16 area. A discrete groundwater sample should be collected in the other area.

Response to Specific Comment 1.

The mapped locations of existing monitoring wells in the vicinity of sampling locations 057-006-014 and S05-2-3 (wells 400MJ-MW1, 400MJ-MW2, and 400MJ-MW3) were found to be in error during the land surveying process. Apparently the ArcView® GIS database has incorrect coordinates for those wells. Due to the historical presence of VOCs in groundwater south of Building 5 (as documented by data from previous locations 057-006-014, 057-006-15, 057-006-16, S05-2-2, S05-2-3 or S05-2-4), the Navy proposes to install one monitoring well (M05-20) at a location approximately 20 feet south of historical sampling location 057-006-016 . The proposed location of the new well is shown on Figure A1-2. Monitoring well M05-20, located within the footprint of former Building 348, will be used to monitor groundwater quality in the area with historical presence of VOCs. Operations at former Building 348 may have been the source of the VOCs previously reported in groundwater. Based on the new, corrected well location map, there is an existing well at the S05-2-4 location, well 400MJ-MW3, and another well to the east near the 057-006-014 location (well 400MJ-MW2). We propose sampling one (or both, if you want) of these wells vs. advancing a new hydropunch sampling location. Therefore, proposed sampling location EA5SB17 will be a soil sampling location only.

In addition, one monitoring well (M05-19) is proposed at the upgradient margin of the OU-2C VOC plume as defined in SAP Appendix A1 Figure A1-3). The proposed location of this well is shown on Figure A1-2. Well M05-19 will provide a permanent monitoring point for the upgradient limit of the VOC plume at OU-2C.

The proposed location M05-20, in combination with data from the historical sampling points plus upgradient well M05-19, should provide the requested information.

Specific Comment 2.

1. *Table A1-18, Numerical Comparison Criteria and Known Maximum Contaminant Levels for Decision Logic Figures A1-17 through A1-20, and Figure A1-19, Decision Logic for SWMU and Data Gap Step-Out Soil Sampling: In cases where samples will be collected to delineate the extent of contamination (e.g., the extent of arsenic in the vicinity of boring 054-001-007) the decision logic is not likely to result in further horizontal step-out sampling to determine the extent of contamination. In areas where the extent of contamination is being delineated, the only appropriate criteria for determining if additional step-out sampling is necessary should be whether the concentration exceeds comparison criteria in Tables A1-1, A1-2, and A1-3. Step 2 on Table A1-18 and Figure A1-19 requires that concentrations exceed the previous maximum criteria, but this precludes the delineation of the horizontal extent of contamination in cases where the first step-out samples exceed comparison criteria but do not exceed the historic maxima (e.g., in the case of boring 054-001-007, where arsenic was detected at the Evaluation Area 4 maximum of 329 milligrams per kilogram [mg/kg], if one of the step-out samples proposed in this Work Plan results in arsenic at 328 mg/kg, Step 2 would stop delineation when further delineation is still needed). Since the goal of delineation sampling is to delineate the extent of contamination for use in developing alternatives and cost estimates in the Feasibility Study (FS) and to determine the extent of any required action during the Remedial Design (RD), the comparison criteria should be used for delineation. As a result, the Step 2 requirement that analytical results exceed the maximum criteria before further horizontal delineation is conducted is inappropriate and should be deleted. Please delete Step 2 from the decision logic for SWMU and Data Gap Step-Out Soil Sampling.*

2. *Table A1-18, Numerical Comparison Criteria and Known Maximum Contaminant Levels for Decision Logic Figures A1-17 through A1-20, and Figure A1-18, Decision Logic for Discrete Groundwater Step-Out Sampling: Similarly, it is unclear why Step 2, requiring soil samples exceed historic maximum is relevant for determining whether discrete groundwater samples for analytes reported in soil is appropriate, since it is possible that contamination in soil would impact groundwater at concentrations lower than the soil maximum concentrations. If there was a site-specific model for dissolution and transport of each soil contaminant to groundwater (including co-solvency and dissolution/transport facilitated by other contaminants), minimum criteria could be set for determining whether discrete groundwater sampling is necessary, but without these site-specific models, the soil maximum concentration should not be used. Please delete Step 2 from Figure A1-18 and Table A1-18.*

3. *Table A1-18, Numerical Comparison Criteria and Known Maximum Contaminant Levels for Decision Logic Figures A1-17 through A1-20; Figure A1-17, Decision Logic for Installation of Permanent Groundwater Monitoring Wells; and Figure A1-20, Decision Logic for SWMU and Data Gap Step-Out Discrete Groundwater Sampling: Similarly, it is unclear whether it is always appropriate to use the maximum groundwater concentration to screen discrete groundwater sample data to determine the need for step out sampling or for permanent monitoring wells. In areas outside the six-phase heating (SPH) treatment areas, it may be important to delineate the extent of contamination in areas where the historic maximum concentration has not been exceeded. This would provide information necessary for developing alternatives and cost estimates for the FS and for the RD. In addition, since SPH should result in reduction of volatile organic compound (VOC) and semi-volatile organic compound (SVOC) concentrations, use of historic maximum criteria may not be appropriate.*

Please delete Step 2 or propose another decision logic question that will result in delineation of the extent of contamination in groundwater and installation of necessary permanent groundwater monitoring wells.

Response to Specific Comment 2.

The Navy proposes to eliminate Step 2 from the Decision Logic figures and from Table A1-18 and to provide a more focused introductory statement on the use of these figures. The primary purpose of step-out sampling is to complete the characterization of areas for which there is little or no historical sampling and no other currently planned sampling points. For the evaluation areas with sampling grids such as Evaluation Area 4 (which includes historical sampling location 054-001-007), an areawide statistical approach for characterization makes step-out sampling generally unnecessary. The current version of the Decision Logic figures is a more generic approach, and Step 2 is designed to eliminate additional sampling in grid-sampling areas where adequate data has been collected or is being collected. To focus the use of the Decision Logic figures, text will be added where these figures are introduced. The following is an example of additional text to be added:

"In the event that analytical results for soil (or discrete groundwater, where applicable) samples collected from the perimeter of grid-sampling areas (i.e., Evaluation Areas 3, 4, 5, and 6) or from SWMU or Data Gap sampling locations outside of grid-sampling areas indicate the presence of constituents for which no previous sampling has been conducted, or constituents at concentrations exceeding comparison criteria, step-out soil sampling (or discrete groundwater sampling) may be required. The decision logic for additional (soil/discrete groundwater) sampling is illustrated on Figures A1-18, A1-19, and A1-20."

Revised Figures A1-17 through A1-20 and revised Table A1-18 are included in Attachment A1 to the final Work Plan.

ATTACHMENT H

RADIOLOGICAL WORK INSTRUCTION

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RADIOLOGICAL WORK INSTRUCTION, ALAMEDA POINT OPERABLE UNIT 2C FOR BECHTEL ENVIRONMENTAL, INC., APRIL 2007

ADMINISTRATIVE PROCEDURES

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New World Technology

RADIOLOGICAL WORK INSTRUCTION

Alameda Point Operable Unit 2C for Bechtel Environmental, Inc.

Prepared by:

New World Technology
448 Commerce Way
Livermore, CA 94551

April 2007

Controlled Copy No. _____

RADIOLOGICAL WORK INSTRUCTION
Alameda Point
Operable Unit 2C
For Bechtel Environmental, Inc.
April 2007

This radiological work instruction will be used to support the scope of field activities at Operable Unit (OU)-2C, Alameda Point for Bechtel Environmental, Inc., (BEI). The field work involves installation of monitoring wells; conducting soil, soil gas, and groundwater sampling; and performing aquifer testing in order to evaluate concentrations of chemical compounds in shallow soil, soil gas, and groundwater and to establish groundwater flow direction at the site.

Areas where the above activities are to be performed have been designated as potentially radiologically impacted therefore; it is possible that portions of the work areas are contaminated, including the soil beneath the building. The radionuclides of concern (ROC's) are radium-226 (^{226}Ra) and depleted uranium (primarily ^{238}U). Radium should be considered the primary radioisotope of concern.

Because the work areas are potentially impacted by low-level radioactive contamination it is possible that workers and equipment may come in contact with this contamination. Therefore, prior to beginning any work, the area within the building identified for the installation of wells will be surveyed for radioactive contamination using Standard Operating Procedures (SOP's) FM-020-01-20, *"Radiation and Contamination Survey Techniques"*, and FM-023-01-20, *"Gamma Scanning of Site Grounds"*, by radiological control technicians.

Radiological Release Limits

TABLE 1

RELEASE CRITERIA FOR EQUIPMENT AND MATERIALS

Radionuclide	Radiation	Equipment (dpm/100 cm^2)	
		Loose	Fixed[a]
^{226}Ra	Alpha	20 α	100 α
^{238}U	Alpha	1,000 α	5,000 α

Notes:
[a] These limits are based on Atomic Energy Commission *Regulatory Guide 1.86.*
Types of radiation: α - alpha, γ - gamma, β$^-$ - beta
cm^2 – square centimeters
dpm – disintegrations per minute

Soil release will be based on observed readings using a 2" by 2" sodium iodide detector (NaI). The release criteria will be no observed readings exceeding 3 sigma (standard deviations) above the background count rate.

Radiological Support

The radiological support activities to be performed include:

- Providing a radiation safety briefing to staff assigned to the project who have not previously received a radiation safety briefing.
- Performing radiation surveys within the building where the activities will be performed.
- Performing incoming equipment and material surveys.
- Providing radiological monitoring during the installation of the borings.
- Providing radiological monitoring during the collection of samples.
- Performing personnel surveys while the work is being performed, if necessary.
- Performing radiological release surveys on outgoing equipment and material.

Table 2 Instrumentation

Type of Measurement/Area Surveyed	Meter	Detector	Typical Background (See Note 1)	Typical Total Efficiency (%) (See Note 1)	Typical Minimum Detectable Concentration (See Note 1)
Alpha-Beta Surface Scans/Direct Measurements	Ludlum Model-2224 Scaler/rate meter or equivalent	Large Area Scintillation Ludlum Model 43-89 (125 cm^2)	150-250 CPM $\beta\gamma$ 0-1 CPM α	~ 3% $\beta\gamma$ ~ 4% α	(2-minute count) ~ 1114-1,426 dpm/100cm^2 $\beta\gamma$ ~30-96 dpm/100cm^2 α
Exposure Rates	Ludlum Model-19 µR meter or equivalent	Scintillation (NaI)	4-5 µR/hr	N/A	2 µR/hr
Direct Measurements Gamma Emissions	Ludlum Model-2350-1 Datalogger or equivalent	2 x 2 (NaI) Scintillation Model 44-10	4000-5000 CPM γ	N/A	1,500 CPM γ
Gross alpha/beta/gamma on Swipe Samples	Ludlum Model-2929 Dual Channel Scaler	Ludlum Model 43-10-1 ZnS Scintillation Detector	50-75 CPM $\beta\gamma$ 0-2 CPM α	~ 6% $\beta\gamma$ ~ 18% α	(3-minute count) ~ 350 dpm/100cm^2 $\beta\gamma$ ~ 17 dpm/100cm^2 α

Note 1: background values, efficiencies and detection sensitivities will be calculated using actual on site conditions

Radiological surface scans will be conducted in the immediate work areas where field activities are to be performed using SOP FM-020-01-20, *"Radiation and Contamination*

Survey Techniques", to ensure that existing radiation and contamination levels are not elevated prior to disturbing the surfaces.

Incoming equipment and materials will be surveyed for existing levels of radioactivity prior to being placed into service on the jobsite. Surveys will be conducted in accordance with SOP FM-003-01-20, "*Release of Materials from Controlled Areas"*.

Additional radiological surveys will be performed on the soil cuttings and soil cores removed during the installation of the new borings. For screening, the soil cuttings and cores will be spread out on plastic sheeting, with a 6-inch maximum thickness. The spread out soil will be scan surveyed with 2"x2" NaI detectors for gamma radiation. If the cuttings or cores exceed the 3 sigma value, they will then be sampled for ^{226}Ra. One four-point composite soil sample of approximately 300-400 grams will be collected and shipped to the laboratory for analysis. The remaining soil/cuttings will be placed in a separate drum and segregated while waiting for sample analysis results.

If samples are collected, they will be analyzed by gamma spectroscopy (DOE GA-01-R MOD or equivalent), by an outside NAVLAP accredited laboratory, with a Minimum Detectable Activity of 0.5 pCi/g or less for ^{226}Ra. Sample results exceeding 1.365 pCi/g will be considered contaminated, based on background studies previously conducted at Alameda Point (*Site 1 Characterization Study Report, TtECi 2005*). Sample control and tracking will be conducted in accordance with BEI sample collection and Chain of Custody procedures.

Solid IDW that has passed the scan, once accumulated, will have a four point composite sample taken from each container, shipped to the off site laboratory and analyzed per the above method for ^{226}Ra prior to approved disposal.

If radiation levels are detected above the limits prescribed in this radiological work instruction, field activities will cease until the work instruction has been revised and the necessary radiological controls implemented to allow the field work to continue in a manner protective of both the worker and the environment.

Surveys of tools, materials, and equipment will be conducted in accordance with SOP FM-020-01-20, *"Radiation and Contamination Survey Techniques"*. If radioactive contamination is identified that is above the release criteria in Table 1, RASO will be notified. No decontamination activities are to be employed under this work instruction.

Outgoing equipment and materials will be surveyed for release prior to leaving the jobsite. Surveys will be conducted in accordance with SOP FM-003-01-20, "*Release of Materials from Controlled Areas"*. Swipe samples will be collected from the tools and equipment and analyzed prior to their leaving the site. If radioactive contamination is

identified that is above the release criteria in Table 1, RASO will be notified and changes to this work instruction will be required prior to any decontamination activities.

Results of the surveys will be submitted to the RASO upon completion of the surveys and compilation of the survey data. A general statement will be included in the daily log that screening was performed and what the screening indicated. The screening data will be provided to RASO and documented for future reference if required.

No radioactive waste (materials, equipment or soils) is expected to be generated during work activities. Should waste materials be identified that exceed the criteria identified in Table 1 or other restrictions stated in this work instruction, they will immediately be secured in an appropriate container and labeled to identify the hazard. RASO will be notified and consulted on identification of a waste storage area and the waste will be disposed of via the Department of the Navy Low-level Radioactive Waste Disposal Program.

No dosimetry will be required for the work force. The assigned radiological control technician will wear a TLD in accordance with NWT operational procedures to provide "negative data" concerning worker exposure to ionizing radiation.

Liquids generated during work activities will consist of rinse water used on equipment (liquid IDW) and a limited number of ground water samples. Though the equipment rinse water is not considered suspect, as the equipment will be surveyed and released prior to rinsing, the field instrumentation is not capable of detecting the limit of 5 pCi/l total radium. Total radium (^{226}Ra and ^{228}Ra) analysis will be performed in conjunction with the chemical analysis using EPA Method 903.1 or equivalent, prior to approved disposal. The ground water samples specified in the Sampling and Analysis Plan will include an analysis by the off site laboratory for total radium by the same method. Ground water sample containers will be swipe surveyed following collection to ensure no loose surface contamination on the containers prior to leaving the sampling site.

New World Technology

ADMINISTRATIVE PROCEDURES

FM-001-01-20
FM-003-01-20
FM-020-01-20
FM-023-01-20

Prepared by:

New World Technology
448 Commerce Way
Livermore, CA 94551

Controlled Copy
No. _____

FM-001-01-20

New World Technology

Administrative Procedure

QUALITY CONTROL FOR HEALTH PHYSICS COUNTING EQUIPMENT AND SYSTEMS

New World Technology
448 Commerce Way
Livermore, CA 94551

New World Technology

APPROVAL PAGE

Procedure Number/Title: **FM-001-01-20, Quality Control for Health Physics Counting Equipment and Systems,** has been reviewed and approved by the following:

APPROVAL SIGNATURES:

William G. Haney, Vice President, Operations	Date
Doc Dennis, Radiation Safety Officer	Date
Donald Wadsworth, President	Date

Section	Title
1.0	Purpose
2.0	References
3.0	Apparatus
4.0	Precautions and Limitations
5.0	Prerequisites
6.0	Calibration
7.0	Procedure
8.0	Records
9.0	Forms and Exhibits

1.0 PURPOSE

1.1 The purpose of this procedure is to establish the necessary actions to provide a quality control program for laboratory counting equipment. This program shall include, but not be limited to, the following:

1.1.1 Establish the necessary actions to determine operating voltages for alpha, beta and gamma sensitive detectors.

1.1.2 Establish the necessary actions to provide well-determined background data for alpha, beta and gamma counting systems.

1.1.3 Establish the necessary actions to evaluate the statistical reliability of various alpha, beta, and gamma counting systems by use of the Chi-squared test.

1.1.4 Establish the necessary actions to prepare statistical control charts to monitor the stability of counting systems and their associated backgrounds.

1.1.5 Establish the necessary actions to determine and utilize "a priori" minimum detectable count rates and minimum detectable activities for each laboratory counting system.

1.1.6 Establish the necessary actions to determine and utilize reporting and "less than" levels for each laboratory counting system.

1.1.7 Provide for the proper documentation of the above actions.

1.2 This procedure specifically excludes multi-channel counting and/or spectrographic systems.

2.0 REFERENCES

2.1 Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG-1575, EPA 402-R-97-016

2.2 The Health Physics and Radiological Health Handbook1992 , Shleien, Revised Edition

2.3 NUREG/CR-5849 "Manual for Conducting Surveys in Support of License Termination"

2.4 NUREG-1505 "A Nonparametric Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys"

2.5 NUREG-1507 "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions"

3.0 APPARATUS

3.1 Appropriate gas supply.

3.2 Traceable standard alpha sources, with radionuclide content appropriate to the system.

3.3 Traceable standard beta sources, with radionuclide content appropriate to the system.

3.4 Traceable standard gamma sources, with radionuclide isotopic content appropriate to the system.

3.5 Suitable check sources.

3.6 Planchettes, forceps, etc.

3.7 Unused, clean air sample fitters.

3.8 Unused, clean smear papers.

3.9 Approved cleaning solvents/agents.

4.0 PRECAUTIONS AND LIMITATIONS

4.1 Exercise care to keep all counting equipment clean and dry.

4.2 Exercise caution when handling or using radioactive sources.

4.3 The sources used for standardization and/or evaluation of counting systems may be deposited on special media (swabs, filter paper, etc.). They may be very fragile and shall be handled with care to avoid flaking or decomposition of the mount. Do not attempt to remove these sources from their planchettes or holders. Do not wipe radioactive surfaces of sources.

4.4 Plated sources shall be handled only by the edges.

4.5 Damaged sources or sources with damaged coverings are no longer traceable in calibration and shall not be used for quantitative calibration.

5.0 PREREQUISITES

5.1 The instrument or system shall be allowed to warm up and stabilize prior to testing.

5.2 Gas flow detectors shall be properly flushed, and the proper flow established prior to testing, according to manufacturer specifications.

5.3 Calibration sources used for standardization or system evaluation shall be traceable, and certification shall be on file at corporate and the specific project.

5.4 Prerequisites appropriate to each sub-section of Section 7.0 below are placed at the beginning of each sub-section.

6.0 CALIBRATION

6.1 Calibration shall be completed on an annual frequency in accordance with the applicable instrument calibration procedure.

7.0 PROCEDURE

7.1 Frequency

7.1.1 Quality control testing and evaluation shall be performed semi-annually (± 15 days), unless exceptions to this frequency are made in the specific Instrument Operation and Calibration Procedure.

7.1.2 The routine frequency may be extended by up to one additional month with written approval of the NWT Site Radiation Safety Officer or his/her designee.

7.1.3 In addition to the routine frequency of performance, quality control testing and evaluation shall be performed under the following conditions:

a. Prior to placing a new counting system into service.

b. After any major repair or alteration to the counting system or detectors.

NOTE 7.2

The following sub-sections (7.2, 7.3, 7.4, etc) may be performed individually and separately from the body of this procedure if such action is required by a specific Instrument Operation and Calibration Procedure. The prerequisites listed for that specific sub-section must be documented as having been completed and the complete documentation package must be prepared with the sub-sections NOT being performed marked as Not Applicable.

7.2 Detector Voltage Plateau

NOTE

This section is required for fixed scaler/counting systems only.

7.2.1 Ensure that the counting system is set up for operation according to the applicable Instrument Operation and Calibration Procedure and/or the manufacturer's technical literature.

7.2.2 Obtain a radiation source with a known counting rate in the region of 1000 to 3000 counts per minute, (cpm).

7.2.3 Record the following information on the Plateau Data Sheet, Form NWT-HPQA-001 or equivalent form.

a. Scaler / Counter ID Number.
b. Detector ID Number, if external/separate.
c. Source ID Number.

7.2.4 Place the source in the detector chamber.

7.2.5 Set the high voltage adjustment of the counting system to the lowest possible setting.

NOTE 7.2.6

DO NOT exceed the manufacturer's limitations or restrictions on voltage for either the detector or the power supply.

7.2.6 Gradually increase the high voltage until a rapid increase in count rate is obtained. Note the high voltage setting.

7.2.7 Reduce the high voltage to approximately 100 volts below the noted increase point.

7.2.8 Obtain, and record on the Plateau Data Sheet, a series of one minute counts at appropriate voltage increments, usually equal increments of 20 to 50 volts are convenient, until EITHER no further voltage increase is possible OR a second sharp increase in count rate is noted.

7.2.9 Using the Voltage Plateau Graph, plot a curve of count rate (vertical axis) versus voltage (horizontal axis).

7.2.10 Record the following on the Voltage Plateau Graph, Form NWT-HPQA-002 or equivalent form.

a. Scaler / Counter ID Number.
b. Detector ID Number, if external/separate.
c. Source ID Number.

7.2.11 The relatively flat portion of the plot is the plateau. The correct operating voltage is located one-third to one-half the distance up the plotted plateau. Pick a point within this range with a convenient value of high voltage. Use whole numbers, if possible a multiple of 10, only.

7.2.12 Record this operating voltage on the Voltage Plateau Graph.

7.2.13 Perform the following:

a. Enter the date, time, and printed name of the individual performing the test on both the data sheet and the graph sheet.
b. Sign both the data sheet and the graph sheet.

7.2.14 The plateau data and graph MAY be submitted to the NWT Site Radiation Safety Officer or his/her designee at this time for review. Review should be performed at this time if:

a. Any of the data were anomalous, or
b. The entire Quality Control evaluation is not being performed at this time.

7.3 Determination of System Background

7.3.1 Prerequisites

A valid voltage plateau, or operating voltage has been determined and documented.

7.3.2 Ensure that the counting system is set up for operation according to the applicable Instrument Calibration and Use Procedure and/or the manufacturer's technical literature.

7.3.3 Record the following information on the Background Data Sheet, Form NWT-HPQA-003 or equivalent spreadsheet.

a. Scaler / Counter ID Number
b. Detector ID Number, if external/separate
c. Source ID Number

7.3.4 Data Accumulation

a. Place a clean, empty planchette in the sample holder.
b. Insert the sample holder in the detector chamber.
c. Set the instrument for a timed count of 1 minute.
d. Count the empty planchette.
e. Record the total counts on the Background Data Sheet Form NWT – HPQA003.

NOTE

The instrument/system may remain in service, using the "old" background during the accumulation of data for the new determination of background. The repetitive counts may be accumulated over several days, however all counts shall be completed within 10 days of the initial count.

7.3.5 Repeat Section 7.3.4 nine additional times.

7.3.6 Remove the empty planchette from the detector chamber.

7.3.7 Calculations:

a. Total the values of the individual counts. Enter the value in the Total box on the data sheet.

b. Divide the total by the number, 10, of determinations and enter this value in the Mean Count, $\bar{x}$, box on the data sheet.

c. Subtract the mean count, $\bar{x}$, from each of the individual counts. Enter the values found in the column labeled $(x-\bar{x})$ on the data sheet.

d Square each of the deviations, $(x-\bar{x})$, and enter the values found in the column labeled $(x-\bar{x})^2$ on the data sheet.

e. Total the values of the squared deviations column, and enter this value in the Sum of Squares, box on the data sheet.

f. Divide the Sum of Squares, by nine (9). Enter this value in the Variance, box on the data sheet.

g. Extract the square root of the Variance, and enter the value in the Standard Deviation (σ) (Counts), box on the data sheet.

h. The Background Count Rate $\pm 2\sigma$ is the acceptable background range.

i. Enter the background range in the appropriate blocks of Form NWT-013 or NWT-013A.

j. Perform the following:

1. Enter the date, time, and (printed) name (of the individual performing the test) on the Background Data Sheet.
2. Sign the data sheet.

k. The Background data MAY be submitted to the cognizant Health Physics Technical Supervisor at this time for review. Review should be performed at this time if:

1. Any of the data were anomalous, or
2. The entire Quality Control evaluation is not being performed at this time.

7.4 Chi-Squared Test of Reliability for Fixed Scalers/Counters (Model 2929 Dual Channel Scaler, Protean Gas Proportional Counter)

7.4.1 Prerequisites

a. A valid voltage plateau, or operating voltage, has been determined and documented.
b. A well determined background value has been obtained and documented.

7.4.2 Ensure that the counting system is set up for operation according to the applicable Instrument Calibration and Use Procedure and/or the manufacturer's technical literature.

7.4.3 Obtain a NIST Traceable Standard Source with isotopic content appropriate to the detector being evaluated.

a. The source should be of sufficient activity to yield a counting rate of 1000 to 50,000 counts per minute.

b. The source should not exceed 50,000 cpm.

7.4.4 Record the following information on the Chi-squared Data Sheet, Form NWT-HPQA004 or equivalent spreadsheet:

a. Scaler/Counter ID Number.
b. Detector ID Number, if external/separate.
c. Source ID Number.

7.4.5 Place the source in the detector chamber.

7.4.6 Collect twenty (20) counts of one (1) minutes duration each. Record the results, in counts per minute, in the column labeled "Gross cpm, C_G".

7.4.7 Subtract the background count rate, C, from each count to obtain the net count rate. Record the results in the column labeled "Net cpm, C_I".

7.4.8 Calculations:

a. Sum the twenty C_I values and record the result in the box labeled:

$$SUM = _____ \Sigma C_I$$

b. Divide the total by 20 and record the result obtained in the box labeled:

$$\text{Mean } (\overline{C}) = _____ (C_I/20)$$

c. Subtract the mean count rate, $\overline{C}$ from each of the C_I values, recording the results in the column, $(C_I - \overline{C})$.

d. Square each of the $(C_I - \overline{C})$ values obtained, record the results in the column labeled, $(C_I - \overline{C})^2$.

e. Sum the twenty $(C_I - \overline{C})^2$ values and record the results in the box labeled: Sum of Squares = $\Sigma(C_I - \overline{C})^2$

f. Calculate the Chi-squared value by dividing the Sum of Squares "$\Sigma(C_I - \overline{C})^2$ by the mean count rate $\overline{C}$ and record the results in the box labeled Chi-Squared Value (C^2).

g. The Chi-Squared value should be between 10.11 and 30.14. If the C^2 value is NOT between 10.11 and 30.14, THEN notify the NWT Site Radiation Safety Officer or his/her designee prior to continuing.

7.4.9 Perform the following:

a. Enter the date, time, and (printed) name (of the individual performing the test) on the Chi-squared Data Sheet.

b. Sign the data sheet.

c. The Chi-squared data MAY be submitted to the NWT Site Radiation Safety Officer or his/her designee at this time for review. Review should be performed at this time if:

1. Any of the data were anomalous, or

2. The entire Quality Control evaluation is not being performed at this time.

7.5 Chi-Squared Test of Reliability for Portable Scalers/Counters (Model 2350-1, 2360's with various attached detectors)

7.5.1 Prerequisites

a. A valid voltage plateau, or operating voltage, has been determined and documented.

b. A well determined background value has been obtained and documented on Form NWT-HPQA003.

7.5.2 Ensure that the counting system is set up for operation according to the applicable Instrument Calibration and Use Procedure and/or the manufacturer's technical literature.

7.5.3 Obtain a NIST Traceable Standard Source with isotopic content appropriate to the detector being evaluated.

a. The source should be of sufficient activity to yield a counting rate of 1000 to 50,000 counts per minute.
b. The source should not exceed 50,000 cpm.

7.5.4 Record the following information on the Chi-squared Data Sheet, Form NWT-HPQA004 or equivalent spreadsheet:

a. Scaler/Counter ID Number.
b. Detector ID Number, if external/separate.
c. Source ID Number.

7.5.5 Place the source in the appropriate location and distance from the active window of the detector, as defined by project work plan.

7.5.6 Collect twenty (20) counts of one (1) minutes duration each. Record the results, in counts per minute, in the column labeled "C_G (Gross cpm)".

7.5.7 Subtract the background count rate, C_B, from each count to obtain the net count rate. Record the results in the column labeled "C_I (Net cpm)".

7.5.8 Calculations:

a. Sum the twenty C_I values and record the result in the box labeled:

$$\text{SUM} = _____ \ \Sigma C_I$$

b. Divide the total by 20 and record the result obtained in the box labeled:

$$\text{Mean } (\overline{C}) = _____ \ (C_I/20)$$

c. Subtract the mean count rate, $\overline{C}$ from each of the C_I values, recording the results in the column, $(C_I - \overline{C})$.

d. Square each of the $(C_I - \overline{C})$ values obtained, record the results in the column labeled, $(C_I - \overline{C})^2$.

e. Sum the twenty $(C_I - \overline{C})^2$ values and record the results in the box labeled:

$$\text{Sum of Squares} = \Sigma (C_I - \overline{C})^2$$

f. Calculate the Chi-squared value by dividing the Sum of Squares "$\Sigma (C_I - \overline{C})^2$ by the mean count rate $\overline{C}$ and record the results in the box labeled Chi-Squared Value (C^2).

g. The Chi-Squared value should be between 10.11 and 30.14. If the C^2 value is NOT between 10.11 and 30.14, THEN notify the NWT Site Radiation Safety Officer or his/her designee prior to continuing.

7.5.9 Perform the following:

a. Enter the date, time, and (printed) name (of the individual performing the test) on the Chi-squared Data Sheet.

b. Sign the data sheet.

c. The Chi-squared data MAY be submitted to the NWT Site Radiation Safety Officer or his/her designee at this time for review. Review should be performed at this time if:

1. Any of the data were anomalous, or

2. The entire Quality Control evaluation is not being performed at this time.

7.6 Counting System Efficiency for Fixed Scalers/Counters Counters (Model 2929 Dual Channel Scaler, Protean Gas Proportional Counter)

7.6.1 Prerequisites

a. A valid voltage plateau, or operating voltage, has been determined and documented.

b. A well determined background value has been obtained and documented.

c. A successful Chi-squared test has been performed and documented.

7.6.2 Non-routine isotopes

a. In addition to the routine frequency of determination, counting system efficiencies SHOULD be determined when isotopes with energies significantly different from the calibration energy must be analyzed.

7.6.3 Enter the following information on the Efficiency Data Sheet Form NWT HPQA05 or equivalent spreadsheet:

a. Scaler/Counter ID Number.

b. Detector ID Number, if external/separate.

c. Source ID Number.

d. The sources present total activity in dpm.

e. The mean counting rate, c, of the source.

7.6.4 Calculation:

a. Complete the following calculation on the Efficiency Data Sheet:

$$E = \frac{Gross\ cpm - Net\ (background)\ cpm}{(Source\ Total\ Activity\ in\ dpm)}$$

NOTE

Non-routine sources and/or geometry should be calculated only at the direction of the Health Physics Technical Supervisor or designee.

7.6.5 Alpha Channel

a. Obtain a 47 mm diameter Th-230 or equivalent reference source greater than 1,000 dpm.

b. Place the source in the detector chamber and count for a period of one minute.

c. Determine the net count rate from the source.

d. Determine the specific efficiency, E

NOTE

Detection efficiencies for different sample types (i.e., geometry, mass, etc.) must be calculated separately.

e. Calculation:

$$E = \frac{Average\ \ cpm - Background\ \ cpm}{Source\ \ Activity\ \ in\ dpm}$$

f. Record the result on the data sheet.

7.6.6 Perform the following:

a. Enter the date, time, and (printed) name (of the individual performing the test) on the Efficiency Data Sheet.

b. Sign the data sheet.

c. The Efficiency data MAY be submitted to the NWT Site Radiation Safety Officer or his/her designee at this time for review. Review SHOULD be performed at this time if:

1. Any of the data were anomalous, or
2. The entire Quality Control evaluation is not being performed at this time.

7.6.7 Beta Channel

a. Obtain a 47 mm diameter Tc-99 or equivalent reference source greater than 1,000 dpm.

b. Perform Steps 7.6.5 (b) through (f).

7.7 Instrument Efficiency for Portable Scalers/Counters (Model 2350-1, 2224's, 2221's, and 2360's with gas proportional, scintillation, and sodium iodide detectors)

7.7.1 Determination of Instrument Efficiency (ε_i) for Alpha and Beta Surface Activity Measurements

The instrument efficiency (ε_i) is determined during calibration and is defined as the ratio between the net count rate (in counts per minute (cpm)) of the instrument and the surface emission rate of the calibration source for a specified geometry. The surface emission rate is the 2π particle fluence that is affected by both the attenuation and backscatter of the radiation emitted from the calibration source.

The following equation is used to calculate the instrument efficiency in counts per particle:

$$\varepsilon_i = \frac{R_{S+B} - R_B}{q_{2\Pi}\left(W_A / S_A\right)}$$

where,

R_{S+B} = the gross count rate of the calibration measurement (cpm)
R_B = the background count rate in cpm
$q_{2\Pi}$ = the 2π surface emission rate of the calibration source (NIST traceable)

W_A = Active Area of the detector window (cm^2)
S_A = Area of the source (cm^2)

Note: This equation assumes that the dimensions of the calibration source be sufficient to cover the window of the instrument detector. If the dimensions of the calibration source are smaller than the detector's window, set W_A equal to the dimensions of the calibration source, i.e., set the quotient of W_A and S_A equal to 1.

The instrument efficiency is determined during calibration by obtaining static counts with the detector over a calibration source that has a National Institute of Standards and Technology (NIST) traceable surface emission rate. The 2π particle fluence rate is corrected for decay, attenuation and scatter, then; the surface emission rate of the source must be corrected for the area subtended by the probe. Factors that can also affect the instruments efficiency are discussed below:

7.7.2 Prerequisites

a. A valid voltage plateau, or operating voltage, has been determined and documented.

b. A well determined background value has been obtained and documented.

c. A successful Chi-squared test has been performed and documented.

7.7.3 Non-routine isotopes

a. In addition to the routine frequency of determination, counting system efficiencies SHOULD be determined when isotopes with energies significantly different from the calibration energy must be analyzed.

7.7.4 Enter the following information on the Efficiency Data Sheet Form NWT HPQA005 or equivalent spreadsheet:

a. Scaler/Counter ID Number.

b. Detector ID Number, if external/separate.

c. Source ID Number.

d. The sources present 2π emission rate in alphas/min, betas/min, or gammas/min.

e. The mean counting rate, c, of the source.

7.7.5 Alpha Measurements

a. Obtain a Th-230 or equivalent reference source greater than 1,000 dpm.

b. Place the source in the appropriate location and distance from the active window of the detector.

c. Determine the net count rate from the source.

d. Determine the specific instrument efficiency, ε_i

e. Calculation:

$$\varepsilon_i = \frac{R_{S+B} - R_B}{q_{2\Pi}\left(W_A / S_A\right)}$$

where,

R_{S+B}	=	the gross count rate of the calibration measurement (cpm)
R_B	=	the background count rate in cpm
$q_{2\Pi}$	=	the 2π surface emission rate of the calibration source (NIST traceable)
W_A	=	Active Area of the detector window (cm^2)
S_A	=	Area of the source (cm^2)

f. Record the result on the data sheet.

7.7.6 Perform the following:

a. Enter the date, time, and (printed) name (of the individual performing the test) on the Efficiency Data Sheet or equivalent spreadsheet.

b. Sign the data sheet.

c. The Efficiency data MAY be submitted to the NWT Site Radiation Safety Officer or his/her designee at this time for review. Review SHOULD be performed at this time if:

1. Any of the data were anomalous, or
2. The entire Quality Control evaluation is not being performed at this time.

7.7.7 Beta Measurements

a. Obtain a Tc-99 or equivalent reference source greater than 1,000 dpm.

b. Perform Steps 7.7.5 (b) through (f).

7.8 Determination of Total Efficiency (ε_t) for Alpha and Beta Surface Activity Measurements (Model 2350-1, 2224's, 2221's, and 2360's with gas proportional, scintillation, and sodium iodide detectors)

The total efficiency (ε_t) is determined during calibration and is defined as the ratio between the net count rate (in counts per minute (cpm)) of the instrument and the surface emission rate of the calibration source for a specified geometry. The surface emission rate is the 2π particle fluence that is affected by both the attenuation and backscatter of the radiation emitted from the calibration source.

The following equation is used to calculate the total efficiency:

$$\varepsilon_t = \varepsilon_i * \varepsilon_s$$

where,

ε_i = the instrument efficiency (count per particle)
ε_s = the contaminated surface efficiency (particle per disintegration)

7.8.1 Surface Efficiency (ε_s) for Surface Activity Measurements

The surface efficiency term is used to determine the 4Π total efficiency for a particular surface and condition. Suitable values are based on the radiation and radiation energy, and are primarily impacted by the backscatter and self-absorption characteristics of the surface on which the contamination exists in the field. Backscatter is most affected by the energy of the radiation and the density of the surface material. Self-absorption characteristics or attenuation are also a function of the radiation's energy and surface condition. Surfaces typically encountered in the field include concrete, wood, dry wall, plaster, carpet, and metal. Surface conditions include both physical effects, such as scabbled concrete, and the effect of surface coatings, i.e., dust, paint, rust, water, and oil.

In the absence of experimentally determined surface efficiencies, ISO-7503-1 and NUREG 1507, provide conservative recommendations for surface efficiencies. ISO-7503-1, recommends a surface efficiency of 0.5 for maximum beta energies exceeding 0.5 MeV, and to use a surface efficiency of 0.25 for beta energies between 0.15 and 0.4 MeV and for alpha emitters. NUREG-1507 provides surface efficiencies based on studies performed primarily at ORISE. In general, NUREG-1507 indicates that the ISO rule-of-thumb for surface efficiencies are conservative, particularly for beta-emitting radionuclides with end-point energies between 0.25 MeV and 0.4 MeV.

7.9 Performance Test for Fixed Scalers/Counters (Model 2929 Dual Channel Scaler, Protean Gas Proportional Counter)

7.9.1 Prerequisites

a. A valid voltage plateau, or operating voltage, has been determined and documented.

b. A well determined background value has been obtained and documented.

c. A successful Chi-squared test has been performed and documented.

7.9.2 Background Check

7.9.2.1 Remove any source or sample from the detector tray.

7.9.2.2 Place the appropriate clean blank in clean counting planchette.

7.9.2.3 Lock the drawer closed.

7.9.2.4 Perform a 10 minute timed background count.

7.9.2.5 Divide the total counts for the alpha and beta-gamma channels by ten (10) to obtain results in CPM.

7.9.2.6 Record the Alpha and Beta-Gamma results in cpm, in the respective columns on the Daily Background and Efficiency Form NWT-013, NWT-013A, NWT-013B, or NWT-013AB.

7.9.2.7 Compare each background to its background and & range.

7.9.2.8 If either background rate exceeds its limits, clean the sample drawer and recheck background.

7.9.2.9 If either background remains out of range, remove the instrument from service and arrange for repair. Notify Health Physics Supervision.

NOTE

It is permissible to use the Proteans control check and/or limit abilities for steps 7.9.3 and 7.9.4.

7.9.3 Alpha Source Check (Th-230 or equivalent)

7.9.3.1 Retrieve from storage the check source identified in the 'SOURCE ID#" space at the top of form NWT-013, NWT-013A, or NWT-013AB.

7.9.3.2 Place the source in an empty counting planchette.

7.9.3.3 Open the sample drawer and place the source/planchette in the sample tray.

7.9.3.4 Close and lock the drawer in the count position, and perform a 1-minute timed count, record the results on Form NWT-013, NWT-013Aor NWT-013AB.

7.9.3.5 Record the result of the source count in the "SOURCE COUNTS" (CPM) column of the form.

7.9.3.6 If the net response is within 10% of the source activity multiplied by the efficiency of the instrument, initial the "Initials" column of Form NWT-013, NWT-013A, or NWT-013AB.

7.9.4 Beta Source Check (Tc-99 or equivalent)

7.9.4.1 Repeat the steps of Section 7.9.3 using the beta check source specified in the "SOURCE ID#" space at the top of form NWT-013, NWT-013B, or NWT-013AB.

7.9.4.2 Record the data in the applicable columns of form NWT-013, NWT-013B, or NWT-013AB.

7.9.4.3 Initial NWT-013, NWT-013B, or NWT-013AB in the appropriate columns. Initial the Performance Test Daily Check Sticker.

7.9.4.4 Return the check sources to their designated storage locations.

7.9.5 Determination of MDC for Fixed Scalers/Counters (Model 2929 Dual Channel Scaler, Protean Gas Proportional Counter)

7.9.5.1 Prerequisites

a. A valid voltage plateau has been performed and documented for those instruments or systems with a variable high voltage capability.

b. A well determined background is available, unless an exception is made in the specific instrument procedure.

c. A successful Chi-squared test has been performed and documented.

d. Counting efficiency for the appropriate emission has been determined and documented.

e. The daily checks have demonstrated that the instrument is in statistical control; OR; where directed by specific procedure, a daily working background has been determined.

7.9.5.2 Calculation

a. Calculate MDC by performing a count of a paired blank for counting time equal to the sample counting time. A paired blank means a sample which is identical, chemically and physically, to the samples to be counted, except that no isotope is present (e.g., for smear samples a smear of a clean surface could be used as a paired blank for smears of potentially contaminated surfaces).

7.9.5.3 MDC may be calculated from the following formula:

$$MDC\,(dpm) = \frac{3 + 4.65\sqrt{C_B * T_B}}{E * T_B}$$

where:

C_B = Background Counts for the paired blank (CPM)
T_B = Sample Count Time for the paired blank (Minutes)
E = Instrument Efficiency for the isotope expected, expressed as a decimal

7.9.5.4 Record the MDC value for the appropriate channel (beta-gamma and alpha) on form NWT-006 or equivalent spreadsheet.

7.10 Determination of Detection Sensitivity – Static and Scan Minimum Detectable Concentration (MDC) for Portable Scalers/Counters (Model 2350-1, 2224's, 2221's, and 2360's with gas proportional, scintillation, and sodium iodide detectors)

7.10.1 Static MDC

The static MDC is the level of radioactivity, on a surface, that is practically achievable by the overall measurement process. The conventional equations below are used to calculate the instrument MDC in dpm per 100 cm^2.

$$MDC = \frac{3 + 4.65\sqrt{C_B}}{\varepsilon_i \varepsilon_s \frac{W_A}{100\ cm^2} T_B}$$

where,

C_B = Background counts in time T_B (min)
T_B = Background counting time (min)
ε_i = the instrument efficiency (count per particle)
ε_s = the contaminated surface efficiency (particle per disintegration)
W_A = the area of the detector window (cm^2)

If the background and sample are counted for different intervals the following equation is used calculate the MDC in dpm per 100 cm^2.

$$MDC = \frac{3 + 3.29\sqrt{R_B T_{S+B}\left(1 + \frac{T_{S+B}}{T_B}\right)}}{\varepsilon_i \varepsilon_s \frac{W_A}{100\ cm^2} T_{S+B}}$$

where,

R_B	=	background count rate (cpm)
T_B	=	background counting time (min)
T_{S+B}	=	sample counting time (min)
ε_i	=	the instrument efficiency (count per particle)
ε_s	=	the contaminated surface efficiency (particle per disintegration)
W_A	=	the area of the detector window (cm^2)

7.10.2 Scanning Minimal Detectable Count Rate, (MDCR)

The minimum detectable number of net source counts in the scan interval, for an ideal observer, can be arrived at by multiplying the square root of the number of background counts (in the scan interval) by the detectability value associated with the desired performance (as reflected in *d'*) as shown in equation below:

$$MDCR = d'\sqrt{b_i} \times 60/i$$

where,

d'	=	index of sensitivity (α and β error) – MARSSIM Table 6.5
b_i	=	number of background counts in scan time interval (count)
i	=	scan or observation interval (s)

7.10.3 Scan MDC

The scan MDC is determined from the minimum detectable count rate (MDCR) by applying conversion factors that account for detector and surface characteristics and surveyor efficiency. As discussed below, the MDCR accounts for the background level, performance criteria (*d'*), and observation interval. The observation interval during scanning is the actual time that the detector can

respond to the contamination source. This interval depends on the scan speed, detector size in the direction of the scan, and area of elevated activity.

The scan MDC for building structure surfaces is calculated using the following formula:

$$Scan\ MDC = \frac{MDCR}{\varepsilon_i \varepsilon_s \frac{W_A}{100\ cm^2}}$$

where,

MDCR	=	discussed in Section 7.10.2
T_B	=	background counting time (min)
ε_i	=	the instrument efficiency (count per particle)
ε_s	=	the contaminated surface efficiency (particles per disintegration)
W_A	=	the area of the detector window (cm^2)

7.11 Maintenance

7.11.1 No special storage requirements.

7.11.2 Electronic maintenance (except external adjustments and cable replacements) shall be performed by a Health Physics Instrumentation Technician or by the manufacturer or an approved vendor.

8.0 RECORDS

The following records will be generated and retained in the permanent project file as a result of using this procedure.

8.1 Form NWT-013 Ludlum Model 2929 Daily Background and Efficiency

8.2 Form NWT-013A Alpha Counting Scaler Daily Background and Efficiency

8.3 Form NWT-013B Beta Counting Scaler Daily Background and Efficiency

8.4 Form NWT-013AB Dual Channel Scaler Daily Background and Efficiency

8.5 Calibration Data Sticker

8.6 Daily Performance Test Check Sticker

9.0 FORMS AND EXHIBITS

9.1 Forms

9.1.1 Form NWT-013 Ludlum Model 2929 Daily Background and Efficiency

9.1.2 Form NWT-013A Alpha Counting Scaler Daily Background and Efficiency

9.1.3 Form NWT-013B Beta Counting Scaler Daily Background and Efficiency

9.1.2 Form NWT-013AB Dual Channel Scaler Daily Background and Efficiency

9.1.3 Form NWT-006 Smear Counting Analysis Report

9.1.4 Form NWT-HPQA001 Plateau Data Sheet

9.1.5 Form NWT-HPQA002 Voltage Plateau Graph

9.1.6 Form NWT-HPQA003 Background Data Sheet

9.1.7 Form NWT-HPQA004 Chi-Squared Data Sheet

9.1.8 Form NWT HPQA005 Efficiency Data Sheet

9.2 Exhibits

9.2.1 Daily Performance Test Check Sticker

9.2.2 Calibration Data Sticker

EXHIBIT 9.1
Daily Instrument Source Check Sticker

New World Technology
Daily Instrument Source Check

Instrument Serial Number	
Probe Serial Number	
Calibration Date	

Month *(Circle One)*												*Technician Initial & Date*						
J	F	M	A	M	J	J	A	S	O	N	D							
1		2		3		4		5		6		7						
8		9		10		11		12		13		14						
15		16		17		18		19		20		21						
22		23		24		25		26		27		28						
29		30		31														

EXHIBIT 9.2
Calibration Data Sticker

Survey Meter Calibration

Model _____ **Serial No.** _____

***Range within 10% unless noted**

x _____ ☐ * _____

x _____ ☐ * _____

x _____ ☐ * _____

x _____ ☐ * _____

x _____ ☐ * _____

Ded. Ck. Source S/N _____

Act. _____ **Reads**

Cal. Date _____ **Due Date** _____

Calibrated by _____

LUDLUM MEASUREMENTS, INC.

Sweetwater, Texas (915) 235-5494

FM-003-01-20

New World Technology

Field Operations Procedure

RELEASE OF MATERIALS FROM CONTROLLED AREAS

New World Technology
448 Commerce Way
Livermore, CA 94551

New World Technology

APPROVAL PAGE

Procedure Number/Title: **FM-003-01-20 Release of Materials From Controlled Areas**, has been reviewed and approved by the following:

APPROVAL SIGNATURES:

_____ _____

William G. Haney, Vice President, Operations Date

_____ _____

Doc Dennis, Radiation Safety Officer Date

_____ _____

Donald Wadsworth, President Date

Section	Title
1.0	Purpose
2.0	References
3.0	Apparatus
4.0	Precautions and Limitations
5.0	Prerequisites
~~6.0~~	~~Calibration~~
6.0 ~~7.0~~	Procedure
7.0 ~~8.0~~	Records
8.0 ~~9.0~~	Forms and Exhibits

1.0 SCOPE

This procedure sets forth the specific requirements for release of materials from controlled areas applicable to New World Technology (NWT) projects.

2.0 PURPOSE

The purpose of this procedure is to specify requirements for releasing material from controlled areas and to minimize the potential for unintentionally releasing contaminated items to uncontrolled areas in accordance with the provisions of Reference 3.1.1.

3.0 REFERENCES AND DEFINITIONS

3.1 References

3.1.1 DOE Order 5400.5 (2-8-90), Radiation Protection of the Public and the Environment

3.1.2 DOE Order 5480.11 (12-21-88), Radiation Protection for Occupational Workers

3.1.3 10 CFR 20 (5-22-91), Standards for Protection Against Radiation

3.1.4 FM-020-01-20, Radiation and Contamination Survey Techniques

3.1.5 NRC's "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Materials (NRC 1993), Office of Nuclear Material Safety and Safeguards (NMSS)."

3.1.6 ANSI N3.1-1987, Selection, Qualification and Training of Personnel for Nuclear Power Plants

3.1.7 TM-003-01-20, Operation of the Ludlum Model-2929

3.1.8 TM-001-01-20, Operation of Contamination Survey Meters

3.1.9 FM-021-01-20, Radiological Area Posting and Access Control

3.1.10 FM-005-01-20, Control of Radioactive Material

3.1.11 FM-004-01-20, Issue and Use of Radiation Work Permits

3.2 Definitions

3.2.1 **Activity** - The rate of disintegration (transformation) or decay of radioactive material. The units of activity for the purpose of this procedure are disintegrations per minute (dpm), Becquerel (Bq), or micro-Curies for loose contamination and disintegrations per minute or millirad/hour for fixed contamination.

3.2.2 **Contamination** - Deposition of radioactive material in any place it is not desired, particularly where its presence may be harmful. The harm may be actual exposure to individuals or release of the material to the environment or general public. Contamination may be due to the presence of alpha particle, beta particle or gamma ray emitting radionuclides.

3.2.3 **Controlled Area** - Any area to which access is controlled in order to protect individuals from exposure to radiation and radioactive materials and/or to prevent the release of radioactive materials to the uncontrolled areas.

3.2.4 **Fixed Contamination** - Radioactive contamination that is not readily removed from a surface by applying light to moderate pressure when wiping with a paper or cloth disk smear, or massilinn.

3.2.5 **Minimum Detectable Activity (MDA)** - For purposes of this procedure, MDA for removable radioactive contamination is defined as the smallest amount of sample activity that will yield a net count with a 95% confidence level based upon the background count rate of the counting instrument used.

3.2.6 **Evaluator** - An individual designated by the Radiological Field Operations Manager to evaluate materials or items in accordance with Sections 6.2, 6.3 and Step 6.5.6.

3.2.7 **Release for Unconditional Use** - A level of radioactive material that is acceptable for use of property without restrictions due to residual radioactive material without license conditions or controls. Under normal circumstances, authorized limits for residual radioactive material are set equal to, or below, the values specified in Reference 3.1.5, Table 1.

3.2.8 **Survey Exempt Materials** - The contents of sealed containers which remain unopened while in a controlled area are exempt, the outside surfaces are not exempt.

4.0 PRECAUTIONS, LIMITATIONS

4.1 Precautions

4.1.1 Instruments used to perform release surveys shall be operated in accordance with the respective operating procedure:

4.1.1.1 Ludlum Model-2929 - Reference 3.1.7

4.1.1.2 Ludlum Model-3 - Reference 3.1.8

4.1.2 MDA for the Ludlum Model-2929 shall be in accordance with Reference 3.1.7.

4.1.3 Large area smears may be used to augment (but not replace) the 100 cm^2 smear survey. Large area wipes may be counted with the Ludlum Model-3 or equivalent. Large area smears are used to obtain immediate information concerning loose contamination for the purpose of radiological protection and to minimize time spent performing disc smears on an item easily identified as contaminated.

4.1.4 A release document package shall include the following forms:

4.1.4.1 NWT-005 - Material Release Log.

4.1.4.3 NWT-001 - Radiological Survey Report or NWT-010, Unconditional Release of Equipment or Items Report and/or NWT-006, Smear Counting Analysis Report.

4.1.4.4 NWT-003 - Daily Instrument Performance Test Log or equivalent.

4.1.5 The release document shall include the following information:

4.1.5.1 The date of the release survey.

4.1.5.2 The number of the release survey.

4.1.5.3 A description or identification of the item.

4.1.5.4 The identity of the Health Physics Technician performing the release survey.

4.1.5.5 The evaluator of the material for release.

4.1.5.6 The release approval of the Health Physics Supervisor or designee.

4.1.6 All surveys performed for the release of material shall be documented on a Radiological Survey Report (NWT-001) and/or on an Unconditional Release of Equipment or Items Report (NWT-010).

4.1.7 Radiation and contamination surveys shall be performed in accordance with Reference 3.1.4.

4.1.8 Items identified as radioactive during the release survey shall be controlled in accordance with Reference 3.1.10.

4.1.9 Personnel performing release surveys shall be logged in on a Radiation Work Permit in accordance with Reference 3.1.11 (if applicable).

4.1.10 Audible response instruments must be used during direct scan surveys.

4.1.11 Instruments used for release surveys shall be within current calibration and shall have had a performance test check performed daily or prior to use in accordance with the instrument's operating procedure.

4.1.12 Release of materials from controlled areas shall be performed in accordance with the provisions and directives of References 3.1.1, 3.1.2, and 3.1.3.

4.1.13 Items presented for release shall be direct scanned in an area of low background.

4.2 Limitations

4.2.1 The maximum probe speed during direct scan surveys of surfaces shall be 2 cm/sec.

4.2.2 A response check shall be performed at the completion of the work day for instrument's used for direct scan surveys in accordance with the instruments operating procedure.

4.2.3 The probe face shall be held within 1/4 inch of the surface being surveyed for alpha, and within 3/8 inch of the surface being surveyed for beta-gamma.

4.2.4 If an instrument used to perform release surveys fails any operational check, it shall be removed from service. All data collected during the period of instrument failure must be evaluated by the Health Physics Supervisor.

4.2.5 Posting and access control of controlled areas shall be performed in accordance with the provisions of Reference 3.1.9.

5.0 RESPONSIBILITIES AND QUALIFICATIONS

5.1 Responsibilities

5.1.1 NWT Radiological Field Operations Manager

5.1.1.1 Implements the requirements of this procedure.

5.1.1.2 Designates qualified evaluators.

5.1.1.3 Reviews the adherence of personnel to the requirements of this procedure, periodically.

5.1.1.4 Ensure Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure.

5.1.2 Health Physics Supervisor

5.1.2.1 Review the release documentation.

5.1.2.2 Approve unconditional releases by signing the NWT-005 form.

5.1.3 Health Physics Technicians

5.1.3.1 Perform the requirements of this procedure.

5.1.3.2 Adhere to other procedures (referenced in this procedure).

5.1.3.3 Document all releases.

5.2 Qualifications

5.2.1 Health Physics Technicians shall be qualified in accordance with the requirements of Reference 3.1.6 to perform release surveys of materials.

5.2.1.1 Documentation supporting qualifications shall be obtained and kept in the permanent project files.

5.2.2 Junior Health Physics/Decontamination Technicians may perform release surveys

under the direct supervision of a Health Physics Technician meeting the requirements of Section 5.2.1.

5.2.3 Evaluators shall be designated by the NWT Radiological Field Operation Manager (Project Manager).

6.0 PROCEDURE

6.1 Release Limits For Gross Activity (Unknown Isotopes) - Regulatory

EMISSION	REMOVABLE (dpm/100 cm^2)	TOTAL (Fixed and Removable) (dpm/100 cm^2)
Alpha	20	100
Beta-Gamma	200	1000

NOTE: **If <u>all</u> of the actual isotopic constituents of the contamination are known <u>and</u> documented on the release documents, the release limits of Table 1 of Reference 3.1.5 may be applied.**

6.2 Inaccessible Surfaces

6.2.1 Items with inaccessible surfaces should be disassembled as completely as possible to facilitate release surveys. Items with inaccessible surfaces will not be unconditionally released unless evaluated by a designated evaluator who authorizes and documents the release.

6.2.2 The following guidance will be used when performing evaluations:

- A history of the item should be reviewed.
- The actual release survey shall be reviewed.
- Determination of the radiological conditions in the area the item has been used or stored shall be reviewed.
- Use of sensitive detectors such as NaI(T1) or equivalent should be considered. (These detectors may indicate internal contamination that the Model-3 or equivalent may not detect due to its lower sensitivity to photon emissions).

6.3 Materials considered hazardous due to their physical or chemical nature and fragile items shall not be unconditionally released unless evaluated. For example, gases, pyrophoric materials, easily damaged electronic devices, or other easily damaged materials cannot be directly or indirectly surveyed. These materials will be evaluated on a case by case basis for release in a manner consistent with Section 6.2.2. Evaluation for release shall be performed by a designated evaluator only.

6.4 Survey Exempt Materials

6.4.1 Items such as briefcases, pens, papers, personal clothing, etc., are exempt from the Health Physics release survey requirements of this procedure.

6.4.2 Individuals shall survey the exempt items in the same manner as a whole body frisk when leaving a controlled area or have a Health Physics Technician perform the survey.

6.5 Survey Procedure

6.5.1 Upon receipt of an item presented for release, attempt to determine the history:

- Purpose of item.
- The current and past use of the item.
- The location(s) in which the item was used or stored.
- If the item was ever used for work with radio-active material or used in an area where radioactive material was used or stored.

This knowledge of the item history should provide the surveyor with information helpful in performing the release survey.

6.5.2 Using protective clothing such as gloves, perform large area smears of 100% of the accessible surfaces of the item using large area wipes (e.g. massilin).

6.5.2.1 Determine if transferable (loose) radioactive material is present by measuring the amount of activity on the surface of the cloth.

6.5.2.2 If the presence of radioactive material is indicated by a count rate above background, the item shall be treated as contaminated until the results of the disc smear survey are obtained and a determination is

made concerning the actual 100 cm^2 loose contamination levels. The material shall be controlled in accordance with Reference 3.1.10.

6.5.3 Perform a direct scan of 100% of all accessible areas of the item, in accordance with the instrument's operating procedure, and Reference 3.1.4.

NOTE: Items presented for release shall be direct scanned in an area of low background, preferably ≤ 100 CPM. The Health Physics Technician performing the release survey shall determine if the background is acceptable for direct scan of the item. Release surveys shall not be done in areas where background is ≥ 300 CPM.

6.5.3.1 If the scan indicates radioactive material on the surface of the item is less than the limits for release for total activity, proceed to 6.5.3.3.

6.5.3.2 If the scan indicates radioactive material on the surface of the item is greater than regulatory limits for total activity, the item cannot be released.

6.5.3.3 During the direct scan of the accessible surfaces of the item, a static measurement shall be taken:

- If an increase in the audible count rate is detected.
- After each minute of scanning.
- When the Health Physics Technician determines that an indication of fixed activity less than ten square centimeters may be present.

6.5.3.4 During the static measurement, the meter probe shall be held at the proper distance from the surface being surveyed for the proper response period to allow the meter reading to stabilize, in accordance with the instrument's operating procedure.

6.5.4 Perform disc smears of 100% of the effective surface area.

6.5.4.1 100% of the effective accessible surface means performing a 100 cm^2 disc smear on all accessible areas of the item <u>suspected</u> of being contaminated.

6.5.5 Count the smears in accordance with Reference 3.1.4.

6.5.5.1 Record smear data on the Smear Counting Analysis Report (NWT-006). If a Model-3 or equivalent was used, document the results on a Radiological Survey Report (NWT-001).

6.5.5.2 If the smear results indicate transferable activity below the release limits, proceed to Step 6.5.6.

6.5.5.3 If the smear results indicated transferable activity above the release limits, the item cannot be released.

6.5.6 If the item has internal or inaccessible surfaces, have NWT personnel disassemble the item and repeat Steps 6.5.2 through 6.5.5 or have the item evaluated for release by a designated evaluator.

6.5.7 If the item meets the release limits or is evaluated as meeting the unconditional release criteria, complete forms NWT-010, NWT-005, and/or NWT-001. Health Physics Supervision must review the release documents and approve the release prior to allowing the item to leave the controlled area.

6.5.8 Items identified as radioactive during the release survey shall be controlled in accordance with Reference 3.1.10.

7.0 RECORDS

The following records are generated by use of this procedure. These records will be maintained in the permanent project file.

7.1 NWT-001 - Radiological Survey Report

7.2 NWT-005 - Material Release Log

7.3 NWT-006 - Smear Counting Analysis Report

7.4 HP Daily Log

7.5 NWT-003 - Daily Instrument Performance Test Log

7.6 NWT-010 - Unconditional Release of Equipment or Items Report

8.0 FORMS

8.1 NWT-003 - Daily Instrument Performance Test Log

8.2 NWT-006 - Smear Counting Analysis Report

8.3 NWT-001 - Radiological Survey Report

8.4 NWT-005 - Material Release Log

8.5 NWT-010 - Unconditional Release of Equipment or Items Report

FM-020-01-20

New World Technology

Field Operations Procedure

RADIATION AND CONTAMINATION SURVEY TECHNIQUES

New World Technology
448 Commerce Way
Livermore, CA 94551

New World Technology

APPROVAL PAGE

Procedure Number/Title: **FM-020-01-20, Radiation and Contamination Survey Techniques**, has been reviewed and approved by the following:

APPROVAL SIGNATURES:

_____ _____

William G. Haney, Vice President, Operations Date

_____ _____

Doc Dennis, Radiation Safety Officer Date

_____ _____

Donald Wadsworth, President Date

Section	Title
1.0	Scope
2.0	Purpose
3.0	References and Definitions
4.0	Precautions, Limitations
5.0	Responsibilities
6.0	Procedure
7.0	Records
8.0	Forms

1.0 SCOPE

This procedure provides guidelines for the performance and documentation of Radiation and Contamination surveys on New World Technology field projects.

2.0 PURPOSE

The purpose of this procedure is to specify requirements for consistent general radiological surveys and documentation of acquired data for routine, pre-operation and post-operation surveys as well as job coverage surveys. This procedure is intended to satisfy the requirements of DOE Order 5480.11.9g (3) (b) and 5480.11.9.g (4) (a) (b) (c), 10 CFR part 20 and California Radiation Control Regulations.

3.0 REFERENCES AND DEFINITIONS

3.1 References

3.1.1 10 CFR 20, Standards for Protection Against Radiation

3.1.2 DOE 5480.11, Radiation Protection for Occupational Workers

3.1.3 ANSI N3.1 - 1987, Selection, Qualifications and Training of Personnel For Nuclear Power Plants

3.1.4 NUREG/1575,MARSSIM, Multi Agency Radiation Survey and Site Investigation Manual

3.1.5 FM-003-01-20, Release of Materials from Controlled Areas

3.1.6 FM-021-01-20, Radiological Area Posting and Access Control

3.2 Definitions

3.2.1 **Activity** - The rate of disintegration (transformation) or decay of radioactive material. The units of activity for the purpose of this procedure are disintegrations per minute (dpm), Becquerel (Bq), or micro-Curies for loose contamination and disintegrations per minute or millirad/hour for fixed contamination.

3.2.2 **Check Source** - A sample of radioactive material in which the exact quantity of radioactive material is not known but the type and energy of the emission is known.

These sources are used for field qualitative response checks or radiation detection instrumentation. These sources are labeled with a sticker that indicates an approximate value of the count rate to be expected when performing a qualitative response check.

3.2.3 **Contamination** - Deposition of radioactive material in any place it is not desired particularly where its presence may be harmful. The harm may be actual exposure to individuals or release of the material to the environment or general public. Contamination may be due to the presence of alpha particle, beta particle or gamma ray emitting radionuclides.

3.2.4 **Controlled Area** - Any area to which access is controlled in order to protect individuals from exposure to radiation and radioactive materials and/or to prevent the release of radioactive materials to the uncontrolled areas.

3.2.5 **Fixed Contamination** - Radioactive contamination that is not readily removed from a surface by applying light to moderate pressure when wiping with a paper or cloth disk smear, or masslin.

3.2.6 **Minimum Detectable Activity (MDA)** - For purposes of this procedure, MDA for removable radioactive contamination is defined as the smallest amount of sample activity that will yield a net count with a 95% confidence level based upon the background count rate of the counting instrument used.

3.2.7 **Qualitative Response Check** - A check of a radiation detection instrument in which the performance of the instrument is checked against a check source for response only.

3.2.8 **Quantitative Response Check (Performance Test)** - A check of a radiation detection instrument in which performance of the instrument is checked against a reference standard with an acceptance value of ± 20% of the reference value.

3.2.9 **Reference Standard** - A sample of radioactive material, usually with a long half-life, in which the activity and the type of emission is known and is N.I.S.T. traceable. These standards are used for calibration and quantitative source checks (Performance Test) of radiation detection instruments.

3.2.10 **Transferable (Loose) Contamination** - Radioactive contamination that is readily removed from a surface by applying light to moderate pressure when wiping with a paper or cloth disk smear, or masslin.

3.2.11 **Radiation Work Permit (RWP)** - A document generated by Health Physics to provide:

3.2.11.1 A description and scope of the work to be performed.

3.2.11.2 The existing radiological conditions in the work area.

3.2.11.3 The limitations placed upon the scope of work.

3.2.11.4 The maximum radiological limits allowed.

3.2.11.5 The protective measures to be employed during the work to protect the worker(s).

3.2.11.6 The period of time the RWP is valid.

3.2.11.7 Special instructions to workers and Health Physics Technicians during the course of work.

3.2.11.8 The proper approvals required to begin work.

4.0 PRECAUTIONS, LIMITATIONS

4.1 Precautions

4.1.1 Personnel performing surveys in known or suspected contaminated areas should avoid unnecessary contamination of survey instruments by using plastic film coverings and exercise care. Covering the mylar window may decrease the beta and alpha efficiency; avoid covering mylar windows.

4.1.2 Exercise care when performing contact measurements with mylar window exposed to prevent damage.

4.1.3 Avoid unnecessary exposure when performing surveys by practicing good ALARA practices.

4.1.4 The surveyor should be aware of:

4.1.4.1 The operation and limitations of the survey instruments used; refer to the particular instrument's operation and calibration procedure.

4.1.4.2 The anticipated range of radiation and contamination levels in the area to be surveyed.

4.1.4.3 Activities in the area that may have or will change radiological safety conditions.

4.1.4.4 Safety considerations and requirements in effect in the area to be surveyed.

4.1.4.5 The nature of the work to be performed in the area the survey is to be performed if the survey is to be used for Radiation Work Permit generation.

4.1.5 Radiation surveys used as a basis for Radiation Work Permits or area postings shall be performed by a Health Physics Technician meeting the requirements of Reference 3.1.3 or by an individual not meeting those requirements under the direct supervision of a Health Physics Technician.

4.1.6 Equipment or area surveys used to determine radiation and contamination levels for informational purposes only (such as during decontamination to check progress) may be performed by individual's not meeting the requirements of Reference 3.1.3

4.1.7 Health Physics Technicians shall follow all applicable RWP and posting instructions when performing radiation and contamination surveys.

4.1.8 Health Physics shall leave an area immediately if during the survey the radiation detection instrument in use appears to be malfunctioning or radiological conditions in the area being surveyed change unexpectedly.

4.1.9 All material such as smears or other survey materials shall be treated as radioactive material until a survey is performed on the material in question.

4.1.10 Sources of radiation smaller than the open window area of an ion chamber instrument may require the use of different beta correction factors. Also, the field beta correction factor and the contact beta correction factor will differ. Refer to the appropriate ion chamber operation and calibration procedure or the calibration sticker for these values.

4.1.11 Contact exposure rates shall be measured at a distance of less than one inch from the source of radiation.

4.1.12 Thirty-centimeter (~12 inches) readings shall be used as the whole body reading for posting purposes.

4.1.13 Prior to entering the area or performing any survey, each radiation detection instrument shall be:

- Battery Checked.
- Checked for obvious physical damage.
- Quantitatively response-checked daily prior to use.
- Checked to ensure the instrument is within current calibration.

If any of the above conditions are unsatisfactory, the instrument shall be tagged out of service and not used.

4.2 Limitations

4.2.1 This procedure does not apply to characterization surveys, nor is it intended to alter current or future characterization survey techniques.

4.2.2 For exposure rate surveys used to determine RWP requirements, job coverage, or stay times, an ion chamber instrument should be used.

4.2.3 The survey techniques described in this procedure do not alter or replace the requirements of Reference 3.1.5.

4.2.4 When using cloths (or masslin) to perform large area smears, results shall be reported in disintegrations per minute (DPM) or mrad/hr above background. Do not attempt to quantify the survey area.

4.2.5 Radiation and contamination surveys may be used to write RWPs if the survey has been performed within 24 hours of RWP initiation or there is reasonable assurance that conditions have not changed.

5.0 RESPONSIBILITIES

5.1 The NWT Radiological Field Operations Manager shall be responsible for:

5.1.1 Implementation of this procedure.

5.1.2 Periodic reviews of adherence to the requirements of this procedure.

5.1.3 Ensure Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure.

5.2 The Health Physics Supervisors shall be responsible for:

5.2.1 Reviewing and approving data generated by the use of this procedure.

5.2.2 Insuring personnel using this procedure comply with all procedural requirements.

5.3 Health Physics Technicians shall be responsible for:

5.3.1 Performing the requirements of this procedure.

5.3.2 Completing all required records and submitting them for review to Health Physics Supervision.

5.4 Junior Health Physics/Decontamination Technicians shall be responsible for:

5.4.1 Performing the requirements of this procedure under direct supervision of a Health Physics Technician.

5.4.2 Completing all required records under direct supervision of a Health Physics Technician.

6.0 PROCEDURE

6.1 General

6.1.1 Radiation and contamination surveys shall be performed on an as-needed basis. The need for performing a survey is identified by the following conditions:

6.1.1.1 An RWP is needed to perform an approved job.

6.1.1.2 A procedural requirement requires a survey.

6.1.1.3 A condition exists where radiological data is needed to form a decision by Health Physics supervision.

6.1.1.4 An investigation is required due to abnormal conditions or indications.

6.1.1.5 An on-going job requires a survey to update radiological postings and/or RWP.

6.1.2 Determine the type of survey to be performed and select the proper radiation detection instrument(s) for the survey.

6.1.2.1 Select an instrument capable of detecting the type of radiation to be surveyed.

6.1.2.2 Select an instrument capable of detecting the range of exposure rate or contamination level expected.

6.1.2.3 Select an instrument calibrated to the range of expected emission energy.

6.1.2.4 Select an instrument that has been calibrated for the type of radiation to be surveyed.

6.1.3 Review and sign in on the applicable RWP for the area to be surveyed.

6.1.4 When entering posted or suspected high radiation areas, or unknown areas, the ion chamber instrument range selector switch shall be selected to the highest range and moved down through the lower ranges until the meter indicates on scale.

6.1.5 When surveying for radiation levels using an ion chamber, gamma reading shall be taken with the beta window closed.

6.1.6 When surveying for beta radiation levels using an ion chamber, readings shall be taken with the beta window open (OW) and then closed (CW). The beta correction factor (CF) for contact beta readings is listed on the instrument calibration sticker. The beta correction factor for field beta readings (30cm from source) is 1.5.

Corrected beta dose rate = (OW-CW) x CF

6.1.7 Instruments used to perform radiation and contamination surveys shall be operated in accordance with their operation and calibration procedure.

6.2 Standard Health Physics Practices Concerning Performance of Radiation Surveys

6.2.1 Check out necessary survey instruments and comply with operational procedures of the instrument's operation and calibration procedure.

6.2.2 The instrument's operation and calibration procedure may be used to assist in determining necessary survey instruments. Instrument limitations are described in these procedures.

6.2.3 General Area Beta/Gamma Radiation Surveys.

6.2.3.1 General area surveys are normally conducted to measure only gamma radiation levels. However, when suspected, general area beta radiation levels can be measured with Model-9, RO2, or RO2A (or equivalent) using the field beta correction factor of 1.5 Document all general area beta radiation levels ≥ 1 mrad/HR on the survey form.

6.2.3.2 For general area room surveys, hold the instrument detector at waist to chest level, utilizing the highest reading obtained for documentation of survey records and postings. Normally, general area surveys are considered as being greater than 30cm away from relevant components and equipment.

6.2.3.3 General area room surveys for RWPs should include accessible areas and positions or levels where personnel will be performing work.

6.2.3.4 Survey data should be documented in accordance with Section 6.6 of this procedure.

6.3 Contact Beta/Gamma Radiation Surveys

6.3.1 Contact surveys should be taken at approximately one inch away from relevant components and equipment.

6.3.1.1 Conduct Beta Radiation surveys:

(a) On open radioactive systems and exposed contaminated equipment internals.

(b) Whenever leakage from a radioactive system is in evidence or is suspected to have occurred.

6.3.2 Contact surveys should also be taken on relevant components and equipment which personnel will be likely to contact during the performance of their work.

6.3.3 When conducting contact surveys on surfaces with high levels of exposed surface contamination, obtain an open window reading and a closed window reading to determine the beta contribution.

6.3.3.1 Denote all corrected Beta readings on the survey form.

(a) True Beta Dose Rate is determined by open window reading minus closed window reading times the beta correction factor of 1.5 for field beta measurements or the contact beta correction factor (4.0) found on the calibration stickers for contact beta measurements.

6.3.4 Document survey data in accordance with Section 6.6 of this procedure.

6.4 Standard Health Physics Practices Concerning Smearable Contamination Surveys

6.4.1 Smear Surveys

6.4.1.1 Wipe a cloth or paper disc smear over an area of 100 cm^2. 100 cm^2 is approximated by a four-inch square or an 18-inch "S".

6.4.1.2 Avoid cross-contaminating the smear samples.

6.4.1.3 Count the disc smears on the appropriate counting equipment. The following guidelines should be used when counting smears.

(a) The Model-3/44-9 or equivalent should be used for counting smears >1,000 dpm and smears taken for beta-gamma in posted contaminated areas.

(b) The Model-3/43-5 or equivalent should be used to count smears obtained from contaminated areas for alpha.

(c) All smears taken for the purpose of determining if the item or area smeared is below the posting requirements for loose activity in accordance with Reference 3.1.6 must be counted on instruments capable of detecting 20 dpm alpha and 1,000 dpm beta-gamma (Model-2929).

(d) Report results in units of dpm/100 cm^2 and document in accordance with Section 6.6 of this procedure.

(e) Smear results >50,000 cpm may be reported in mrad/hr/100 cm^2.

6.4.2 Large Area Smear Survey (Wipe)

6.4.2.1 Large area smears are used to obtain a gross indication of contamination levels in large areas or on pieces of equipment suspected to have contamination present. Large area smears may also be used to check normally clean areas or equipment for presence of contamination.

6.4.2.2 Wipe over the surface to be surveyed.

6.4.2.3 Count the wipe with a count rate meter equipped with a 44-9 probe or equivalent for beta-gamma and/or a Model-3/43-5 or equivalent for alpha.

6.4.2.4 Use the highest reading obtained for reporting results. Results should be recorded in units of dpm/wipe above background.

(a) When using wipes to check a clean area, or piece of equipment for contamination; if there is any indication of activity above background on the wipe, the area must be smeared using disc smears in accordance with Step 6.4.1 of this procedure.

6.4.2.5 Document results in accordance with Section 6.6 of this procedure.

6.5 Standard Health Physics Practices Concerning Fixed Contamination Surveys

6.5.1 Fixed contamination surveys are used to obtain indications of fixed contamination levels on surface areas, pieces of equipment, or tools for characterization and/or release surveys.

6.5.2 The Model-3/44-9 or equivalent should be used for fixed contamination surveys for beta-gamma.

6.5.3 The Model-3/43-5 or equivalent should be used for fixed contamination surveys for alpha.

6.5.4 When surveying for fixed beta-gamma contamination the probe should be held within one-half inch or less from the surface being surveyed. The movement rate of the detector probe should be one-half probe width per second or slower.

6.5.5 When surveying for fixed alpha contamination the probe should be held within one-quarter inch or less from the surface being surveyed. The movement rate of the detector probe should be one-half probe width per second or slower.

6.5.6 When performing direct scan surveys of objects, surface areas etc., static readings should be performed frequently to insure the detection of residual activity.

6.5.7 When performing free release surveys 100 % of all accessible areas of the item being surveyed should be direct scan surveyed whenever practical.

6.5.8 Use the highest reading obtained for reporting results. Results should be reported in units of net CPM above background or dpm/100 cm^2.

6.5.8.1 The following formula should be used for converting direct probe readings in CPM to dpm/100 cm^2:

$$A_S = \frac{R_{S+B} - R_B}{\varepsilon_I \varepsilon_S \frac{W_A}{100\ cm^2}}$$

where,

A_S = total surface activity (dpm/100 cm^2)
R_{S+B}= the gross count rate of the measurement in cpm,
R_B = the background count rate in cpm
ε_I = the instrument efficiency (counts per particle)
ε_s = the contaminated surface efficiency (particles per disintegration)
W_A = the physical area of the detector window (cm^2)

In the absence of experimentally determined surface efficiencies, ISO-7503-1 and NUREG 1507, provide conservative recommendations for surface efficiencies. ISO-7503-1, recommends a surface efficiency of 0.5 for maximum beta energies exceeding 0.5 MeV, and to use a surface efficiency of 0.25 for beta energies between 0.15 and 0.4 MeV and for alpha emitters. NUREG-1507 provides surface efficiencies based on studies performed primarily at ORISE.

In general, NUREG-1507 indicates that the ISO rule-of-thumb for surface efficiencies are conservative, particularly for beta-emitting radionuclides with end-point energies between 0.25 MeV and 0.4 MeV.

6.5.9 Document the results in accordance with Section 6.6 of this procedure.

6.6 Documentation of Surveys

6.6.1 All radiation and contamination surveys shall be documented on a Radiological Survey Report NWT-001 or equivalent form.

6.6.1.1 Smears counted with portable instruments shall have the results recorded in the appropriate columns.

6.6.1.2 Drawings shall be included as necessary to clearly explain survey locations.

6.6.1.3 The header of the NWT-001 shall be complete prior to submission for review.

6.6.1.4 All unused blank areas of NWT-001 shall have N/A entered in the area.

6.6.1.5 Survey numbers are obtained from the Radiation/Contamination Survey Log NWT-034.

6.6.1.6 Gamma readings are recorded in mR/hr.

6.6.1.7 Corrected beta readings shall be annotated as such.

6.6.1.8 Neutron readings shall be annotated as mrem/hr.

6.6.1.9 Alpha values shall be annotated with the α symbol.

6.6.1.10 Beta values shall be annotated with the β symbol.

6.6.1.11 Contact readings shall be annotated with an asterisk.

6.6.1.12 30 cm readings shall be annotated with the value underlined.

6.6.1.13 Smear locations shall be numbered with the number circled.

6.6.1.14 Large area smears shall be numbered with the number inside a triangle.

6.6.1.15 A narrative explanation of abnormal or unsafe conditions should be included on the survey.

6.6.2 Smears counted with fixed instrumentation such as the Ludlum Model-2929 shall be recorded on Form NWT-006.

6.6.3 Isotopic analysis results shall be attached to Form NWT-001. The survey (NWTS) number shall be recorded on each page.

7.0 RECORDS

The following records are generated by the use of this procedure. These records shall be reviewed daily by Health Physics supervision and retained in the permanent project file.

7.1 Smear Counting Analysis Report, NWT-006

7.2 Radiological Survey Report, NWT-001

7.3 Radiation/Contamination Survey Log, NWT-034

8.0 FORMS

8.1 NWT-006, Smear Counting Analysis Report

8.2 NWT-034, Radiation/Contamination Survey Log

8.3 NWT-001, Radiological Survey Report

FM-023-01-20

New World Technology

Field Operations Procedure

GAMMA SCANNING OF SITE GROUNDS

New World Technology
448 Commerce Way
Livermore, CA 94551

New World Technology

APPROVAL PAGE

Procedure Number/Name: **FM-023-01-20, Gamma Scanning of Site Grounds,** has been reviewed and approved by the following:

APPROVAL SIGNATURES:

_____ _____

William G. Haney, Vice President, Operations Date

_____ _____

Doc Dennis, Radiation Safety Officer Date

_____ _____

Donald Wadsworth, President Date

Section	Title
1.0	Scope
2.0	Purpose
3.0	References
4.0	Precautions, Limitations
5.0	Responsibilities
6.0	Procedure
7.0	Records

1.0 SCOPE

This procedure describes the appropriate methods for performing gamma radiation scans of site grounds (outside areas) on NWT field projects.

2.0 PURPOSE

The purpose of this procedure is to provide guidelines for performing gamma radiation scans of site grounds.

3.0 REFERENCES

3.1 Project/Site Health and Safety Plan

3.2 Project/Site Detailed Work Procedure

3.3 NUREG/1575-MARSSIM, Multi Agency Radiation Survey and Site Investigation Manual

3.4 NUREG/CR-5512, Residual Radioactive Contamination From Decommissioning

3.5 TM-015-01-20, Operation and Calibration of the Ludlum Model 2350-1 Data Logger.

4.0 PRECAUTIONS, LIMITATIONS

4.1 Precautions

4.1.1 The Ludlum Model-44-10 scintillation detectors are not guaranteed light tight when outside of their detector cases.

4.1.2 Due to the very low response ranges, this instrument should not be used in areas where elevated (>5 mrem/hr) radiation fields are anticipated.

4.1.3 When using this instrument in a known, or suspected contaminated area, seal the instrument in a protective media (i.e., plastic, poly) to prevent contamination of the instrument.

4.2 Limitations

4.2.1 The proper operation of the Ludlum Model 2350-1 Data Logger depends strongly on the condition of the battery. Therefore, the battery check should be performed before each use and periodically during use to ensure proper operation.

4.2.2. Calibration shall be performed annually, after maintenance is performed, if the instrument fails the performance test or if proper operation is in question.

4.2.3 A daily performance test is required when this instrument is in use.

5.0 RESPONSIBILITIES

5.1 NWT Radiological Field Operations Manager (Project Manager) is responsible to:

5.1.1 Implement this procedure.

5.1.2 Periodically review adherence to the requirements of this procedure.

5.1.3 Ensure Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure.

5.2 Health Physics Supervisors are responsible for:

5.3.1 Assignment of Health Physics Technicians performing this procedure.

5.3.2 Review and approval of documentation generated by the use of this procedure.

5.3 Health Physics Technicians are responsible for:

5.3.1 Performance of the requirements of this procedure.

5.3.2 Adherence to other procedures referenced.

5.3.3 Documentation of all work performed under this procedure.

6.0 PROCEDURE

6.1 For gamma scan surveys of outside areas a Ludlum Model 2350-1 Data Logger coupled to an Ludlum Model 44-10, 2" x 2" NaI(Tl) detector or equivalent should be used.

6.2 Follow the requirements of Reference 3.5 for use of the Ludlum Model-2350-1 Data Logger.

6.3 Set the audio response switch to the "on" position.

6.4 Using the keypad, in accordance with reference 3.5, set the instrument response time to the appropriate setting. (F:Fast 4 sec response time, erratic instrument readout display S:Slow, 22 sec response time, stable instrument readout display).

6.5 Using the keypad, in accordance with Reference 3.5, set the range setting to an appropriate range for the activity being investigated. When entering an area of unknown radiation levels always enter the area on the highest range and scale down until an upward instrument readout display is observed.

NOTE:

The Model 44-10 detector is a scintillation solid attached to a fragile glass photomultiplier tube with a glass wall. The thickness of this wall is similar to that of a light bulb. If the detector is subjected to shock the tube will break and disable the detector.

6.6 The Model 44-10 detectors case is cylindrical, the bottom of the detector (away from the detector cable connection) is the area where the crystal is located. This area of the detector should be held closest to the source of activity when performing surveys.

NOTE:

For optimum detection sensitivity changes in the instrument response are monitored via the audible output, rather then noting fluctuations in the instrument display window.

6.7 Place the detector at a distance from the surface in accordance with References 3.1 and 3.2.

6.8 While walking over the surface move the detector back and forth in a serpentine pattern over the surface being scanned at a rate of about 0.5m/sec.

6.9 Read the meter after sufficient response time (i.e., the instrument display readout) changing ranges as necessary for the activity encountered. If the meter is used for an extended period of time, check the battery condition periodically to ensure proper operation.

6.10 Locations of radiation levels one and a half times background levels shall be marked on facility maps and identified for further measurements and/or sampling.

7.0 RECORDS

The following records will be generated and retained in the permanent project file as a result of using this procedure.

None